

Decomposed games, focal points, and the framing of collective and individual interests*

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Abstract

We study whether the strategically equivalent decomposition of coordination games with focal points into two components is behaviourally relevant. The decompositions allow us to manipulate the framing of the game and to emphasise collective or individual interests. We observe that the game decompositions are indeed behaviourally relevant. Under a stronger framing manipulation, we find that the frequency of salient choices decreases when a pure coordination game is framed as two simultaneous battle of the sexes components. Also, we observe that the frequency of salient choices is higher when the pure coordination component of a decomposed battle of the sexes game is presented first than when the game is presented without decomposition. Furthermore, we find that the size of the separated pure coordination payoff does not impact behaviour. Our results highlight the behavioural relevance of framing via game decompositions.

Keywords: Decomposed games, focal points, narrow bracketing, framing, collective interest

JEL Codes: C72, C91, D90

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1 Introduction

Consider the battle of the sexes game (BS) between a Bach admirer and a Stravinsky enthusiast regarding two evening concerts on 21 March 2026. “Their main concern is to go out together, but one person prefers Bach and the other person prefers Stravinsky” (Osborne and Rubinstein, 1994, p. 15). It is common knowledge that the evening happens to be on Bach’s 341st birthday, which makes the Bach event salient. In experiments, such saliency enables high levels of coordination in pure coordination games (PC), however, its effectiveness is severely reduced in BS games.

In this paper, we ask whether the saliency-related coordination success of the two music devotees can be increased by emphasising their common interests, that is, the pure coordination element of the game “to go out together”? And, conversely, we ask whether coordination decreases when the common interest is de-emphasised in a PC game by splitting it into two battle of the sexes games. More generally, our aim is to test whether redescribing a game can lead to systematic differences in behaviour. We do so by introducing game decompositions that allow us to manipulate certain features of the game.

Table 1 shows one of many possible decompositions of a simple BS game into a pure coordination component (pc) and the remaining battle of the sexes component (bs), noted as $pc + bs$.¹ The pc component emphasises the common interests between players, whereas bs retains the feature of conflict of the simple BS game. Across component games, players have to choose identical strategies so that, theoretically, the two component games and the simple game are equivalent. We refer to these games as “decomposed games” throughout the paper. In this study, we also implement independent games which, by contrast, do not impose such restrictions on choices. We refer to these games as “unlinked games.”

$$\begin{array}{c|cc} & \underline{B} & S \\ \hline \underline{B} & 11, 10 & 0, 0 \\ S & 0, 0 & 10, 11 \end{array} = \begin{array}{c|cc} & \underline{B} & S \\ \hline \underline{B} & 4, 4 & 0, 0 \\ S & 0, 0 & 4, 4 \end{array} + \begin{array}{c|cc} & \underline{B} & S \\ \hline \underline{B} & 7, 6 & 0, 0 \\ S & 0, 0 & 6, 7 \end{array}$$

Table 1: Decomposition of BS game into $pc + bs$. Salient strategy $\underline{B}$.

Mixed-motive games, as Schelling (1960, p. 89) calls BS games, are a natural starting point to study decomposed games. Experimental evidence shows that in pure coordination games, payoff-irrelevant salient features allow players to coordinate with a success rate higher than that predicted by random choice (Mehta et al., 1994; Bardsley et al., 2010). This success is commonly explained with the theory of team reasoning, which is an attempt to

¹Henceforth we will indicate component games with lowercase letters and simple games with uppercase letters.

formalise the intuition expressed in Schelling’s (1960) theory of focal points and postulates that players look for a selection rule that maximises the chances of coordination when all act in line with that rule (Sugden, 1995; Bacharach, 2006). A candidate rule is to choose the salient strategy if one is present. The literature has furthermore established that this success is severely reduced in battle of the sexes games due to the players’ conflicts of interest (Crawford et al., 2008; Isoni et al., 2013, 2020). The frequent mis-coordination is attributed to level- k reasoning, in which payoff salience shapes level-0 players’ behaviour. The common explanation for why these games hinder team-based reasoning is that the payoff asymmetry in the BS detracts attention from salient labels that offer a solution to the coordination game (Sitzia and Zheng, 2019; van Elten and Penczynski, 2020; Arjona et al., 2022). Decomposing a BS game into a $pc+bs$ game, by making the common interest component more prominent, might therefore increase coordination compared to a simple BS game. The intuition is that the absence of the conflict of interest in the pc component helps players see how choosing according to the salient label can be used to solve the coordination problem. Once this rule is identified, players may then apply it to the entire game, increasing the chances of coordination despite the existing conflict of interest.

Building on this literature, we experimentally test whether decompositions that emphasise the common interest component in a mixed-motive game indeed increase coordination success in ways that are consistent with a shift from an individualistic to a collective type of reasoning. Similarly, we also test whether decompositions that emphasise players’ conflicts of interest decrease coordination in line with the predictions of level- k reasoning.

Our setup gives rise to further questions: Is the game play influenced by the nature and the order of the component games? Does it matter if the decomposition implements a stronger framing manipulation, where the second component is only visible after a provisional choice is made on the first component? Furthermore, given that the decomposition is not unique, does the size of the separated pc payoff influence the success of coordination?

Although in this study we focus on coordination games with salient labels, the concept of game decompositions can be applied to any game. At the core of this universality is the packaging and ordering of consequences that game decompositions achieve. This way, they enable a highly-controlled and structured implementation of a variety of framings of strategic situations. In doing so, they provide a new path for a systematic analysis of framing effects on behaviour and possibly uncover general mechanisms.

The concept of narrow bracketing enters this picture as the process that leads to behavioural differences between simple and decomposed games: If players narrow bracket, they do not fully integrate the component games into the simple game. Therefore, the nature and order of the component games may influence behaviour. (Read et al., 1999; Tversky

and Kahneman, 1981; Rabin and Weizsäcker, 2009).²

We find evidence that behaviour in decomposed games differs from that in simple games, implying that narrow bracketing takes place. Against our expectations, the mere presence of a *pc* component does not always increase coordination success. Specifically, in a *BS* decomposition, the *pc* component influences behaviour in the expected direction only in the stronger framing manipulation in which this component is displayed first and requires a provisional decision to be made before component 2 is revealed. By contrast, when the *bs* component game is visible first, the coordination success is not significantly different from that in the simple *BS* game.

In the stronger framing manipulation of the *bs + bs* decomposition of a simple *PC* game, the artificially introduced conflict of interest in the *bs* components decreases coordination significantly compared to the simple *PC* game. This result demonstrates the versatility and power of game framing via game decompositions and clearly evidences narrow bracketing because the negative effect on coordination can only be explained by the framing with two *bs* component games of an otherwise unchanged *PC* game.

The negative influence of a *bs* component also extends to independent games, where players are free to choose different strategies across components. We observe that when a *bs* game is played first, coordination success in the subsequent *pc* game is lower than when the *pc* game is played first. By contrast, coordination success in the *bs* game is not affected by the order of play.

These results suggest that the presence of competing individual interests in *bs* games has a stronger influence on behaviour than the presence of fully aligned interests in *pc* games. Finally, we do not find evidence that the size of the separated *pc* payoff matters.

