On the Relevance of Irrelevant Strategies*

Ayala Arad † Benjamin Bachi ‡ Amnon Maltz§

October 22, 2023

Abstract

The experimental literature on individual choice has repeatedly documented how seemingly-irrelevant options systematically shift decision-makers' choices. However, little is known about such effects in strategic interactions. We experimentally examine whether adding seemingly-irrelevant strategies, such as a dominated strategy or a duplicate of an existing strategy, affects players' behavior in simultaneous games. In coordination games, we find that adding a dominated strategy increases the likelihood that players choose the strategy which dominates it, and duplicating a strategy increases its choice share; The players' opponents seem to internalize this behavior and best respond to it. In single-equilibrium games, these effects disappear. Consequently, we suggest that irrelevant strategies affect behavior only when they serve a strategic purpose. We discuss different theoretical approaches that accommodate the effect of salience and may explain our findings.

Keywords: Coordination, Dominated Strategy, Salience, Level-k, Asymmetric dominance effect, Experiment.
JEL Codes: C91, D91

*This study was pre-registered at the AEA RCT Registry. Its registration number is AEARCTR-0004129 and it is available at https://doi.org/10.1257/rct.4129-1.0. We acknowledge support from the Israel Science Foundation, grant number 664/17.

†Tel Aviv University, Coller School of Managment, aradayal@tauex.tau.ac.il
‡University of Haifa, Department of Economics, bbachi@econ.haifa.ac.il
§University of Haifa, Department of Economics, amaltz@econ.haifa.ac.il

1 Introduction

Suppose that two public transport companies are planning a bus line from one city to another. Both are considering either an express line that drives directly between the cities' central stations or a local-town line that stops in several small towns along the way. Let's further suppose that demand for these lines is such that if they choose different lines, both will make nice profits but the express line will earn more. If they choose the same type of line, they split the demand for that line and both earn less than in the previous case. Table $1(a)$ shows their potential payoffs for each choice.

Now imagine that one of the companies is considering an additional option: A local-village line that stops in a couple of rural villages in between the small towns and is expected to generate the same payoffs as the local-town line regardless of the competing company's strategy. As in the first scenario, each company chooses only one line. This situation is depicted in Table $1(b)$. Would the companies' likelihoods of choosing one type of bus line over the other change due to this strategically duplicated option? Would the likelihood change if the local-village line is expected to generate slightly lower payoffs than the local-town line, regardless of the competing company's strategy (i.e., if it is a strictly dominated strategy)?

In standard solution concepts in game theory, such as Nash equilibrium (Nash, 1951), correlated equilibrium (Aumann, 1974) and rationalizability Bernheim (1984), duplicated and dominated strategies are deemed irrelevant. That is, the game's outcome does not change whether these strategies are included in the strategy space or not. Even according to common equilibrium refinements, such as perfect equilibrium (Selten, 1988) and proper equilibrium (Myerson, 1978) there is no room for irrelevant strategies to affect equilibrium selection. At the same time, the experimental literature on non-strategic individual behavior has repeatedly documented how seemingly irrelevant options systematically shift decision-makers' choices. For example, the presence of an asymmetrically dominated option has been shown to increase the choice probabilities of the option that dominates it, a phenomenon known as the asymmetric dominance effect (Huber et al., 1982). This effect and other *context effects* have been studied almost exclusively in the domain of individual choice. Amaldoss et al. (2008) took the asymmetric dominance effect to the strategic domain and demonstrated that it shows up in coordination games when a dominated strategy is added to one of the two players' strategy sets.

In the current study, we extend the scope of the work by Amaldoss et al. (2008) along two dimensions and experimentally examine *two* types of irrelevant strategies in *two* types of strategic games. This extension brings about our main contributions: (1) We examine, for the first time, the effect of a duplicated strategy in strategic scenarios (in addition to the effect of a dominated strategy), and (2) by analyzing two strategic contexts jointly, we shed light on the mechanism that underlies the effects of irrelevant strategies in games.

We study eight simultaneous-move one-shot 2x2 matrix-form *base games* to which we add an irrelevant strategy to the row player's strategy set. Thus, for each base game, we

Table 1: Public Transport Example

Table 1(a)

	Local-Town	Express
Local-Town	40,40	**60,80**
Express	**80,60**	50,50

Table 1(b)

	Local-Town	Express
Local-Town	40,40	**60,80**
Local-Village	40,40	**60,80**
Express	**80,60**	50,50

Notes: In Table 1(a) both companies are considering two lines. In Table 1(b) the company in the row position considers three lines. Equilibria are in bold.

construct two 3x2 *extended games*. The added strategy is either dominated by one, and only one, of the original strategies (as in Amaldoss et al., 2008) or a duplicate of one of the original strategies. Clearly, when the added strategy is a dominated strategy, players who maximize their own payoff should never choose it. Therefore, their opponents should also ignore it if they maximize their own payoff and believe that the row players do so as well. The duplicated strategy, as the name suggests, is identical to an existing strategy in terms of both players' payoffs. Unlike a strictly dominated strategy, payoff-maximizing players *may* choose the added strategy because they should clearly be indifferent between the two identical strategies. However, under standard solution concepts, a duplicated strategy should not be chosen instead of any of the player's other strategies. Consequently, this addition should not affect their opponents' choices either. Thus, both types of added strategies should not affect the standard game-theoretic analysis of the strategic interaction.[1]

Our base games comprise four *coordination games* and four *single-equilibrium games*. Coordination games are a natural starting point to examine the effect of irrelevant strategies since they present players with an inherent difficulty of coordinating on one of the equilibria. In these situations, cues–such as the irrelevant strategies we introduce–may serve as an informal guideline for players to follow. However, studying solely these games does not allow disentangling individual-based effects of irrelevant strategies, i.e., effects that would arise even in individual choice problems, from effects that are due to strategic considerations. Since we are interested in teasing out which of the two underlying mechanisms is in play, we introduce the single-equilibrium games, that are strategically simpler than coordination games (although by no means trivial). As we discuss in Section 4, in single-equilibrium games, adding irrelevant strategies does not affect players' strategic considerations, and hence any evidence for their influence shall be interpreted as an individual-based effect rather than a strategic effect. Thus, examining the single-equilibrium games *alongside* the coordination games brings about our ability to distinguish between the two potential

[1]While our main focus in this work is on irrelevant strategies, we also examine the effect of adding a relevant, yet extreme strategy, which we elaborate upon in the next section.

psychological mechanisms.

For each type of game, we examine three effects that the added strategy may have on the games' outcomes. First, the *direct effect*, i.e., the change in the behavior of the row players across base games and extended games. Second, the *indirect effect*, i.e., the change in the behavior of the column players across base games and extended games. Ultimately, we analyze how the interplay of these influences shapes the overall outcomes of games. In the coordination games, we test whether players are more likely to coordinate on one equilibrium over the other in the extended games and whether their overall coordination rate increases. We conduct a comparable analysis in single-equilibrium games, investigating whether players in the extended games are more likely to reach the equilibrium outcome or another designated outcome, where total surplus is maximized.

We find that irrelevant strategies affect players' choices in coordination games. First, in terms of the direct effect, adding an asymmetrically dominated strategy increases the choice likelihood of the strategy that dominates it, and duplicating a strategy increases the likelihood that it will be chosen. Second, these additions seem to be taken into account by the column players: They are more likely to choose the best response to the row player's strategy whose choice frequency increased in the extended games. These findings do not show up in the single-equilibrium games. In fact, we find no evidence that row or column players change their behavior when an irrelevant strategy is added to these games. This suggests that the influence of irrelevant strategies is not driven by an intuitive response. Rather, in coordination problems, players seem to make use of the added strategies as a coordination device: They focus their attention and synchronize their actions on one of the two equilibria, which becomes more salient due to the asymmetric addition. Indeed, in the extended games we find higher coordination rates on the equilibrium that corresponds to the row players' dominating/duplicated strategy (and the column players' best response to that strategy) compared to the base games. These findings may be explained by the notion of salience put forth by Schelling (1960). According to *Schelling salience*, players who face a coordination problem look for a choice rule that, if followed by the other players, will lead the way to successful coordination. While our base games lack a natural focal point, each of our extended games creates a focal equilibrium that gives rise to a natural choice rule that both players can follow. In Section 5 we discuss Schelling salience in relation to our findings.