Game decompositions illustrate how games can be framed in multiple ways by separating and emphasising different elements of the overall strategic situation. In coordination games, our study explores which of these elements lead to significant differences in player behaviour and is thus a first step towards designing interventions based on these effects. As a result, if we could describe the strategic situation to our Bach and Stravinsky enthusiasts, we would start with an emphasis on the common interests to “go out together”, and then mention their different preferences last, after reminding them of Bach’s birthday. Incidentally, the same emphasis on “common interests” can be found in commentaries surrounding negotiations between countries, such as the US-China trade negotiation or the pre-war relationship between Russia and Ukraine (Reuters, 2021; TASS, 2021). Such negotiations could simplistically

²Note that our definition of narrow bracketing goes beyond the mere integration of the action consequences. Full integration will require to also “undo” any intuitive reaction to the nature of the component games.

be modelled as a *BS* game and such comments can be viewed as a way to decompose the strategic game in order to influence the outcome.

Understanding which decompositions lead to systematic behavioural changes can guide organisations, policy-makers, employers, etc. to design strategic environments to steer behaviour in desired directions. We hope that our study draws more attention to the way in which previously unmodelled details of strategic interactions are conveyed to the decision-makers.

Related Literature In studying game decompositions, we add to a strand of game theory which uses game decompositions for mostly theoretical and diagnostic purposes (Candogan et al., 2011; Kalai and Kalai, 2013; Demuyne et al., 2019; Jessie and Saari, 2019). These purposes favour unique decompositions involving few components with stable interpretations. In contrast, with our focus on game framing, we are open to exploring any type of decomposition that might reflect behaviourally interesting ways of separating payoffs or, in other words, of packaging action consequences. In our experiments, for example, our decompositions organise component games by the motives they reflect and thus explore highlighting ($pc + bs$), obfuscating or extending ($bs + bs$) the strategic elements of the original game.

Jessie and Kendall (2020) and Kendall (2022) experimentally study some of the above mentioned diagnostic decompositions (Jessie and Saari, 2019) and implement components individually. This way, they validate the interpretation of what they define as the “behavioural” component of their unique decomposition. However, implementing components in isolation breaks the strategic equivalence between the decomposition and the original game. This aspect is crucially different from our approach. We maintain this equivalence by implementing all components of a decomposed game and requiring players to select a single action. In this way, our decompositions provide a controlled method for implementing different frames of the same strategic situation, thereby contributing a structured framework for the analysis of framing and behaviour in games.

The selection of decompositions can be motivated by empirical evidence and by predictive theories. In choosing this study’s decomposed games, we are guided by the literature on coordination games with payoff-irrelevant focal points. Previous empirical evidence (Crawford et al., 2008; Bardsley et al., 2010; Isoni et al., 2013) shows that conflict of interest seems to inhibit team-reasoning and evoke individualistic level- k reasoning while its absence facilitates team reasoning (Faillo et al., 2017; van Elten and Penczynski, 2020).

We also contribute to the literature on mechanisms that facilitate coordination. Chen and Chen (2011) show that lab-induced group identity promotes coordination in weak-link games via a social preference mechanism towards in-group members. While we consider

games in which social preferences are irrelevant to equilibrium selection, shared interests have been suggested to induce a team reasoning or “we”-thinking perspective among players (Bacharach, 2006), which enables coordination via focal points. This perspective might be involved in the mechanism behind increased coordination in decomposed *BS* games with a *pc* component. Our decompositions, by splitting the payoffs of a simple game, can be related to *gradualism*, which consists of a gradual increase of the stakes from low to high levels. Gradualism has been shown to facilitate coordination in weak-link games (Ye et al., 2020). By “training” players to coordinate on low-stake games first, this method facilitates coordination when stakes are higher. Our decompositions rely on a different mechanism to induce higher coordination, which consists of influencing the players’ reasoning approach to the game.

Our study also relates to narrow bracketing and its associated literature on individual decision-making under risk (Read et al., 1999; Tversky and Kahneman, 1981; Lian, 2021). Just like experimental subjects are influenced by features of simple lotteries irrespective of the compound lotteries they combine to (Rabin and Weizsäcker, 2009), we find that features of component games matter for decisions irrespective of the simple game they originate from. Basically, intuitive reactions to parts of a decision problem do not add up precisely to the reaction to the overall problem. This type of narrow bracketing leaves room for framing to matter in decomposed games. To the best of our knowledge, evidence of narrow bracketing in games is so far limited to Bland’s (2019) analysis of two simultaneously played Volunteer’s dilemmas, which finds support for narrow bracketing in the homogeneous quantal response equilibrium models, although the reduced-form analysis rejects specific implications of narrow bracketing.

Finally, our study relates to more general considerations of order effects. Once a decomposition is implemented, the presentation order of the component games must inevitably be defined. In psychology, primacy and recency effects have been studied with respect to elementary cognitive operations that influence decision-making, such as recall and belief updating (Murdock, 1962; Hogarth and Einhorn, 1992). Game decompositions allow us to study whether mere permutations of descriptions give rise to such effects in games.

2 Experimental design and procedures

2.1 The games

We employ a set of simple games inspired by the *XY*-game in Crawford et al. (2008). In these games, two players are required to choose one of two strategies. In the games we

employ, strategies are labelled by the resulting payoff allocation in the case of coordination. One of the strategies is made salient by underlining it. If players choose the same strategy then the allocation is enforced, otherwise they earn nothing. The two choices are presented as follows:

- You receive £a and the other receives £b
- You receive £b and the other receives £a

In a pilot experiment, underlining one of the strategies proved to be a more powerful cue for coordination than using X and Y . We implemented one simple PC game, in which $a = b$, and two simple BS games, in which $a > b$. The payoff matrices for these games are reported in table 2. In line with the experiment's framing, the strategies have been labelled as $\underline{A}$ and A .

	<u>A</u>	A		<u>A</u>	A		<u>A</u>	A	
<u>A</u>	10, 10	0, 0		<u>A</u>	11, 10	0, 0	<u>A</u>	12, 9	0, 0
A	0, 0	10, 10		A	0, 0	10, 11	A	0, 0	9, 12
(a) <i>PC</i> (10, 10).				(b) <i>BS</i> (11, 10)			(c) <i>BS</i> (12, 9)		

Table 2: Implemented simple games.

	<u>A</u>	A		<u>A</u>	A		<u>A</u>	A		
<u>A</u>	10, 10	0, 0	=	<u>A</u>	7, 6	0, 0	+	<u>A</u>	3, 4	0, 0
A	0, 0	10, 10		A	0, 0	6, 7		A	0, 0	4, 3

(a) Decomposition of PC into a $bs+bs$.

	$\underline{A}$	A		$\underline{A}$	A		$\underline{A}$	A		
$\underline{A}$	11, 10	0, 0	=	$\underline{A}$	7, 6	0, 0	+	$\underline{A}$	4, 4	0, 0
A	0, 0	10, 11		A	0, 0	6, 7		A	0, 0	4, 4

(b) Decomposition of BS into a $bs+pc$.

Table 3: Simple games and examples of how they can be decomposed.

In addition to the simple games, we implement 27 decomposed games obtained by separating the payoffs of the simple games into two components, component 1 and component 2. The simple PC game is decomposed either into two pc component games ($pc + pc$) or two bs component games ($bs + bs$) (see table 3a). The simple BS games are decomposed into one pc component game and one bs component game (see table 3b).

Table 4 lists all simple and decomposed games that we employed.³ For any given type of decomposition (e.g., $pc + bs$), we implement at least four decomposed games derived from the same simple game. For BS decompositions, this range enables us to verify whether the size of the pc payoffs matters. Furthermore, component 1 payoffs do not allow participants to infer the underlying simple game as they are implemented with differing component 2 games, e.g. $(7, 7 + 3, 3)$, $(7, 7 + 4, 3)$ and $(7, 7 + 5, 2)$.

In a battle of the sexes game, whether simple or decomposed, we define player 1 ($P1$) as the player whose payoff is higher in the focal point equilibrium and player 2 ($P2$) as the other player. For the $bs + bs$ decomposed game, we let component 1 define $P1$. It follows that $P1$ has the lower own-payoff in the focal point equilibrium in the second bs component game. The reverse is true for $P2$. When facing a decomposed game, a player must choose the same strategy in both components. This guarantees that a simple game and any decomposed games derived from it are theoretically equivalent.

Simple Game	Decomposed Games				Simple Game
	$pc + pc$	$bs + bs$	$pc + bs$	$bs + pc$	
$PC(10, 10)$	$(0, 0 + 10, 10)^{ab}$	$(1, 0 + 9, 10)^a$	$(0, 0 + 11, 10)^b$	$(11, 10 + 0, 0)^b$	$BS(11, 10)$
	$(4, 4 + 6, 6)^a$	$(3, 0 + 7, 10)^b$	$(4, 4 + 7, 6)^a$	$(7, 6 + 4, 4)^a$	
	$(7, 7 + 3, 3)^b$	$(4, 3 + 6, 7)^b$	$(7, 7 + 4, 3)^b$	$(4, 3 + 7, 7)^b$	
	$(9, 9 + 1, 1)^b$	$(5, 2 + 5, 8)^a$	$(10, 10 + 1, 0)^a$	$(1, 0 + 10, 10)^a$	
	$(10, 10 + 0, 0)^a$	$(7, 5 + 3, 5)^b$	$(0, 0 + 12, 9)^a$	$(12, 9 + 0, 0)^a$	$BS(12, 9)$
		$(7, 6 + 3, 4)^a$	$(4, 4 + 7, 5)^b$	$(7, 5 + 4, 4)^b$	
			$(7, 7 + 5, 2)^a$	$(5, 2 + 7, 7)^a$	
			$(9, 9 + 3, 0)^b$	$(3, 0 + 9, 9)^b$	

Notes: The games $pc(0, 0)$ and $bs(1, 0)$ have different equilibrium features than standard pc and bs games, respectively. The superscripts a , b , and ab indicate the SER session (a or b) in which these games were implemented as decomposed games. Games implemented as decomposed games in one session were implemented as unlinked games in the other session. The decomposed game $(0, 0 + 10, 10)$ was implemented in both types of sessions and thus features as both linked and unlinked game.

Table 4: Implemented simple and decomposed games (outcomes of the equilibrium AA in each component game reported).

2.2 The experiments

We have run two experiments, *PARALLEL* and *SERIAL*.⁴

³Due to a typo, instead of $(4, 4 + 8, 5)$ our experiment implemented $(4, 4 + 7, 5)$. Since behaviour in these games is not significantly different from other decomposed games of the $BS(12, 9)$ game, we expect that this would have been true for $(4, 4 + 7, 5)$ as well.

⁴The names refer to the simultaneous and sequential transmission of multiple pieces of information, called parallel and serial, respectively. All games are “simultaneous games” in terms of game theory. It is

In *PARALLEL*, we implement simple and decomposed games (30 games overall) with the component games presented on the screen at the same time (see figure 1). Component 1 is always displayed at the top of the screen and component 2 at the bottom.

In *SERIAL*, the framing manipulation of decomposed games is strengthened by presenting the component games on the screen one after the other and by requiring a decision in component 1 to be made before component 2 is shown (see figure 2).

Once component 2 is displayed, the option chosen in component 1 was not preselected. In other words, participants were required to make an active choice in component 2 as well, ensuring that they engaged with both components. If the option chosen in the second component did not match that chosen in the first, participants had to manually change their choice in either component in order to continue to the next task. We could have presented component 2 with a preselected option matching the choice in component 1. This design, however, would be problematic because it would have introduced a default option, potentially leading to a default bias (e.g., Samuelson and Zeckhauser, 1988; Johnson and Goldstein, 2003; Sitzia et al., 2015), which might have resulted in participants simply moving to the next task by accepting the preselection taken from component 1.

In *SERIAL*, if only decomposed and simple games were implemented, decisions in component 1 would always be inconsequential, given that participants could revise their selection when component 2 was displayed. To strengthen the *SERIAL* manipulation and increase the perceived relevance of component 1, we implemented the component games as independent games as well. We refer to these games as unlinked games in contrast to the decomposed games. For every decomposed game there is one unlinked game with exactly the same payoffs and components. In unlinked games, the decision made in component 1 cannot be revised once component 2 is displayed. Therefore, when players are presented with a component 1 game (or a simple game), participants know that their decision might be payoff-relevant, as they might not be able to change it afterwards. Note that, decomposed games in *SERIAL* are theoretically equivalent to the simple games because a binding decision is made only when both components are visible and therefore players have complete information about the whole game. In contrast, unlinked games are not theoretically equivalent to decomposed games, as a binding decision in component 1 cannot be revised when component 2 is displayed. We note however that, although interesting to study in their own right, the experimental purpose of unlinked games is to ensure that decisions in component 1 are probabilistically incentivised.⁵

therefore useful to introduce different adjectives for this mode of framing.

⁵In order to identify games in the experiment, the instructions employ a simple terminology: “linked” allocations for decomposed games, “unlinked” allocations for unlinked games, and “allocations” for simple games. Instructions are reprinted in ??.

We did not implement unlinked games in *PARALLEL*, as in this experiment, the presentation of the components is simultaneous and thus does not guide players' attention. Therefore, unlinked games did not offer the same value for us in *PARALLEL* as in *SERIAL*. We recognise, however, that implementing unlinked games in this experiment as well would have been an interesting addition, but, at the same time, it would have increased the number of treatments beyond the scope of this study.

Scenario

1 out of 31

Please select an allocation by clicking on the "Choose this allocation" button. Click OK to continue.

TASK 1

Choose this allocation You receive €a and the other receives €b.

Choose this allocation You receive €c and the other receives €d.

The two tasks are linked.

TASK 2

Choose this allocation You receive €e and the other receives €f.