Another related idea raised by Mehta et al. (1994) and discussed in Section 5 is that of *primary and secondary salience*. According to this notion, the highlighted strategy is an intuitive choice (due to primary salience) that may serve as a starting point for iterative reasoning. In Appendix C we show that a slightly adjusted general cognitive hierarchy model (Chong et al., 2016), which captures this idea, is able to explain our findings.[2]

[2]Appendix C also explores other related models, such as quantal response equilibrium (McKelvey and Palfrey, 1995) and sampling equilibrium (Osborne and Rubinstein, 1998). These models allow irrelevant strategies to influence choice behavior but, unlike the GCH model, they only offer a partial explanation for our findings.

2 Related Literature

2.1 Irrelevant Options in Individual Choice

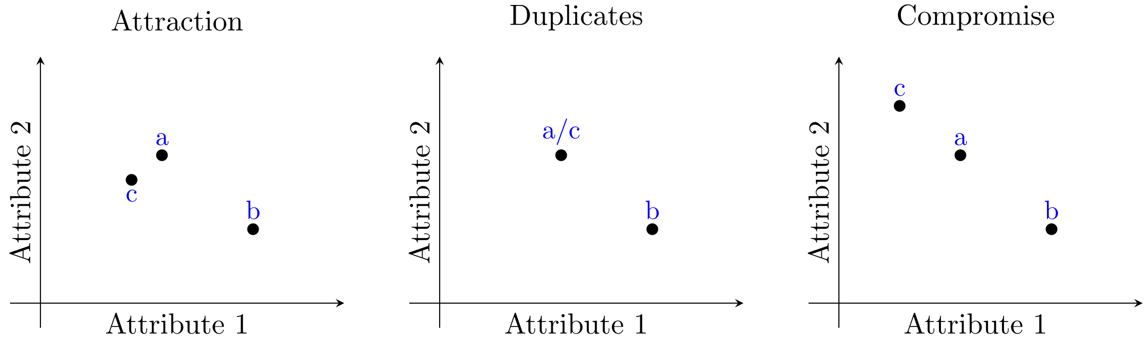
Our addition of an asymmetrically dominated strategy draws upon the individual choice literature on the asymmetric dominance effect, also known as the *attraction effect* (Huber et al., 1982). This effect arises when a decoy option, c, is added to a two-alternative set $\{a, b\}$ (see Figure 1-Attraction). When the decoy is dominated by one alternative (a in Figure 1-Attraction) but not by the other, choices have been found to shift in the direction of the dominating alternative. The experimental evidence for this effect in non-strategic choice problems is large and spans a variety of goods, services and even perceptual decision tasks.[3] Most of the psychological mechanisms that were suggested as explanations for the attraction effect share the idea that the dominating alternative b shines brighter when the decoy alternative is present. This may be due to reason-based approaches, as in Lombardi (2009) and de Clippel and Eliaz (2012), which hinge on ideas raised in Simonson (1989), Tversky and Simonson (1993) and Shafir et al. (1993). It may also stem from dimensional weights (Tversky et al., 1988; Wedell, 1991) or from focusing on different consideration sets (Ok et al., 2015).

The exploration of the effect of a duplicated strategy on players' behavior, which we call the *duplicates effect*, is inspired by the theoretical literature on random choice. It refers to the increase in choice share of an existing option due to an addition of an alternative that is essentially identical to it (See Figure 1-Duplicates). It has been discussed by McFadden et al. (1973) in his famous blue-bus/red-bus example. Similar examples have also been raised by Debreu (1960) and Tversky (1972) to demonstrate a problem that may arise in Luce's random utility model (Luce, 1959), according to which adding a duplicate of an existing option in a choice set would increase the combined choice share of the duo. This problem is known in the literature as the duplicates problem and is discussed by Gul et al. (2014). While theoretically criticized, it remains plausible that presenting one option twice could emphasize its presence, increase its salience, and consequently enhance its appeal to the decision maker. It may also lead to naive diversification, i.e., the tendency to spread choices evenly among existing options (as documented, for example, by Benartzi and Thaler, 2001).

There are almost no experimental studies that examined whether a duplicated option affects individual behavior, or not. In fact, we are aware of only one experiment that addresses the duplicates problem in individual choice conducted 60 years ago by Becker et al. (1963), and in which most of the subjects were not affected by the duplicated option. However, many studies examined the related *similarity effect* in which an option c, which is

[3] See, among many others, Wedell (1991); Ariely and Wallsten (1995); Dhar and Glazer (1996); Doyle et al. (1999); Scarpi (2008); Hedgcock et al. (2009); Trueblood et al. (2013). A more critical view has been raised by Frederick et al. (2014) and Yang and Lynn (2014) while Huber et al. (2014) and Simonson (2014) provide a response.

Fig. 1: Attraction, Duplicates and Compromise Effects in a Two-Attribute-Space



Notes: The attraction and compromise effects refer to the increase in the choice share of a due to the addition of c. The duplicates effect refers to an increase in the choice share of a and c compared to the choice share of a when c is absent.

similar to an existing option, a, but not identical to it, is added to the choice set. In these studies, the choice share of a relative to b drops in the presence of the similar alternative, c. An additional finding, more relevant to our work, is that the combined share of choices of a and c is larger than the share of a when c is not available. When c is very similar to a, adding it to the set may feel like duplicating a. Yet, in the similarity effect literature a and c are never identical, hence, this additional finding can be rationalized with preference maximization.[4]

In addition to our main examination of irrelevant strategies, we also test the effect of adding a relevant, yet extreme strategy, to one player's strategy set. This enables the examination of a strategic analogue to the compromise effect, i.e., situations in individual choice contexts in which a *relevant* yet extreme option that is added to the choice set leads decision makers to view one of the original options as a compromise. More specifically, as shown in Figure 1-Compromise, when c is added to a doubleton set $\{a, b\}$, preferences shift in the direction of the midway alternative a.[5] Unlike dominated and duplicated options described above, there may be good reasons to choose the extreme option, even according to standard preference maximization. Nonetheless, as we elaborate upon later, examining the addition of an extreme strategy alongside the irrelevant strategies enables us to strengthen our conclusions regarding the nature of context effects in strategic interactions. Specifically, it allows us to examine if these effects occur due to an instinctive response or strategic considerations.

[4]For a recent review of the similarity effect, see Wollschlaeger and Diederich (2020).

[5]This effect has also been widely studied in various contexts, such as consumer choice (Simonson and Tversky, 1992), investments (Geyskens et al., 2010) and voting (Herne, 1997). See Lichters et al. (2015) for a review.

2.2 Irrelevant Strategies in Games

Only two experiments examined the effect of adding an asymmetrically dominated strategy in matrix-form games. Colman et al. (2007) add an asymmetrically dominated strategy to *both* players' strategy set and find that it increases the choice probability of the dominating strategy. However, given their design, it is impossible to disentangle direct effects of the added strategy from indirect ones. Closer to our work is Amaldoss et al. (2008) who add an asymmetrically dominated strategy only to the row players' strategy set. They examine the effect of this addition in coordination games and find that it increases the row players' choice probabilities of the dominating strategy in one-shot games as well as in repeated interactions with feedback. The column players, however, seem to take the effect of this addition into account only when the game is repeated and feedback is provided. As discussed earlier, we extend the scope of their work by studying a new effect (the duplicates effect) in addition to the asymmetric dominance effect, and by examining both effects in coordination games *and* single-equilibrium games. These extensions allow us to draw a more general picture of the effect of irrelevant strategies.

Recently, Galeotti et al. (2021) explore whether the attraction and the compromise effects arise in bargaining games. Their work examines these effects from the point of view of cooperative games. In the experiment, two players need to agree on a payoff allocation, or else they receive nothing, and are allowed to chat freely and make allocation offers until they reach an agreement. In the base games, there are two possible allocations, each one preferred by a different player. In their "dominance extension", there exists another allocation that is Pareto dominated by one of the original allocations but not the other. In their "compromise extension", after adding a third allocation, one of the original allocations becomes second best for both players. Thus, their base game is equivalent to a $2X2$ coordination game, with 2 equilibria, and the extensions are equivalent to $3X3$ coordination games with 3 equilibria. They find that players coordinate on equilibrium in a manner that is consistent with the attraction and compromise effects.[6] Our work complements Galeotti et al. (2021) as they focus on whether the *pair of players* are affected by an added *equilibrium* in the context of *cooperative games*, while we focus on whether each *individual player* is affected by an added irrelevant *strategy* in the context of *non-cooperative games.*

3 Experimental Design

Our experiment consists of eight two-player simultaneous-move base games, of which four are coordination games and four are single-equilibrium games. In the coordination games, each player has to choose between the action that is associated with his preferred equilibrium and the action that is associated with the opponent's preferred equilibrium. In the

[6] Evidence for the compromise effect in similar bargaining environments is also found in Galeotti et al. (2019).

single-equilibrium games, players have to choose between the action that is associated with the equilibrium and the action that is associated with surplus maximization.