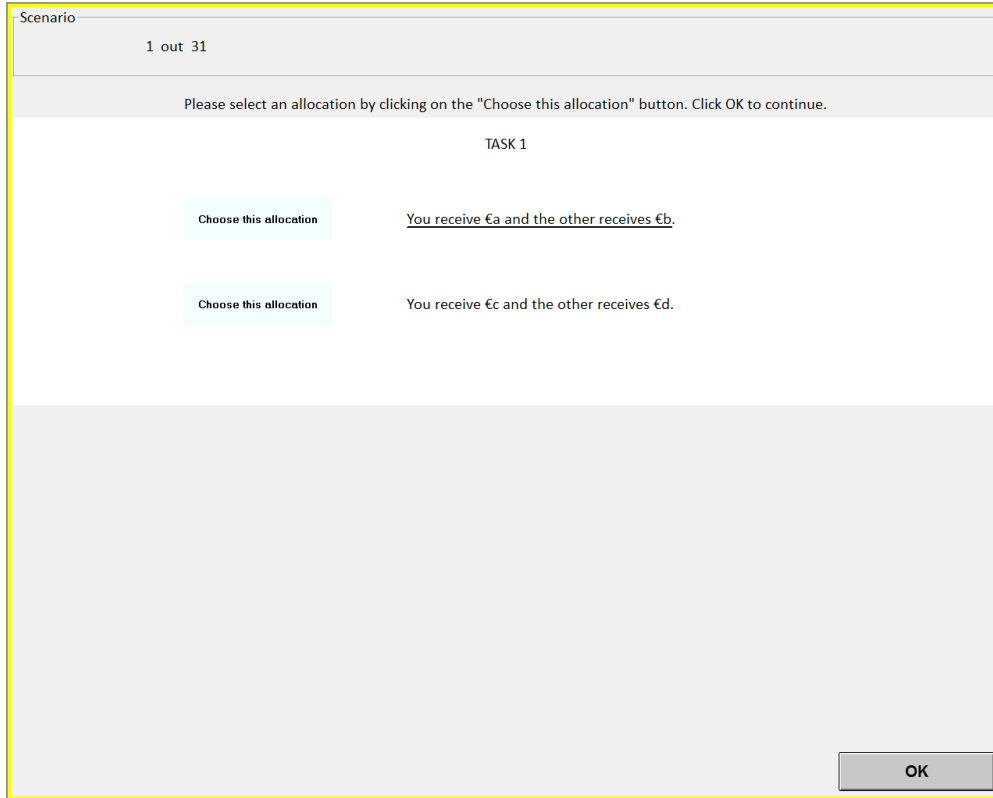
Choose this allocation You receive €g and the other receives €h.

OK

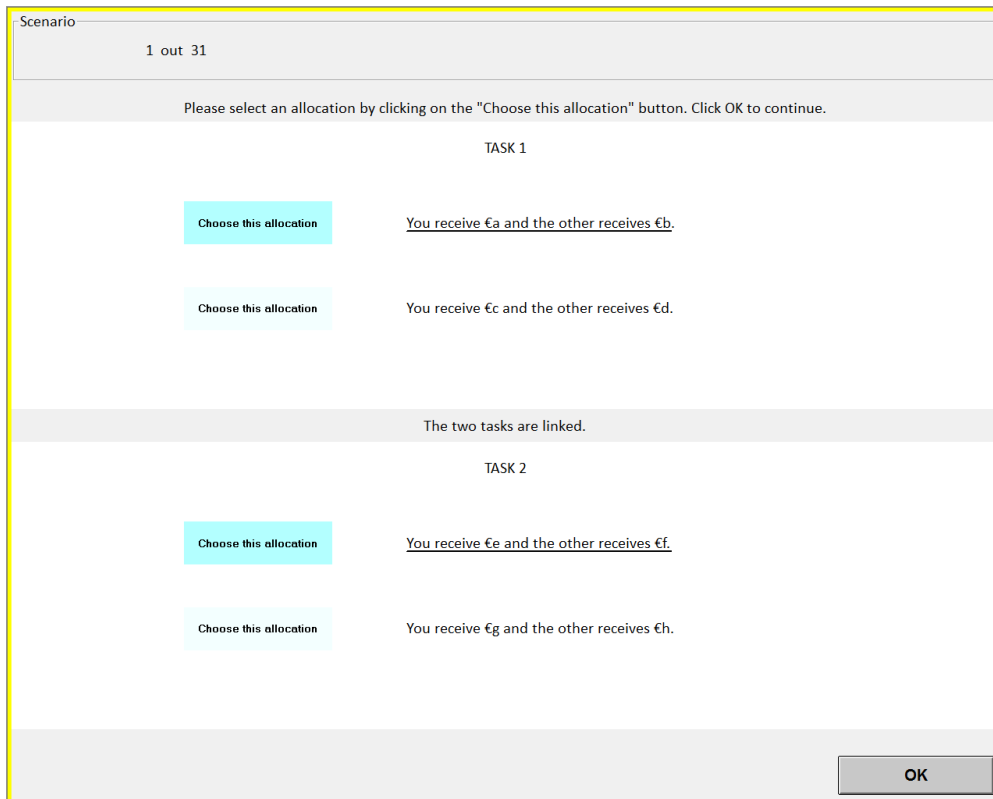
Figure 1: Screenshot of compound game in experiment *PARALLEL*.

In order to have a similar number of games in the experimental sessions, *SERIAL* features two types of sessions: SER_a and SER_b . Each type features only about half of the decomposed games in *PARALLEL* with the remaining half implemented as unlinked games. As we implement 27 decomposed games, one decomposition $(0, 0 + 10, 10)$ was implemented in both SER_a and SER_b as both decomposed and unlinked games. Therefore, participants in each type of session overall faced 14 decomposed games, 14 unlinked games, and 3 simple games (31 games overall). The decomposed games in SER_a are implemented as unlinked games in SER_b , and vice versa. Table 4 indicates what decomposed games are played in SER_a and/or SER_b with the superscript a and/or b next to the relevant games. Decomposed games are selected so that both SER_a and SER_b feature an equally numerous representation of $pc + pc$, $bs + bs$, $pc + bs$, and $bs + pc$ for each simple game employed. The same player

definitions used in simple and decomposed games are applied to unlinked games. In both *PARALLEL* and *SERIAL*, player roles were randomly assigned in each game across all relevant games.



(a) Screen 1 with component 1.



(b) Screen 2 with components 1 and 2.

Figure 2: Screenshots of decomposed games in *SERIAL*.

2.3 Procedures

The experiments were run in the AWI laboratory at the University of Heidelberg (Germany) in July 2018. We recruited 148 subjects with the online system hRoot (Bock et al., 2014): 46 subjects in *PARALLEL* and 102 subjects in *SER_a* or *SER_b* sessions. Upon arrival, subjects were handed the experimental instructions that were read aloud by the experimenter. Subjects then answered a brief questionnaire to check their understanding of the experiment. When all participants were ready, the experiment started. The order of the games was randomised across participants, and feedback was only provided at the end of the session for one randomly selected game, which was then used to determine the experimental earnings. In addition, all participants were given a participation fee of €4. Average earnings were about €10.38.

3 Hypotheses

The literature’s results about the quite distinct behaviour observed in pure coordination games and battle of the sexes games motivate our decompositions. In this section, we will therefore derive detailed hypotheses for our games using a combination of the two most prominent behavioural models in this literature: team reasoning (Bacharach, 2006; Schelling, 1960; Sugden, 1995) and level- k thinking (Crawford et al., 2008). Following Isoni et al. (2019), we will assume that players are capable of using both modes of reasoning, although only one at a time.

The simple games feature two players $i = \{1, 2\}$ and two strategies $s = \{\underline{A}, A\}$. Strategies are uniquely labelled with one label per strategy, one of which is salient ($\underline{A}$). By virtue of this labelling, one strategy stands out. If players choose the same strategy, which is equivalent to choosing the same label, their payoffs are $\pi_{is} \in \{a, b\}$ (with $a \geq b > 0$) and zero otherwise. The simple games are used to derive decomposed and unlinked games. These games consist of two component games $c = \{1, 2\}$, each with two strategies $s(c) \in \{\underline{A}, A\}$. In decomposed games, players are required to choose the same strategy in both component games. In unlinked games, players are not constrained in their strategy choice. If two distinct decomposed games are derived from the same simple game, we say that they reduce to the same simple game.

Two players team-reason if they independently look for a uniquely optimal rule which, if followed by both players, maximises the chances of coordination leading to the best possible outcome for the team. In coordination games in which labels are common knowledge, the best rule for the team is to choose the label salient strategy, i.e. $s = \underline{A}$.