For each game, we construct three extended games—a *dominance extension*, a *duplicates extension* and a *compromise extension*. The extended games are constructed by adding a third strategy to the row player's strategy set so that it becomes a 3x2 game. This strategy is either dominated by the top row of the original base game's matrix, identical to it, or more extreme with respect to it.[7] In every base game the row player's strategies are denoted by Top and Bottom while in the extensions, they are referred to as Top, Middle and Bottom. The column player's strategies are consistently labeled as Left and Right.

In total, we investigate the players' behavior in 32 games: 8 base games and 3 extended games for each base game. To mitigate subjects' fatigue, 4 unrelated games, which were not presented in matrix form, were interspersed in between the other games. Table 2 shows one of the coordination base games and one of the single-equilibrium base games alongside their three extensions. All base games, their extensions, the order in which they were played and experimental details regarding our choice of payoff matrices appear in Appendix A.

We carried out a computerized lab experiment with a between-subject design, i.e., choices of subjects who played the base games were compared to choices of different subjects who played the extended games. For this purpose, subjects were randomly and equally assigned to two groups. In each group, all subjects played the same four base games as row players and the additional four base games as column players. Players' roles were reversed across groups: if one group played a certain game as row players, the other group played the game as column players. A group of subjects who played a base game as row players played all three extensions of that base game as column players, and vice versa. Thus, a subject never played a base game and its extension in the same role. Moreover, a base game and its extension, or two extensions of the same base game, were separated by at least two other games (extensions/base games of the other 7 games or one of the 4 unrelated games). To mitigate potential influences of the order in which the games were presented, subjects in each group were randomly assigned to one of two versions of the questionnaire. Both versions consisted of the same games but they presented these games in reversed orders. In each game, a player was randomly matched with a different anonymous opponent, and for each player, one game was randomly chosen for payment purposes. Subjects received feedback on the games' outcomes only at the end of the experiment.

The experiment was pre-registered on the AEA RCT Registry (Arad et al., 2019). It was held in the Interactive Decision Making Lab of The Coller School of Management at Tel Aviv University. We ran 21 sessions during the Spring and Fall semesters of 2019, in which 238 subjects participated. Subjects were undergraduate students from various fields of study who were registered with the lab. Instructions appeared on subjects' screens and

[7] If the strategy a yields a higher payoff for the row player than b when the column player plays one strategy, but yields a lower payoff than b when the column player plays his other strategy, then the row player's added extreme strategy c yields an even higher payoff in the former case and an even lower payoff in the latter. Thus, the strategy a becomes a compromise strategy.

Table 2: Payoffs of Base Games 1 (Coordination) and 5 (Single-Equilibrium) and Their Extensions

	Base		Dominance Extension		Duplicates Extension		Compromise Extension	
Game 1 (Coordination)	40,40	**50,80**	40,40	**50,80**	40,40	**50,80**	10,30	**80,30**
	80,50	30,30	35,20	45,20	40,40	**50,80**	40,40	50,80
			80,50	30,30	**80,50**	30,30	**80,50**	30,30
Game 5 (Single-Equilibrium)	40,40	**50,50**	40,40	**50,50**	40,40	**50,50**	20,40	**60,40**
	80,80	30,90	35,30	45,30	40,40	**50,50**	40,40	50,50
			80,80	30,90	80,80	30,90	80,80	30,90

Note: Equilibria are indicated in bold.

were read out loud by the experimenter (the instructions appear in Appendix A). Following the instructions, subjects were acquainted with matrix-form games in a training session that included 5 matrix-form games and 8 quiz questions with feedback. Each session lasted roughly 45 minutes and subjects' average payoff was 75 ILS (25 ILS show-up fee plus 50 ILS on average earned during the experiment), which was roughly equivalent to 22 USD at the time.

4 Results

4.1 Irrelevant Strategies

We define the row player's target strategy as the top strategy in the base games. This is the strategy that dominates the added strategy in the dominance extensions and the duplicated strategy in the duplicates extensions. Thus, the row player's target strategy is Top in the base and dominance extension games, and Top and Middle in the duplicates extension. We define the column player's target strategy as the best response to the row player's target strategy. The target equilibrium is defined as the outcome that arises when both players choose their target strategy.

We present the results of the direct effect of the added strategy on the row players, followed by the indirect effect on the column players. Finally, we examine the effect on the probability of coordination on the target equilibrium and on overall coordination.

Direct Effects. Before we proceed to the results, note that out of 476 choices made by the row players in the dominance extensions, there were only 17 choices (3.6%) of the dominated strategy in the coordination games and 13 such choices (2.7%) in the single-equilibrium games. This suggests that subjects were aware that this strategy is dominated by another. Since our main interest lies in the ratio of choices of the two strategies of the base game, the

Table 3: Percentages of Row Players' Target Choices

	Coordination				*Single-Equilibrium*			
	1	2	3	4	5	6	7	8
Base Game	59	51	59	56	46	44	54	49
Dominance Extension	62	62	62	66	52	53	54	53
Duplicates Extension	73	76	75	66	49	49	54	51

table and the regression analysis below exclude choices of the dominated strategy. We also examine whether the choice share of the target strategy increases overall, i.e., considering *all* choices. This examination is discussed later and its corresponding analysis is presented in Appendix B.

Table 3 shows the percentages of choices of the target strategy by row players in each game. In the coordination games (1-4), the target strategy is chosen more frequently when the irrelevant strategy is present: there is an increase of 3%-11% in the dominance extension and of 10%-25% in the duplicates extension. In single-equilibrium games, the irrelevant strategy has a small and seemingly insignificant effect on the row players. Adding a dominated strategy increases the choice frequency of the target strategy by 0%-9% while duplicating a strategy increases its choice frequency by 0%-5%.

Next, we pool together choices for all four games of the same type (i.e., coordination or single-equilibrium game) and run logistic regressions in which the dependent variable is a dummy that receives 1 if the target strategy was chosen and 0 otherwise.[8] The main explanatory variable is a dummy that receives 1 when the game is presented in the extended form and 0 in the base form. We control for the game, the questionnaire version (i.e., the order in which the games were presented), the gender and the number of correct answers in the training session. [9] We run three specifications for each effect for each type of game: (i) non-clustered errors, (ii) clustered errors at the subject level, and (iii) clustered errors at the subject level alongside subject fixed effects.

Tables 4 and 5 report the results of our logistic regressions and provide further evidence for the effect of adding the irrelevant strategies. The coefficient of the extension variable in coordination games (Table 4) is positive and significant at the 5% level in all specifications (odds ratio ranging from 1.32 to 1.56 in the dominance extension, and from 2 to 3 in the duplicates extension). In the single-equilibrium games (Table 5), however, we do not find a consistent effect of the extensions on row players' choices.

We repeated the analysis above when including choices of the dominated strategy. In Appendix B, we present both the percentages of target strategy choices and the regression analysis. The results are generally quite similar to those reported above. In coordination

[8]OLS regressions lead to the same qualitative results.

[9]Running the regressions without the controls does not have any qualitative effects on the results.

Table 4: Logistic Regression Models: Row Players' Choices in Coordination Games

	Dependent variable: Target Choice					
	Dominance Extension			Duplicates Extension		
	(1)	(2)	(3)	(4)	(5)	(6)
Extension	0.28**	0.28**	0.45**	0.71***	0.71***	1.19***
	(0.13)	(0.12)	(0.20)	(0.14)	(0.12)	(0.22)
Version	-0.05	-0.05		-0.06	-0.06	
	(0.14)	(0.17)		(0.14)	(0.18)	
Gender (male=1)	-0.10	-0.10		0.01	0.01	
	(0.13)	(0.17)		(0.14)	(0.18)	
correct	0.12	0.12		0.07	0.07	
	(0.09)	(0.14)		(0.09)	(0.13)	
$game_2$	-0.15	-0.15	-0.26	-0.11	-0.11	-0.19
	(0.19)	(0.17)	(0.28)	(0.20)	(0.18)	(0.30)
$game_3$	0.01	0.01	0.01	0.04	0.04	0.06
	(0.19)	(0.18)	(0.30)	(0.20)	(0.18)	(0.30)
$game_4$	0.04	0.04	0.06	-0.23	-0.23	0.39
	(0.19)	(0.17)	(0.28)	(0.19)	(0.18)	(0.31)
Constant	-0.49	-0.49	-0.18	-0.16	-0.16	-0.46**
	(0.75)	(0.75)	(0.21)	(0.75)	(1.04)	(0.20)
Observations	935	935	639	952	952	644

Notes: Numbers represent coefficients (β), std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

games, we find an increase in target choices in the dominance extensions compared to the base games, although this effect is slightly weaker when including dominated-strategy choices. In single-equilibrium games, the addition of the dominated strategy does not seem to have any impact.[10]

Indirect Effects. We now examine whether extending the row player's strategy space has an effect on the column player's behavior. Table 6 shows the percentage of choices of the target strategy by column players. In coordination games, the choice percentage of the target strategy is significantly higher in both dominance and duplicates extension games compared to the base games. This suggestive evidence of an indirect effect is further supported by the regressions that are presented in Table 7.[11] According to the regressions'

[10]When including dominated choices in the regressions, we group them together with choices of the non-target strategy. Given this grouping, one may conduct a one-sided test if H0 assumes regularity (i.e., adding an option cannot increase the choice share of an existing option) or a two-sided assumption-free test. Using the former test, the coefficient of the extension variable in coordination games is consistently positive and significant at the 10% level across all specifications. The coefficients become insignificant if one opts for the two-sided test. As for single-equilibrium games, the results are very similar to those that we obtain when we exclude the choices of the dominated strategy.

[11]We ran the regressions for the column players using the same specifications as the ones used for the row players.

Table 5: Logistic Regression Models: Row Players' Choices in Single-Equilibrium Games

	Dependent variable: Target Choice					
	Dominance Extension			Duplicates Extension		
	(1)	(2)	(3)	(4)	(5)	(6)
Extension	0.19	0.19*	0.45**	0.10	0.10	0.24
	(0.13)	(0.10)	(0.22)	(0.13)	(0.09)	(0.21)
Version	0.16	0.16		0.12	0.12	
	(0.13)	(0.19)		(0.13)	(0.19)	
Gender (male=1)	0.23*	0.23		0.16	0.16	
	(0.13)	(0.19)		(0.13)	(0.19)	
correct	0.14	0.14		0.06	0.06	
	(0.09)	(0.11)		(0.09)	(0.11)	
$game_6$	-0.04	-0.04	-0.10	-0.05	-0.05	-0.13
	(0.19)	(0.15)	(0.32)	(0.18)	(0.14)	(0.31)
$game_7$	0.19	0.19	0.39	0.25	0.25*	0.56*
	(0.19)	(0.15)	(0.33)	(0.18)	(0.15)	(0.34)
$game_8$	0.08	0.08	0.15	0.10	0.10	0.21
	(0.19)	(0.13)	(0.28)	(0.18)	(0.15)	(0.33)
Constant	-1.54**	-1.54*	0.80***	-0.90	-0.90	0.85***
	(0.76)	(0.90)	(0.20)	(0.73)	(0.93)	(0.21)
Observations	939	939	510	952	952	528

Notes: Numbers represent coefficients (β), std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

coefficients, compared to the base game, the column player is between 1.75 to 2.6 times more likely to choose the target strategy when a dominated strategy is added to the row player's strategy set, and 3 to 6 times more likely to choose it when the row player's target strategy is duplicated. In the single-equilibrium games, however, there is no significant effect on the column players' behavior (see the regression results in Table 8).[12]

[12] Note that the coefficient of the version variable is significant in this table, suggesting that the target is chosen more frequently in one of the two versions, averaging over base games and extensions. However, the effect of the addition of the row player's strategy on the column players (i.e., the difference between column players' target choices in the base games and the extensions) remains insignificant when running these regressions for each version separately.

Table 6: Percentages of Column Players' Target Choices

	Coordination				*Single-Equilibrium*			
	1	2	3	4	5	6	7	8
Base Game	41	48	48	46	53	55	46	50
Dominance Extension	50	61	61	65	46	58	49	55
Duplicates Extension	68	76	62	78	63	57	46	51

Coordination Rates and Equilibrium Play. We now examine whether the introduction of the additional strategy increases coordination rates on the target equilibrium and whether it affects coordination in general. Many studies have identified factors that facilitate coordination in two-player coordination games (see Camerer, 2011 for a review). These include behavioral mechanisms, such as order of play (Amershi et al., 1992; Rapoport, 1997) and framing (Hargreaves Heap et al., 2014), as well as more rational factors such as the presence of an outside-option (Cooper et al., 1994), the game's symmetry (van Elten and Penczynski, 2020), recommendations (Van Huyck et al., 1992; Brandts and MacLeod, 1995), communication (Cooper et al., 1994) and costly communication (Kriss et al., 2016; Blume et al., 2017). We contribute to this literature by examining whether adding a dominated or duplicated strategy facilitates coordination. Following the analysis of coordination games, we examine whether the target equilibrium or surplus-maximizing outcome is reached more frequently in the presence of the irrelevant strategy.

Table 9 shows the percentages with which each of the coordination game's outcomes was reached. Recall that each player was randomly matched with another player in each game. The percentages in the table are calculated according to the outcome of play of this random matching.[13] Equilibria in each game appear in bold and the target equilibrium is marked with an asterisk.

The dominance and duplicates extensions have higher coordination rates on the target equilibrium than the base games in all four games. The effect is relatively large in the duplicates extensions, in which the probability of reaching the target equilibrium is 47% – 55% compared to 24%-30% in the base games. The coordination increase in the dominance extensions is in the range of 2% to 16%. Overall coordination, i.e., on either of the two equilibria, in the dominance extensions is roughly the same as in the base games while it increases in the duplicates extensions.

We also run logistic regressions to examine the increase in the likelihood of reaching the target equilibrium and, an equilibrium in general, for each extension, aggregated over the four coordination games (Table 10 and Table 11 respectively) while controlling for the

[13] As we are interested in actual rates that the target equilibrium was reached, in this section we do not exclude choices of the dominated strategy. However, outcomes that involve these actions do not appear in Table 9.

Table 7: Logistic Regression Models: Column Players' Choices in Coordination Games

	Dependent variable: Target Choice					
	Dominance Extension			Duplicates Extension		
	(1)	(2)	(3)	(4)	(5)	(6)
Extension	0.56***	0.56**	0.98**	1.07***	1.07***	1.78***
	(0.13)	(0.11)	(0.20)	(0.14)	(0.12)	(0.23)
Version	0.08	0.08		0.06	0.06	
	(0.13)	(0.17)		(0.14)	(0.17)	
Gender (male=1)	0.19	0.19		0.06	0.06	
	(0.13)	(0.17)		(0.14)	(0.17)	
correct	-0.03	-0.03		0.01	0.01	
	(0.09)	(0.09)		(0.09)	(0.08)	
$game_2$	0.36*	0.36**	0.68**	0.32	0.32*	0.49
	(0.19)	(0.16)	(0.28)	(0.19)	(0.17)	(0.30)
$game_3$	0.36*	0.36**	0.62**	0.02	0.02	0.03
	(0.19)	(0.17)	(0.30)	(0.19)	(0.18)	(0.30)
$game_4$	0.40**	0.40**	0.74***	0.34*	0.34*	0.52*
	(0.19)	(0.17)	(0.28)	(0.19)	(0.17)	(0.30)
Constant	-0.44	-0.44	0.13	-0.54	-0.54	-2.58***
	(0.74)	(0.76)	(0.20)	(0.76)	(0.70)	(0.30)
Observations	952	952	680	952	952	704

Notes: Numbers represent coefficients (β), std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

Table 8: Logistic Regression Models: Column Players' Choices in Single-Equilibrium Games