The version of the level- k model in Crawford et al. (2008) assumes that players differ in their level of strategic sophistication. Level-0 players ($L0$) have a payoff bias, in that they choose, with a probability $p > 0.5$, the strategies whose equilibria have a higher own-payoff. If both equilibria have the same own-payoff, $L0$ choose according to label salience with probability $p > 0.5$.⁶ Higher levels anchor their beliefs on the behaviour of $L0$ and best-respond to players just one level below theirs. $L1$ best-respond to $L0$, $L2$ to $L1$ and so on. The distribution of levels in the population is exogenously given and $L0$ only exist in the mind of other players. $L1$ in a PC will therefore always choose the label salient strategy $s = \underline{A}$, as the probability of coordination is greater than one half. All levels greater than $L1$ will best-respond by choosing the same strategy. In BS games, how often the label salient strategy is chosen depends on the distribution of levels. For our purposes, without making any further assumption, it suffices to say that $s = \underline{A}$ will be chosen less frequently than in a PC game.

Following Isoni et al. (2019), let us define the probability that a player uses team-reasoning as τ . The probability that a player uses level- k reasoning is $\kappa = 1 - \tau$. If we consider the whole population of players, this probability can be interpreted as a proportion.

We assume that the type of games (i.e. pure coordination or battle of the sexes games) determines these probabilities irrespective of the game being a simple or a component game. For a PC game, where $a = b$, experimental evidence suggests that team reasoning is more prevalent than level- k reasoning, therefore $\tau_{PC} > \kappa_{PC}$. By contrast, level- k thinking is more prevalent in BS games, therefore $\kappa_{BS} > \tau_{BS}$ (van Elten and Penczynski, 2020). This further implies that $\tau_{PC} > \tau_{BS}$.

Hypothesis 1 (Simple games). *The frequency of choice of the salient strategies is greater in the simple PC than in the simple BS games.*

We will derive predictions for the reasoning in decomposed games with the help of two assumptions.

Assumption 1 (Narrow bracketing). *In decomposed games, components are evaluated separately.*

The first assumption is that players do not integrate the component payoffs. They think of each component individually. Like in simple games, the probability of reasoning is determined by the type of the component game. In a pc component, players are more likely to team-reason, in a bs component, they are more likely to use level- k reasoning. Because

⁶Other hierarchical reasoning models assume that level-0 players choose randomly. We use the model that Crawford et al. (2008) tailored to coordination games with salient labels.

in a decomposed game the same strategy must be chosen in both components, we need a selection rule that picks out the component that determines which strategy is chosen.

Assumption 2 (The pivotal component). *The probability that the strategy selected in the decomposed game is that selected in component 1 is $0.5 < p_{PARALLEL} < p_{SERIAL}$.*

We assume the pivotal component to be component 1, which is always displayed at the top of the screen, and likely to be seen first. Compared to *PARALLEL*, experiment *SERIAL* features a stronger framing manipulation as component games are displayed one by one. Hence the higher p .

On the basis of these assumptions, the next two hypotheses spell out the most basic implications for behaviour in decomposed games.

Hypothesis 2 (*PC decomposition*). *Decomposing a PC game into $pc + pc$ does not lead to a change in the frequency of choice of the salient strategy relative to the simple PC game. By contrast, decomposing a PC game into $bs + bs$ leads to a decrease in this frequency relative to the simple PC game. The effect is stronger in SERIAL than in PARALLEL.*

As in $bs + bs$ both components are battle of the sexes games, the probability that players use level- k reasoning is greater than in *PC*.

Hypothesis 3 (*BS decomposition*). *Decomposing a BS game into $bs + pc$ or $pc + bs$ increases the frequency of choice of the salient strategy relative to the simple BS game. The effect is stronger in SERIAL than in PARALLEL.*

This hypothesis essentially spells out that the mere presence of a pc component in a decomposed game increases the frequency of salient choices relative to a simple *BS* game. Because the first component game is assumed to be more important for the mode of reasoning, a pc component 1 leads to more frequent team reasoning and salient choices. A bs component 1 leads to more level- k reasoning. However, albeit with a lower probability, the pc component 2 can still influence modes of reasoning by making the rule for coordination, based on salience, more prominent. For this reason, we expect the frequency of salient strategy choices to be greater than in the simple *BS*.

When comparing these two decomposed games with each other, the pivotality assumption similarly implies that $bs + pc$ results in a less frequent choice of salient options than in $pc + bs$ due to the bs component 1. The stronger framing manipulation of the order in *SERIAL* will make this difference more pronounced.

Hypothesis 4 (*BS order*). *Decomposing a BS game into a $bs + pc$ leads to a lower frequency of choice of the salient strategy than in a $pc + bs$ decomposition. The effect is stronger in SERIAL than in PARALLEL.*

Although not theoretically modelled, the magnitude of the coordination payoff in the *pc* component might influence coordination success. Parravano and Poulsen (2015) show that an increase in the *PC* payoffs leads to an increase in coordination while a proportional increase in the payoffs of a *BS* game does not significantly affect coordination.

Hypothesis 5 (*BS pc component payoff*). *For a decomposed BS game, a higher coordination payoff in the pc component increases the frequency of choice of the salient strategy in the decomposed game.*

This increase in salient choices could happen, for example, if the team-optimal rule is made more salient by a higher symmetric payoff in *pc*.⁷

4 Results

4.1 The simple games

Table 5 shows that the choice frequency of the salient strategy⁸ is, in support of Hypothesis 1, significantly greater in the *PC* game than in both *BS* games (McNemar test, on pooled *PARALLEL* and *SERIAL* data; $p < 0.001$ for *PC* vs. *BS*(11, 10), $p < 0.001$ for *PC* vs. *BS*(12, 9))⁹. We have run complementary regression analyses, which we report in table ?? in ??, that corroborate the findings from these non-parametric tests. In the simple *BS* games, both players choose less often the salient strategy, but the reduction is more pronounced for *P2*.

Result 1 (Simple Games). *The choice frequency of the salient strategy is greater in PC than in the two BS games (Bonferroni-corrected for two tests $p < 0.001$).*¹⁰

⁷For decomposed games derived from the same *BS*, a *bs* component with smaller coordination payoffs is always associated with a higher relative degree of conflict between players. Since the interaction between this higher degree of conflict and the smaller total payoff size remains unclear, we refrain from making any claims about the effects of *bs* on the choice of the salient strategy.

⁸?? looks at coordination success as the outcome variable and supports the results we present here in terms of frequency of the salient strategy.

⁹Each observation within the same simple game represents a different subject's choice, so the choices in that game are independent of one another.

¹⁰For each Result that tests a Hypothesis, we apply a Bonferroni correction when more than one pairwise comparison is made to test that Hypothesis. In this case, the pairwise comparisons are *PC* vs *BS*(11, 10) and *PC* vs *BS*(12, 9). The same correction is applied to Results 2 and 3. In Result 2, which tests Hypothesis 2, the tests are *PC* vs. *pc + pc* and *PC* vs. *bs + bs* and in Result 3, which tests Hypothesis 3, the pairwise comparisons are *bs + pc* vs. *BS* and *pc + bs* vs. *BS*. Corrections are applied separately for each hypothesis. Result 4 uses the same data as 3 but tests a different hypothesis, so no correction is applied, as only one pairwise comparison is made. We also apply the correction separately in *PARALLEL* and *SERIAL* as these are distinct experimental environments with different framing strengths.