	Dependent variable: Target Choice					
	Dominance Extension			Duplicates Extension		
	(1)	(2)	(3)	(4)	(5)	(6)
Extension	0.05	0.05	0.09	0.15	0.15	0.33
	(0.13)	(0.10)	(0.23)	(0.13)	(0.10)	(0.22)
Version	-0.39***	-0.39**		-0.37***	-0.37*	
	(0.13)	(0.19)		(0.13)	(0.20)	
Gender (male=1)	0.16	0.16		0.16	0.16	
	(0.13)	(0.19)		(0.13)	(0.20)	
correct	-0.34***	-0.34**		-0.28***	-0.28**	
	(0.10)	(0.15)		(0.10)	(0.13)	
$game_6$	0.28	0.28*	0.60*	-0.09	-0.09	-0.17
	(0.19)	(0.14)	(0.31)	(0.19)	(0.13)	(0.29)
$game_7$	-0.09	-0.09	-0.19	-0.48***	-0.48***	-1.07***
	(0.19)	(0.14)	(0.31)	(0.19)	(0.15)	(0.34)
$game_8$	0.12	0.12	0.26	-0.31*	-0.31*	-0.67*
	(0.19)	(0.13)	(0.29)	(0.19)	(0.16)	(0.36)
Constant	3.09***	3.09***	0.91***	2.85***	2.85***	1.46***
	(0.82)	(1.19)	(0.19)	(0.80)	(1.07)	(0.24)
Observations	952	952	524	952	952	504

Notes: Numbers represent coefficients (β), std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

Table 9: Outcome Distribution for Coordination Games

	Base		Dominance		Duplicate	
Game 1	33	**26***	33	**28***	26	**47***
	26	15	**17**	21	**6**	21
Game 2	**24***	28	**37***	24	**55***	21
	24	**24**	24	**13**	21	**3**
Game 3	**30***	29	**36***	24	**50***	25
	18	**24**	24	**13**	13	**13**
Game 4	33	**24***	21	**40***	12	**54***
	21	23	**12**	19	**10**	24

Notes. Outcome distribution per coordination base game and corresponding extension. Numbers present percentages. Equilibria are in bold. The target equilibrium is marked with *. Each game was played by 119 row players and 119 column players.

games themselves. In Table 10 the dependent variable is a dummy that receives 1 if the target equilibrium was reached and 0 otherwise, and the main explanatory variable is the dummy for the relevant extension. In Table 11 the dependent variable is a dummy that receives 1 if an equilibrium was reached (target or not) and 0 otherwise and the main explanatory variable is, once again, the dummy for the relevant extension. In both tables, we report two specifications for every extension: one with no fixed effects (columns 1 and 3) and one with subject fixed effects (columns 2 and 4). Table 10 shows a significant positive increase in the likelihood of reaching the target equilibrium in both dominance and duplicates extensions. Table 11 shows that this increase leads to a rise in overall coordination play in the duplicates extensions but not in the dominance extensions.

Moving on to the single-equilibrium games, Table 12 shows the percentages with which each of the outcomes in these games was reached. The equilibrium and the surplus-maximizing outcome are in bold. The equilibrium is also marked with an asterisk. For both the dominance and duplicates extensions, the equilibrium is reached more frequently in the extended games than in the base games in 3 out of 4 games. The surplus-maximizing outcome is reached less frequently on average.

To give a formal account for the findings in Table 12, we run two types of logistic regressions. In Table 13, the dependent variable is a dummy that receives 1 if the equilibrium was reached and 0 otherwise, and the main explanatory variable is the dummy for the relevant extension. In Table 14 the dependent variable is a dummy that receives 1 if the surplus-maximizing outcome was reached and 0 otherwise, and the main explanatory variable is, once again, the dummy for the relevant extension. In both tables, we report two specifications for every extension: one with no fixed effects (columns 1 and 3) and one with subject fixed effects (columns 2 and 4). Table 13 shows no significant effects of reach-

Table 10: Logistic Regression Models: Target Equilibrium Play in Coordination Games

	Dependent variable: Target Equilibrium			
	Dominance Extension		Duplicates Extension	
	(1)	(2)	(3)	(4)
Extension	0.45***	0.64***	1.11***	1.62***
	(0.14)	(0.17)	(0.14)	(0.18)
$game_2$	0.17	0.35	0.12	0.10
	(0.20)	(0.25)	(0.20)	(0.24)
$game_3$	0.30	0.46*	0.15	0.15
	(0.20)	(0.24)	(0.20)	(0.24)
$game_4$	0.25	0.36	0.10	0.11
	(0.20)	(0.25)	(0.20)	(0.24)
Constant	-1.24***	-0.65***	-1.15***	-1.36***
	(0.17)	(1.03)	(0.16)	(1.16)
Observations	952	851	952	920

Notes: Numbers represent coefficients (β), Std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

ing the equilibrium in the extensions compared to the base games. Table 14 shows that the negative effect on the probability of the surplus-maximizing outcome is insignificant for the duplicates extension and significant for only one of the two specifications of the dominance extension. Overall, it is evident that the frequency with which the equilibrium or the surplus-maximizing outcome is reached is not significantly affected by the irrelevant strategy.

4.2 Relevant Strategy

The added strategy in the compromise extensions was chosen in 13.7% of the cases in the coordination games and 17.6% in the single-equilibrium games, which is evidence of the fact that it is indeed perceived as a relevant strategy. Table 15 reports the relative choice share of the compromise strategy (Up in the base game and Middle in the extension) compared to the competing strategy (Bottom), excluding choices of the added strategy. There seem to be no significant differences in choice shares of the compromise strategy by row players between base games and extensions. Specifications (1)-(3) of the logistic regressions in Tables 17 and 18 further support this impression as the coefficients on the extension dummy variables are not significant for any type of game.

Notice that in the compromise extensions, the added strategy is an equilibrium strategy while the compromise strategy is not. In fact, the latter is not even a best response to either of the two column player's strategies. Thus, a higher choice frequency of the compromise strategy in the extensions is likely to be driven by an individual-based compromise effect, i.e., an instinctive response, rather than by a strategic reaction. As we elaborate upon below, in Subsection 4.3, we suggest that the lack of evidence of a compromise effect

Table 11: Logistic Regression Models: Overall Equilibrium Play in Coordination Games

	Dependent variable: Equilibrium			
	Dominance Extension		Duplicates Extension	
	(1)	(2)	(3)	(4)
Extension	-0.03	-0.06	0.39***	0.53***
	(0.13)	(0.15)	(0.13)	(0.16)
$game_2$	0.034	0.14	0.02	0
	(0.18)	(0.22)	(0.18)	(0.22)
$game_3$	0.12	0.24	0.22	0.29
	(0.18)	(0.22)	(0.19)	(0.22)
$game_4$	0	0.02	0.07	0.08
	(0.18)	(0.22)	(0.19)	(0.22)
Constant	-0.05	1.48	-0.09	0.75
	(0.15)	(1.12)	(0.15)	(1.12)
Observations	952	936	952	928

Notes: Numbers represent coefficients (β), Std. errors in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table 12: Outcomes Distribution for Single-Equilibrium Games

	Base		Dominance		Duplicate	
Game 5	18	**28***	29	**22***	18	**30***
	29	25	**24**	24	**18**	33
Game 6	21	**23***	18	**32***	19	**29***
	24	32	**22**	23	**24**	28
Game 7	**24***	30	**28***	24	**29***	25
	23	**24**	21	**25**	18	**29**
Game 8	**25***	24	**30***	22	**25***	26
	24	**27**	24	**22**	26	**23**

Notes. Outcome distribution per single-equilibrium base game and corresponding extension. Numbers present percentages. The single equilibrium and surplus-maximizing outcome are in bold. The equilibrium is also marked with an *. Each game was played by 119 row players and 119 column players.

Table 13: Logistic Regression Models: Equilibrium Play in Single-Equilibrium Games

	Dependent variable: Equilibrium			
	Dominance Extension		Duplicates Extension	
	(1)	(2)	(3)	(4)
Extension	0.16	0.19	0.18	0.26
	(0.15)	(0.21)	(0.15)	(0.20)
$game_6$	0.13	0.22	-0.15	-0.34
	(0.21)	(0.29)	(0.21)	(0.28)
$game_7$	0.04	0.14	-0.15	-0.33
	(0.21)	(0.29)	(0.21)	(0.28)
$game_8$	0.15	0.29	-0.19	-0.42
	(0.21)	(0.29)	(0.21)	(0.28)
Constant	-1.19***	0.12	-0.99***	0.27
	(0.17)	(0.92)	(0.16)	(1.12)
Observations	952	602	952	660

Notes: Numbers represent coefficients (β), Std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

Table 14: Logistic Regression Models: Surplus Maximizing Outcome in Single Equilibrium Games

	Dependent variable: Surplus-Maximizing Outcome			
	Dominance Extension		Duplicates Extension	
	(1)	(2)	(3)	(4)
Extension	-0.15	-0.48**	-0.14	-0.25
	(0.15)	(0.22)	(0.15)	(0.22)
$game_6$	-0.16	-0.43	0.02	-0.05
	(0.21)	(0.33)	(0.22)	(0.32)
$game_7$	-0.09	0.02	0.14	0.34
	(0.21)	(0.31)	(0.21)	(0.32)
$game_8$	0.07	0.09	0.07	0.09
	(0.21)	(0.30)	(0.21)	(0.31)
Constant	-0.97***	-0.69	-1.11***	-0.75
	(0.17)	(1.64)	(0.17)	(1.11)
Observations	952	573	952	547

Notes: Numbers represent coefficients (β), Std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

substantiates the fact that individual-based biases do not automatically translate into strategic environments.

As for indirect effects, Table 16 illustrates that in both coordination games and single-equilibrium games, column players tend to select their target strategy more frequently compared to the base games. This observation is further corroborated by the regressions presented in specifications (4)-(6) within Tables 17 and 18. Notice however that in coordination games, the column players' best response to the row players' compromise strategy, i.e., the column player's target strategy, is the same as their best response to the added strategy, which is part of an equilibrium of the extended game. Thus, it is impossible to disentangle whether it arises as a response to an expected behavioral action of the row player or as a reaction to the expectation that the row player tries to reach the new equilibrium. In Appendix C, we show that the absence of a behavioral response of the row players in coordination games alongside more frequent choices of the target by column players is captured by the GCH model of Chong et al. (2016) (with one minor adjustment). Finally, the indirect effects that show up for the column players in single-equilibrium games are somewhat puzzling since these players have a dominating strategy in the base games as well as in the extensions. However, players may also consider choosing the surplus-maximizing outcome. Indeed, we find that column players' choices are quite balanced across the two strategies in the base games. In the presence of the extreme strategy, choosing the strategy that leads to the surplus-maximizing outcome and "mis-coordinating" may lead to an extremely low payoff for the row player. This may naturally weaken the incentive to choose this strategy, especially for column players who originally targeted the surplus-maximizing outcome, i.e., players who exhibit other-regarding preferences.

4.3 Discussion

In coordination games, we find that adding an irrelevant strategy in the form of a dominated/duplicated action assists in stirring the row players' actions in the direction of one equilibrium over another. At the same time, the addition of these strategies has no effect on the row players' actions in single-equilibrium games, where the decision is whether to play an equilibrium strategy or a surplus-maximizing strategy. The different patterns across types of games indicate that our row players' behavior is not a manifestation of individual-based biases, i.e., it is not due to an automatic reaction to the added strategy

Table 15: Percentages of Row Players' Choices of the Compromise Strategy

	Coordination				*Single-Equilibrium*			
	1	2	3	4	5	6	7	8
Base Game	59	51	59	56	46	44	54	49
Compromise Extension	53	51	63	54	39	36	48	47

that arises without consideration of the strategic situation at hand. Rather, it seems that the irrelevant added strategy impacts row players' actions through their desire for cues to facilitate coordination, that is, it serves a strategic purpose.[14]

The column players choose to follow their target strategy, which is consistent with best responding to the target strategy of the row player, more often in the extended coordination games than in the base games. Moreover, just like the row players, they do not exhibit this pattern in the single-equilibrium games. Thus, it seems that the column players utilize the added strategy as a means for coordination, similarly to the row players.

Putting these behavioral patterns together, it seems that both row and column players may be thinking about the irrelevant strategy as a public coordination device that guides them in choosing a choice rule that, if adopted by both players, will resolve the coordination problem they face. Indeed, as our analysis confirms, the behavioral patterns of row and column players lead to higher coordination rates on the target equilibrium in the presence of the irrelevant strategy.

The addition of the extreme relevant strategy, does not seem to have any effect on the row players in any type of game. Notice that in this case the added strategy is part of a new equilibrium of the extended game. Thus, the behavioral reaction that corresponds to the compromise effect, i.e., a tendency to choose the middle strategy, is offset by strategic considerations of reaching an equilibrium. Given the above support for strong strategic considerations of our subjects, it is not surprising that when the added strategy is a legitimate choice for a strategic row player, its "behavioral role" in highlighting the middle action is attenuated.

Finally, we assess whether the effect of the added strategy varies with subjects' experience. Although subjects did not receive any feedback on the outcome of play after each game, experience may affect subjects' behavior. For example, it is possible that it takes time to understand the underlying structure of the games and the potential gains that may arise by following the behavioral cues in the extended games. In order to do so, we

Table 16: Percentages of Column Players' Choices of the Best Response to the Compromise Strategy

	Coordination				*Single-Equilibrium*			
	1	2	3	4	5	6	7	8
Base Game	41	48	48	46	53	55	46	50
Compromise Extension	50	63	58	53	55	61	55	57

[14]Of course, we cannot dismiss the possibility that the added irrelevant strategy does induce an intuitive response, at least for some players, but we do not observe it in single-equilibrium games because it is overshadowed by other effects that are unique to these games. For example, it is conceivable that some players find it simple to identify the equilibrium strategy and follow it in the single-equilibrium base games, but struggle to do so in the more complex extensions. This could counterbalance the intuitive gravitation towards the target strategy, giving the impression of an overall neutral impact of the added strategy.

Table 17: Logistic Regression Models: Compromise Extension in Coordination Games

	Dependent variable: Target Choice					
	Row Players			Column Players		
	(1)	(2)	(3)	(4)	(5)	(6)
Compromise Extension	-0.04	-0.04	-0.15	0.41***	0.41***	0.63***
	(0.14)	(0.12)	(0.22)	(0.13)	(0.12)	(0.20)
Version	-0.02	-0.02		0.13	0.13	
	(0.14)	(0.18)		(0.13)	(0.16)	
Gender (male=1)	-0.27**	-0.27		0.04	0.04	
	(0.14)	(0.18)		(0.13)	(0.16)	
correct	0.05	0.05		-0.13	-0.13	
	(0.09)	(0.11)		(0.09)	(0.08)	
$game_2$	-0.18	-0.18	-0.38	0.41**	0.41**	0.59**
	(0.19)	(0.17)	(0.32)	(0.19)	(0.18)	(0.28)
$game_3$	0.21	0.21	0.33	0.31*	0.31*	0.49*
	(0.19)	(0.18)	(0.32)	(0.19)	(0.17)	(0.27)
$game_4$	-0.03	-0.03	-0.07	0.17	0.17	0.20
	(0.19)	(0.16)	(0.30)	(0.19)	(0.17)	(0.27)
Constant	0.01	0.01	1.20***	0.43	0.43	0.49**
	(0.76)	(0.89)	(0.23)	(0.75)	(0.73)	(0.19)
Observations	887	887	562	952	952	708

Notes: Numbers represent coefficients (β), Std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

Table 18: Logistic Regression Models: Compromise Extension in Single-Equilibrium Games

	Dependent variable: Target Choice					
	Row Players			Column Players		
	(1)	(2)	(3)	(4)	(5)	(6)
Compromise Extension	-0.22	-0.22**	-0.15	0.26**	0.26**	0.51**
	(0.14)	(0.11)	(0.23)	(0.13)	(0.11)	(0.22)
Version	0.12	0.12		-0.16	-0.16	
	(0.14)	(0.20)		(0.13)	(0.19)	
Gender (male=1)	0.13	0.13		0.08	0.08	
	(0.14)	(0.20)		(0.13)	(0.19)	
correct	0.03	0.03		-0.28***	-0.28	
	(0.09)	(0.10)		(0.10)	(0.17)	
$game_6$	-0.12	-0.12	-0.35	0.16	0.16	0.29
	(0.20)	(0.17)	(0.35)	(0.19)	(0.16)	(0.32)
$game_7$	0.33*	0.33**	0.64*	-0.15	-0.15	-0.32
	(0.19)	(0.17)	(0.36)	(0.19)	(0.15)	(0.31)
$game_8$	0.21	0.21	0.27	-0.03	-0.03	-0.09
	(0.19)	(0.15)	(0.31)	(0.19)	(0.15)	(0.31)
Constant	-0.64	-0.64	1.06***	2.38***	2.38*	-0.23
	(0.77)	(0.87)	(0.24)	(0.80)	(1.42)	(0.22)
Observations	868	868	469	952	952	552

Notes: Numbers represent coefficients (β), Std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

conducted a similar regression analysis to the one reported above, while accounting for whether games appeared in the early or late stages of the experiment. A detailed description of this analysis and its results appears in Appendix B2. Overall, there does not seem to be a consistent difference in the influence of the added strategies between early and late games. Thus, this analysis suggests that experience does not play a significant role in our setting.