Experiment	Players	PC	BS	
			(11, 10)	(12, 9)
<i>PARALLEL</i>	<i>All</i>	0.826	0.630	0.478
	<i>P1</i>	–	0.696	0.522
	<i>P2</i>	–	0.565	0.435
<i>SERIAL</i>	<i>All</i>	0.843	0.608	0.647
	<i>P1</i>	–	0.706	0.765
	<i>P2</i>	–	0.510	0.529

Table 5: Fractions of salient strategy choices in the simple games PC and BS by experiment and player type.

4.2 The decomposed games

Table 6 reports the proportion of salient strategy choices, for all decomposed game types, by experiment and player type. Because our main concern is whether behaviour differs across these four decomposed game types, we focus on averages without distinguishing whether they reduce to the simple $BS(12, 9)$ or the simple $BS(11, 10)$.

Experiment	Players	Simple PC Average	PC		BS		Simple BS Average
			$pc + pc$	$bs + bs$	$bs + pc$	$pc + bs$	
<i>PARALLEL</i>	<i>All</i>	0.826	0.865	0.743	0.598	0.614	0.554
	<i>P1</i>	–	–	0.783	0.723	0.728	0.609
	<i>P2</i>	–	–	0.703	0.473	0.500	0.500
<i>SERIAL</i>	<i>All</i>	0.843	0.843	0.634	0.581	0.699	0.627
	<i>P1</i>	–	–	0.778	0.730	0.750	0.735
	<i>P2</i>	–	–	0.490	0.431	0.647	0.520

Notes: The column “Simple BS Average” shows the average fraction of salient strategy choices in $BS(11, 10)$ and $BS(12, 9)$. In a BS game, $P1$ is the player whose payoff is higher in the focal point. In $bs + bs$, $P1$ is identified in component 1.

Table 6: Fractions of label salient choices in the decomposed games by experiment and player type.

PC Decomposition. In hypothesis 2, we expect behaviour in $pc + pc$ and simple PC to be similar, but $bs + bs$ to be different. We find evidence in support of this hypothesis in *SERIAL*. In *PARALLEL*, the behavioural difference between $bs + bs$ and PC goes in the expected direction, but is considerably smaller than in *SERIAL* and not significant. Note that the lower frequency of salient strategy choices in $bs + bs$ compared to that in the simple

PC is mainly influenced by the behaviour of *P2* and to a lesser extent by that of *P1*. This is consistent with the assumption that component 1 has a stronger effect on behaviour than component 2 in both experiments and especially in *SERIAL*. Because *P2s* have a lower own-payoff in the focal point equilibrium of component 1, they choose the salient strategy less often than the non-salient one. (Wilcoxon signed-rank test¹¹, *PC* vs *pc + pc*: $p = 0.783$ in *PARALLEL* and $p = 0.601$ in *SERIAL*; *PC* vs *bs + bs*: $p = 0.064$ in *PARALLEL* and $p < 0.001$ in *SERIAL*). The regression results in table ?? in ?? corroborate these findings.

Result 2 (*PC* decomposition). *In PARALLEL, the choice frequency of the salient strategy is not significantly lower in bs+bs than in PC (Bonferroni-corrected for two tests $p = 0.128$). In SERIAL, the difference is strongly significant and, as in the simple BS games, is primarily driven by P2's behaviour in bs + bs (Bonferroni-corrected for two tests $p < 0.001$).*

The influence of individual component games on behaviour in the above decompositions suggests that, in line with narrow bracketing, players do not fully integrate outcomes. In *PARALLEL* however, the fact that the frequency of salient strategy choices in *bs + bs* is significantly greater than that in *BS* ($p = 0.002$ in *PARALLEL*), indicates some incomplete integration of the component games. This difference between *bs + bs* and *BS* is smaller and not significant in *SERIAL*, suggesting a lower degree of integration likely due to the sequential display of the components ($p = 0.181$ in *SERIAL*).

BS Decomposition. Table 6 shows that in *PARALLEL*, the *BS* decompositions feature an increase, albeit not significant, in the choice frequency of the salient strategy compared to the simple *BS* ($p = 0.305$ for *bs + pc* vs. *BS*, and $p = 0.191$ for *pc + bs* vs. *BS*). Thus the result does not support Hypothesis 3 in *PARALLEL*. In *SERIAL*, only in *pc + bs* subjects choose this strategy significantly more frequently than in *BS* ($p = 0.014$), supporting our hypothesis. Contrary to our hypothesis, in the *bs + pc* decomposition, this strategy is chosen less often, although the difference is not significant at the 5% level ($p = 0.055$). The regression results in table ?? in ?? corroborate these findings.

Result 3 (*BS* Decomposition). *In PARALLEL, the frequencies of salient strategy choices in the bs + pc and pc + bs decompositions do not differ significantly from those in the simple BS games. In SERIAL, however, we find that this frequency is significantly greater in the pc + bs decomposition than in the simple BS (Bonferroni-corrected for two tests $p = 0.028$), whereas it is not significantly different in the bs + pc decomposition.*

¹¹Hereafter, unless otherwise stated, all within-subject tests are Wilcoxon signed-rank tests. For each subject, we averaged their choices across games of the same type, so each observation in the Wilcoxon signed-rank test represents the subject's mean choice value (between 0 and 1) for that game type.

The isolation of the *pc* component in the *BS* decomposition in *PARALLEL* does not have the hypothesised effect of increasing the frequency of the salient strategy choices. For this decomposition to be effective, *SERIAL*'s stronger emphasis of the component 1 is needed. An implication of this finding is that, when both components are presented simultaneously, as in *PARALLEL*, merely knowing that a *bs* component is present influences behaviour more than knowing that a *pc* component is present. In *SERIAL*'s *pc+bs*, subjects' initial exposure to the *pc* component makes their behaviour more in line with simple *PC* games.

BS Order. Result 3 already foreshadows the order effects between the two decomposed games. We find results consistent with Hypothesis 4 in both experiments, but the effect is statistically significant only in *SERIAL* (*pc + bs* vs. *bs + pc*, $p = 0.694$ in *PARALLEL* and $p < 0.001$ in *SERIAL*).

Result 4 (*BS Order*). *In PARALLEL, the frequency of salient strategy choices in a bs + pc decomposition is not significantly lower than in a pc + bs decomposition. In SERIAL, by contrast, this difference is significant and in the hypothesised direction ($p < 0.001$).*

The difference in salient strategy choices between *bs + pc* and *pc + bs* is mainly driven by the behaviour of subjects in the role of *P2*. The bottom line of table 6 shows that *P2*s choose the salient strategy only 43% of the time when the *bs* component is played before the *pc* one. By contrast, they choose it significantly more when *pc* is displayed first (*pc + bs* vs. *bs + pc*, $p = 0.539$ for *P1*, $p < 0.001$ for *P2*).