5 Theoretical Approaches

The results that we presented show that the addition of irrelevant strategies has a significant effect on the outcome of play in coordination games but not in single-equilibrium games. Classic game-theoretic approaches rule out such effects but behavioral models have the flexibility to accommodate them.

Salience is perhaps the most natural concept through which our findings in coordination games may be explained. A strategy is more salient if its features draw players' attention more than other strategies. For example, in the duplicates extension, the strategic situation is identical to the base game but one of the row player's strategies is now highlighted since it appears twice. Possible pathways through which salience can affect players' behavior are nicely described by Mehta et al. (1994). Their work focuses on salience in symmetric coordination games but we believe that their ideas carry over to our context, even though we add irrelevant strategies in a non-symmetric fashion, i.e., only to the row player. Mehta et al. (1994) discuss three types of salience. The first is *primary salience* which refers to strategies that are more likely than others to come to the minds of the players. *Secondary salience* refers to situations in which players maximize their expected utility under the assumption that their opponents choose the primary salient strategy. Finally, *Schelling salience* (due to Schelling, 1960) is a choice rule that, if followed by both players, will solve the coordination problem in a successful manner.

Primary and secondary salience fit well into the framework of level-k thinking (Stahl and Wilson, 1994, 1995; Nagel, 1995). The level-k model assumes that the population of players consists of a number of types that differ in their depth of reasoning. A level-0 player is non-strategic and is usually assumed to choose each of the strategies with equal probability. For any $k \geq 1$, a level-k type best responds to the belief that he faces a player of level $k-1$. Going back to the ideas of Mehta et al. (1994) within this framework, level-0 players are attracted to the salient strategy (i.e., primary salience) while level-1 players best respond to players of level-0 (i.e., secondary salience). This type of iterative reasoning has been studied by Crawford and Iriberri (2007); Arad (2012); Arad and Rubinstein (2012); Hargreaves Heap et al. (2014), and Alaoui and Penta (2016).

Assuming that duplicated strategies and dominating strategies have primary salience allows one to derive behavioral predictions that are in line with our findings.[15] One caveat

[15] See Appendix C for a formal discussion.

of this approach is that primary salience is not clearly defined, which leaves room for interpretation regarding which strategies are salient and which are not. In Appendix C, we briefly present the Generalized Cognitive Hierarchy (GCH) model (Chong et al., 2016) which is an extension of a level-k model in which level-0 players are attracted to strategies that never yield the minimal payoff for any of the opponent's strategies, a concept they refer to as minimum aversion salience. This concept induces an attraction to our target strategies by level-0 players, without making ad-hoc assumptions regarding salience. We show that the GCH model delivers predictions that are in line with our findings due to the response of higher cognitive levels to this attraction.

Schelling salience is different in essence, and it is not necessarily related to primary or secondary salience, although it might be. Using the words of Mehta et al. (1994) it is

> ... a *rule of selection* which, if followed by both players, would tend to produce successful coordination. A rule of selection ... is salient to the extent that it "suggests itself" or seems obvious or natural to people *who are looking for ways to solving coordination problems.*

In our coordination games, it is quite plausible that our sample of students may reason a-la Schelling salience, i.e., by looking for a rule that suggests itself or seems obvious for a random student in the lab to follow. Choosing the strategy that is more noticeable (duplicated or dominant) than the other and best responding to it may be an obvious rule that would lead to the increased choices of the target strategies in the extensions.

Thus, Schelling salience may be another tacit coordination mechanism that leads some strategies to become focal. Unlike the other types of salience mentioned above, this one has more of a "simultaneous feel". It does not require iterative reasoning, but rather a common rule that is followed by both players in a specific game, under the implicit understanding that if they indeed follow it, there is hope of successful coordination.

6 Concluding Remarks

We design an experiment to test whether seemingly irrelevant strategies affect players' actions in a manner that violates the standard approach in game theory. We find that dominated strategies, and even more so duplicated strategies, affect behavior in coordination games: they highlight one equilibrium over another and facilitate coordination. However, in single-equilibrium games, these strategies are indeed irrelevant and do not affect behavior. We conclude that irrelevant strategies do not affect behavior through an immediate intuitive reaction to the added strategies. Rather, they seem to assist players whenever they are in need for cues to solve coordination problems. We suggest that in the extended games, some strategies become salient. This, in turn, leads to improved coordination through either a focal point argument or an iterative chain of responses of different levels of hierarchical reasoning.

Irrelevant strategies naturally appear in real-life strategic situations, as in our opening bus line example. Furthermore, they may be intentionally added to strategic interactions by one of the players or by a third party. For example, in different types of negotiations, such as between firms' managements and employee unions, seemingly innocuous irrelevant strategies may affect the outcome of the deliberations in a manner that is highlighted in our work. This allows for sophisticated manipulation by parties through the adjustment of the set of strategies they bring to the table. Thus, seemingly irrelevant strategies should be taken into account by players, choice architects and even social planners. On the theoretical and predictive front, existing solution concepts of strategic interactions may be enriched in order to account for the relevance of irrelevant strategies.

References

Alaoui, L. and A. Penta (2016): "Endogenous depth of reasoning," *The Review of Economic Studies*, 83, 1297–1333.

Amaldoss, W., J. R. Bettman, and J. W. Payne (2008): "Biased but Efficient: An Investigation of Coordination Facilitated by Asymmetric Dominance," *Marketing Science*, 27(5), 903–921.

Amershi, A. H., A. Sadanand, and V. Sadanand (1992): "Player importance and forward induction," *Economics Letters*, 38, 291–297.

Arad, A. (2012): "The tennis coach problem: A game-theoretic and experimental study," *The BE Journal of Theoretical Economics*, 12.

Arad, A., B. Bachi, and A. Maltz (2019): "Context Effects in Strategic Environments: An Experimental Study," *AEA RCT Registry*.

Arad, A. and A. Rubinstein (2012): "The 11-20 money request game: A level-k reasoning study," *American Economic Review*, 102, 3561–73.

Ariely, D. and T. S. Wallsten (1995): "Seeking Subjective Dominance in Multidimensional Space: An Explanation of the Asymmetric Dominance Effect," *Organizational Behavior and Human Decision Processes*, 63(3), 223–232.

Aumann, R. J. (1974): "Subjectivity and correlation in randomized strategies," *Journal of mathematical Economics*, 1, 67–96.

Becker, G. M., M. H. Degroot, and J. Marschak (1963): "Probabilities of choices among very similar objects: An experiment to decide between two models," *Systems Research and Behavioral Science*, 8(4), 306–311.

Benartzi, S. and R. H. Thaler (2001): "Naive diversification strategies in defined contribution saving plans," *American economic review*, 91, 79–98.

Bernheim, B. D. (1984): "Rationalizable strategic behavior," *Econometrica: Journal of the Econometric Society*, 1007–1028.

Blume, A., P. H. Kriss, and R. A. Weber (2017): "Pre-play communication with forgone costly messages: experimental evidence on forward induction," *Experimental Economics*, 20, 368–395.

Brandts, J. and W. B. MacLeod (1995): "Equilibrium selection in experimental games with recommended play," *Games and Economic Behavior*, 11(1), 36–63.

Camerer, C. F. (2011): *Behavioral game theory: Experiments in strategic interaction*, Princeton University Press.

Camerer, C. F., T.-H. Ho, and J.-K. Chong (2004): "A cognitive hierarchy model of games," *The Quarterly Journal of Economics*, 119, 861–898.

Chong, J.-K., T.-H. Ho, and C. Camerer (2016): "A generalized cognitive hierarchy model of games," *Games and Economic Behavior*, 99, 257–274.

Colman, A. M., B. D. Pulford, and F. Bolger (2007): "Asymmetric dominance and phantom decoy effects in games," *Organizational Behavior and Human Decision Processes*, 104, 193–206.

Cooper, R., D. V. DeJong, R. Forsythe, and T. W. Ross (1994): "Alternative institutions for resolving coordination problems: Experimental evidence on forward induction and preplaycommunication," in *Problems of coordination in economic activity*, Springer, 129–146.