	Dependent Variable: Salient Strategy Chosen					
	<i>PARALLEL</i>			<i>SERIAL</i>		
	<i>All</i> (1)	<i>P1</i> (2)	<i>P2</i> (3)	<i>All</i> (4)	<i>P1</i> (5)	<i>P2</i> (6)
<i>pc</i> payoff	0.031 (0.022)	0.041* (0.023)	0.021 (0.027)	-0.027* (0.015)	-0.024 (0.019)	-0.031 (0.019)
Period	0.003 (0.002)	0.006* (0.003)	0.001 (0.003)	0.000 (0.002)	0.000 (0.003)	-0.001 (0.003)
<i>bs + pc</i>	-0.021 (0.022)	-0.015 (0.028)	-0.028 (0.026)	-0.118*** (0.032)	-0.020 (0.045)	-0.215*** (0.043)
<i>BS</i> (12, 9)	-0.004 (0.024)	0.041 (0.041)	-0.049 (0.030)	0.039 (0.053)	0.069 (0.054)	0.010 (0.070)
<i>N</i>	736	368	368	816	408	408

Notes: Logit regression with standard errors clustered at the subject level. Significance levels: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. *N*: Number of observations.

Table 7: The effect of the size of the *pc* payoffs on fractions of salient strategy choices.

In order to test the robustness of result 4 and to evaluate hypothesis 5 regarding the size of the pc payoffs in BS decompositions, we turn to a regression analysis. Table 7 reports the marginal effects from logit regressions, with standard errors clustered at the subject level. The analysis only uses observations from BS decompositions. The dependent variable is a binary variable that takes value one if the salient strategy is chosen and zero otherwise. The independent variables are the size of the pc payoffs in the independent of the position of the pc component (“ pc payoff”), categorised as 1 = (0, 0), 2 = (4, 4), 3 = (7, 7), and 4 = (10, 10) or (9, 9); “Period”, which captures changes in participants’ salient choices over time; and a dummy variable “ $bs + pc$ ” that takes value one if bs is component 1 and takes value zero as the baseline category if pc is component 1, i.e., $pc + bs$. The “ $BS(12, 9)$ ” is a dummy variable that takes value one if the decomposed game reduces to the simple BS with payoffs (12, 9) in the focal equilibrium and zero otherwise. In table 7, the baseline category for this dummy is “ $BS(11, 10)$ ”, which refers to the cases in which the decomposed game reduces to the simple BS with payoffs (11, 10). This dummy captures whether the level of conflict in the simple BS affects participants’ choices of the salient strategy.

We estimate six models: three per experiment. “*All*” considers both players’ data, “*P1*” and “*P2*” consider only player 1’s and player 2’s data, respectively. In *PARALLEL*, the estimated coefficient of the “ $bs + pc$ ” dummy is not significantly different from zero. In *SERIAL*, by contrast, the estimated coefficient is negative and strongly significant, implying fewer salient strategy choices compared to those in the $pc + bs$ decomposition (see also table ?? in ??). This result is mainly driven by *P2*’s behaviour as evidenced in column (6).

The pc component payoff. The different payoff decompositions of the simple BS games allow us to test hypothesis 5.¹²

The estimated coefficient of “ pc payoff” is positive and not significant at the 5% level in *PARALLEL* for *P1* and negative and not significant at the 5% level in *SERIAL* for *All*. Overall, these results do not show a systematic influence of the pc payoff size and are thus not supportive of our hypothesis 5.

Result 5 (*BS pc component payoff*). *For decomposed BS games, different payoffs in the pc component game do not have an effect on the frequency of choice of the salient strategy.*

Why might the pc payoff be less relevant than we thought? A $BS(11, 10)$ game, for example, can be decomposed into a $bs + pc$ game either as (7, 6 + 4, 4) or as (1, 0 + 10, 10). Even if the higher pc payoff in the latter decomposition emphasises the coordination motive, it also comes with a starker relative difference between the players’ bs payoffs. This might emphasise the individual conflict and counterbalance the pc payoff’s effect.

¹²More details of these games can be found in the $pc + bs$ and $bs + pc$ columns of table 4. In *PARALLEL*, each subject played 16 decomposed BS games. In *SER_a* or *SER_b*, each subject played 8 such games.

4.3 Underlying mechanisms

The results so far allow us to discuss possible underlying mechanisms. Based on our results, we conjecture that *bs* components are more likely to influence behaviour than *pc* components. The conflict of interest may draw attention to the payoffs at the expense of payoff-irrelevant cues that help solve the coordination problem as modelled by team reasoning (Arjona et al., 2022).

One may argue that decision inertia could also play a role if the decision made in the first component game is mechanically applied to the entire decomposed game without engaging further with component 2.¹³ However, if decision inertia were the main driver of our results, we would broadly expect to observe few switches in choices between components and no systematic differences driven by the type of the component 2 game.

To shed some light on these two different mechanisms, i.e., the salience of the conflict of interest induced by the *bs* component versus decision inertia, we use data on switches from the *SERIAL* experiment. There, we recorded preliminary choices in component 1 before component 2 was displayed. For each type of game, table 8 reports the switches from the non-salient strategy in component 1 to the salient strategy in component 2, as well as the proportion of switches from the salient strategy in component 1 to the non-salient strategy in component 2. We present results for all players in the *pc + pc* decomposition. For the other decompositions, we also present the results separately by player. We remind the reader that in the *bs + bs* decomposition, the focal point equilibrium favours *P1* in the first *bs* component and *P2* in the second *bs* component. Therefore, for *P1*, switches from the non-salient to the salient option imply switches to the equilibrium that favours them, while switches from the salient to the non-salient option imply switches to the equilibrium that favours *P2*. The opposite holds for *P2*.¹⁴

Four regularities are noteworthy. First, in the *pc + pc* decomposition, we observe a small number of switches. Second, we see moderate levels of switching in *bs + bs*, which are driven by both players 1 and 2 who primarily switch towards the action that favours them in the second component. For example, the switch towards the salient choice is made by *P2s*, who are favoured in the second *bs* component if coordination occurs on the salient equilibrium. Overall, this pattern seems indicative of strong framing effects induced by this specific decomposition. After all, this decomposition is obtained from a simple *PC*, in which

¹³Because it relates to prior own decisions, we consider this type of inertia distinct from default bias as this relates to a preselected option rather than an own choice (see section 4.2).

¹⁴We have not recorded preliminary choices in *PARALLEL* because, by design, participants see both components simultaneously and the choice order across components is not enforced. Moreover, even if it were, we could not ensure that such a choice would not be influenced by the other component game, and therefore be informative.

Strategy switch	Players	<i>PC</i>		<i>BS</i>	
Component 1 $\rightarrow$ Decomposed game		<i>pc</i> + <i>pc</i>	<i>bs</i> + <i>bs</i>	<i>bs</i> + <i>pc</i>	<i>pc</i> + <i>bs</i>
Non-salient $\rightarrow$ <u>Salient</u>	<i>All</i>	0.023	0.134	0.059	0.081
	<i>P1</i>	–	0.034	0.020	0.085
	<i>P2</i>	–	0.293	0.125	0.076
<u>Salient</u> $\rightarrow$ Non-salient	<i>All</i>	0.021	0.098	0.076	0.593
	<i>P1</i>	–	0.294	0.200	0.392
	<i>P2</i>	–	0.013	0.017	0.736

Notes: In a *BS* game, *P1* is the player whose payoff is higher in the focal point. In *bs* + *bs*, *P1* is identified in component 1.

Table 8: Proportion of strategy switches out of all choices of the indicated decomposed game strategy.

the absence of conflict of interest, as evidenced in the literature (Mehta et al., 1994; Isoni et al., 2013) leads to much higher coordination success.

Third, decomposed *BS* games with a first *bs* component game feature low levels of switching. This implies that the second *pc* component game does not induce many revisions of decisions made in the first *bs* component. Fourth, in the *pc* + *bs* decomposition, we have computed the proportion of salient choices in the *pc* component, before the *bs* component was revealed, to be 0.821. This is significantly higher than the proportion of salient option choices in the decomposed game (0.699, as shown in table 6, $p < 0.001$). This is not surprising given that, in this decomposed game, we observe higher levels of switches from salient to non-salient than in the other direction (see last column of table 8). Out of all observations featuring the salient strategy in this decomposed game, only 8.1% show a switch toward this strategy in component 2. Out of all observations featuring non-salient choices in the decomposed game, 59.3% indicate a switch away from the salient strategy. The switching tendency is most pronounced for *P2s* (73.6% of all *P2* choices), who would be disfavoured by coordinating on the salient strategy in *bs*.

In conclusion, while we cannot rule out the presence of some decision inertia, the substantial and heterogeneous levels of switching, their direction and the differences in switching behaviour between *P1* and *P2* are consistent with our conjecture that the conflict of interest in the *bs* component games draws attention to the payoffs at the expense of label salience. In the literature, the high coordination rates observed in pure coordination games are often interpreted as consistent with players engaging in team-reasoning or more generally in collective thinking (Crawford et al., 2008; van Elten and Penczynski, 2020; Faillo et al., 2017). The fact that switches are more frequent when a *pc* component is displayed before a *bs* could

be considered illustrative of a “fragility” of team reasoning, which is somewhat undermined when the second component game reveals the presence of conflicting interests. The $bs + bs$ result further suggests that a decomposition that introduces conflict of interests in the simple PC game, in which interests are fully aligned, can reduce the power of focal points as if the simple game featured some degree of conflict of interest.

4.4 The unlinked games

Unlinked games feature only in *SERIAL* and differ from decomposed games in that players’ actions are not constrained to coincide between components. We will use the notation $\times$ (e.g. $pc \times pc$) to distinguish them from decomposed games.

We remind the reader that we employed these games in *SERIAL* to probabilistically incentivise choices in component 1 (see section 2.2). As a piece of evidence that subjects indeed treated first component choices seriously, table 9 shows that the proportions of salient strategy choice in the first components in both decomposed and unlinked games are very similar, and their differences are not statistically significant ($p = 0.514$ for first component bs , and $p = 0.522$ for first component pc).

First Component	Decomposed games		Unlinked games	
	$P1$	$P2$	$P1$	$P2$
bs	0.790	0.373	0.768	0.403
pc	0.824		0.833	

Table 9: Proportion of salient strategy choices in the first component in *SERIAL*.

Beyond the experimental manipulation, the unlinked games allow us to explore whether the patterns observed in decomposed games also occur in these games. Table 10 reports proportions of salient strategy choices by game type and component.

In both components of the unlinked game $pc \times pc$, the choice frequencies of salient strategies are above 80%. In line with our results so far, these frequencies are not significantly different from those observed in the simple PC game ($p = 0.104$ and $p = 0.724$ for PC vs. $pc1$ and $pc2$ respectively). Similarly, the choice frequency in each individual component of $bs \times bs$ is not statistically different from the average frequency observed in the simple BS games ($p = 0.694$ and $p = 0.964$ for average BS vs. $bs1$ and $bs2$ respectively).

In both unlinked games $pc \times bs$ and $bs \times pc$, subjects choose significantly more often the salient strategy in the pc component than in the bs one ($p < 0.001$). In addition, the choice frequency in pc is significantly greater in $pc \times bs$ than in $bs \times pc$ ($p < 0.001$). This difference is mainly driven by $P2$ ’s behaviour. When the pc component is displayed before the bs one,

Players	$pc \times pc$		$bs \times bs$		$pc \times bs$		$bs \times pc$	
	$pc1$	$pc2$	$bs1$	$bs2$	$pc1$	$bs2$	$bs1$	$pc2$
All	0.807	0.846	0.578	0.598	0.853	0.603	0.591	0.716
$P1$	–	–	0.791	0.464	0.868	0.779	0.750	0.804
$P2$	–	–	0.366	0.732	0.838	0.426	0.431	0.627

Notes: $pc1$ and $bs1$ are the component games displayed first; $pc2$ and $bs2$ are the component games displayed after.

Table 10: Proportion of salient strategy choices in unlinked games by component game and player.

$P2$ s choose the salient strategy 83.8% of the time. When the pc component is displayed after the bs one, the choice frequency drops to 62.7% ($p < 0.001$). As a consequence, the choice frequencies in the pc component and the simple PC game are significantly different if the pc component is displayed after the bs component, but not when it is displayed before it ($p < 0.001$ for $pc2$ vs. PC in $bs \times pc$ and $p = 0.233$ for $pc1$ vs. PC in games $pc \times bs$).

In contrast, for both unlinked games $pc \times bs$ and $bs \times pc$, salient strategy choices in the bs component are not significantly influenced by the displaying sequence ($p = 0.491$). Finally, in line with our predictions, the salient strategy in these components is chosen as frequently as in both BS games ($p = 0.285$ for $bs1$ vs. BS and $p = 0.405$ for $bs2$ vs. BS).

Result 6 (Unlinked games). *The salient strategy is chosen as often in bs games as it is in the simple BS games. In the pc games, the salient strategy is chosen as often as in the simple PC games only when these component games are displayed before a bs component.*

The order effects observed in the $bs \times pc$ and $pc \times bs$ games are in line with asymmetric behavioural spillovers from bs to pc but not vice versa. In ensembles of games, behavioural spillovers from one game to another have been observed on numerous occasions (Knez and Camerer, 2000; Cooper and Kagel, 2008; Bednar et al., 2012; Haruvy and Stahl, 2012; Galbiati et al., 2018; Liu et al., 2019; Engl et al., 2021; Greiff and Giamattei, 2024). We conjecture that this asymmetry is explained by the conflict of interest in $bs1$ that affects the salience of the focal point in $pc2$. In $pc2$, subjects may pay less attention to payoff-irrelevant salient cues, and this leads to a lower fraction of strategy salient choices. This effect is primarily driven by $P2$, possibly because they favour the non-salient action in $bs1$, their attention to the salient label is reduced to a greater extent in $bs1$, and this spills over to the subsequent $pc2$ component game. By contrast, and in line with this explanation, behaviour in $pc1$ components spills over to the $bs2$ component game to a lesser extent. Decomposed games of this type feature qualitatively similar effects, although it might not be adequate to

view these as “spillover” effects as only one decision is taken.

5 Conclusion

Decompositions of games offer a way to systematically vary the frame of a game while keeping the game-theoretic structure unchanged. In the spirit of a “proof-of-concept”, our study provides evidence of how games can be decomposed in behaviourally relevant, yet strategically equivalent ways by separating and thus emphasising different elements of the overall strategic situation. Guided by empirical evidence, we investigate whether behaviour in battle-of-the-sexes games and pure coordination games is influenced by the way these games are decomposed.

Our experiments indeed show behavioural changes that depend on the nature and the order of the component games. Understanding which decompositions produce predictable behavioural effects can help organisations, policy-makers, employers, and others design strategic environments that steer behaviour in desired directions. Behavioural changes might result from, for example, changes in reference points, separation or integration of gains or losses, and obfuscation of the strategic elements present in a game. Importantly, decomposed games offer a formal structure to study framing effects systematically and experimentally.

Replication package:

The replication materials for this study are available at <https://doi.org/10.5281/zenodo.23120369>.

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