Costa-Gomes, M. A. and V. P. Crawford (2006): "Cognition and behavior in two-person guessing games: An experimental study," *American economic review*, 96, 1737–1768.

Crawford, V. P. and N. Iriberri (2007): "Fatal attraction: Salience, naivete, and sophistication in experimental "hide-and-seek" games," *American Economic Review*, 97(5), 1731–1750.

de Clippel, G. and K. Eliaz (2012): "Reason-based choice: A bargaining rationale for the attraction and compromise effects," *Theoretical Economics*, 7, 125–162.

Debreu, G. (1960): "Review of 'Individual Choice Behavior: A Theoretical Analysis' by R.D. Luce," *American Economic Review*, 50, 186–188.

Dhar, R. and R. Glazer (1996): "Similarity in Context: Cognitive Representation and Violation of Preference and Perceptual Invariance in Consumer Choice," *Organizational Behavior and Human Decision Processes*, 67(3), 280–293.

Doyle, J. R., D. J. O'Connor, G. M. Reynolds, and P. A. Bottomley (1999): "The robustness of the asymmetrically dominated effect: buying frames, phantom alternatives, and in-store purchases," *Psychology & Marketing*, 16(3), 225–243.

Frederick, S., L. Lee, and E. Baskin (2014): "The Limits of Attraction," *Journal of Marketing Research*, 51(4), 487–507.

Galeotti, F., M. Montero, and A. Poulsen (2019): "Efficiency versus equality in bargaining," *Journal of the European Economic Association*, 17, 1941–1970.

——— (2021): "The attraction and compromise effects in bargaining: Experimental evidence," *Management Science*.

Geyskens, I., K. Gielens, and E. Gijsbrechts (2010): "Proliferating private-label portfolios: How introducing economy and premium private labels influences brand choice," *Journal of Marketing Research*, 47(5), 791–807.

Gul, F., P. Natenzon, and W. Pesendorfer (2014): "Random choice as behavioral optimization," *Econometrica*, 82, 1873–1912.

Hargreaves Heap, S., D. Rojo Arjona, and R. Sugden (2014): "How portable is level-0 behavior? A test of level-k theory in games with non-neutral frames," *Econometrica*, 82, 1133–1151.

Hedgcock, W., A. R. Rao, and H. Chen (2009): "Could Ralph Nader's entrance and exit have helped Al Gore? The impact of decoy dynamics on consumer choice," *Journal of Marketing Research*, 46(3), 330–343.

Herne, K. (1997): "Decoy alternatives in policy choices: Asymmetric domination and compromise effects," *European Journal of Political Economy*, 13, 575–589.

Huber, J., J. W. Payne, and C. Puto (1982): "Adding Asymmetrically Dominated Alternatives: Violations of Regularity and the Similarity Hypothesis," *Journal of Consumer Research*, 9(1), 90–98.

——— (2014): "Let's Be Honest About the Attraction Effect," *Journal of Marketing Research*, 51(4), 520–525.

Kriss, P. H., A. Blume, and R. A. Weber (2016): "Coordination with decentralized costly communication," *Journal of Economic Behavior & Organization*, 130, 225–241.

Lichters, M., M. Sarstedt, and B. Vogt (2015): "On the practical relevance of the attraction effect: A cautionary note and guidelines for context effect experiments," *AMS Review*, 5, 1–19.

Lombardi, M. (2009): "Reason-based choice correspondences," *Mathematical Social Sciences*, 57(1), 58–66.

Luce, R. D. (1959): *Individual Choice Behavior: A Theoretical Analysis*, New York: Wiley.

McFadden, D. et al. (1973): "Conditional logit analysis of qualitative choice behavior," in *Frontiers in Econometrics*, Institute of Urban and Regional Development, University of California, 105–142.

McKelvey, R. D. and T. R. Palfrey (1995): "Quantal response equilibria for normal form games," *Games and economic behavior*, 10, 6–38.

Mehta, J., C. Starmer, and R. Sugden (1994): "The nature of salience: An experimental investigation of pure coordination games," *The American Economic Review*, 84, 658–673.

Myerson, R. B. (1978): "Refinements of the Nash equilibrium concept," *International journal of game theory*, 7, 73–80.

Nagel, R. (1995): "Unraveling in Guessing Games: An Experimental Study," *American Economic Review*, 85(5), 1313–1326.

Nash, J. (1951): "Non-cooperative games," *Annals of mathematics*, 286–295.

Ok, E. A., P. Ortoleva, and G. Riella (2015): "Revealed (P)Reference Theory," *American Economic Review*, 105(1), 299–321.

Osborne, M. J. and A. Rubinstein (1998): "Games with procedurally rational players," *American Economic Review*, 834–847.

Rapoport, A. (1997): "Order of play in strategically equivalent games in extensive form," *International Journal of Game Theory*, 26, 113–136.

Scarpi, D. (2008): "The impact of decoys and background information on consumers' preferences and decision making," *The International Review of Retail, Distribution and Consumer Research*, 18(1), 1–15.

Schelling, T. C. (1960): *The strategy of conflict*, Harvard University Press.

Selten, R. (1988): "Reexamination of the perfectness concept for equilibrium points in extensive games," in *Models of Strategic Rationality*, Springer, 1–31.

Shafir, E., I. Simonson, and A. Tversky (1993): "Reason Based Choice," *Cognition*, 49(1-2), 11–36.

Simonson, I. (1989): "Choice Based on Reasons: The Case of Attraction and Compromise Effects," *Journal of Consumer Research*, 16(2), 158–174.

——— (2014): "Vices and Virtues of Misguided Replications: The Case of Asymmetric Dominance," *Journal of Marketing Research*, 51(4), 514–519.

Simonson, I. and A. Tversky (1992): "Choice in context: Tradeoff contrast and extremeness aversion," *Journal of marketing research*, 29(3), 281–295.

Stahl, D. O. and P. W. Wilson (1994): "Experimental evidence on players' models of other players," *Journal of Economic Behavior and Organization*, 25(3), 309–327.

——— (1995): "On Players' Models of Other Players: Theory and Experimental Evidence," *Games and Economic Behavior*, 10(1), 218–254.

Trueblood, J. S., S. D. Brown, A. Heathcote, and J. R. Busemeyer (2013): "Not just for consumers: Context effects are fundamental to decision making," *Psychological science*, 24(6), 901–908.

Tversky, A. (1972): "Elimination by aspects: A theory of choice." *Psychological review*, 79, 281.

Tversky, A., S. Sattath, and P. Slovic (1988): "Contingent weighting in judgment and choice," *Psychological Review*, 95(3), 371–384.

Tversky, A. and I. Simonson (1993): "Context-dependent preferences," *Management science*, 39(10), 1179–1189.

van Elten, J. and S. P. Penczynski (2020): "Coordination games with asymmetric payoffs: An experimental study with intra-group communication," *Journal of Economic Behavior & Organization*, 169, 158–188.

Van Huyck, J. B., A. B. Gillette, and R. C. Battalio (1992): "Credible assignments in coordination games," *Games and Economic Behavior*, 4(4), 606–626.

Wedell, D. H. (1991): "Distinguishing among models of contextually induced preference reversals," *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 17(4), 767–778.

Wollschlaeger, L. M. and A. Diederich (2020): "Similarity, attraction, and compromise effects: Original findings, recent empirical observations, and computational cognitive process models," *The American Journal of Psychology*, 133(1), 1–30.

Yang, S. and M. Lynn (2014): "More Evidence Challenging the Robustness and Usefulness of the Attraction Effect," *Journal of Marketing Research*, 51(4), 508–513.

Appendix A: Details of Experimental Design

Appendix A1: Payoff Matrices

For robustness purposes, for each game type we examined four different payoff matrices that slightly varied in their monetary payoffs and in the location of equilibria. The construction of the base games and their extensions followed a set of predetermined rules. Below we describe the main rules alongside a brief explanation of their underlying rationale. The payoff matrices appear in Tables A.1 and A.2.

1. Coordination base games are symmetric which allows for a swift understanding of the base game. The equilibrium payoffs on the other hand are asymmetric, i.e., (x, y) and (y, x) where $x \neq y$.

2. In the extended games, the added strategy generates the same payoff to the column player regardless of his own action. This reduces the potential for direct effects on the column players' behavior so that any effect on the column players is more likely to be a reaction to the expected change in the behavior of the row players due to the added strategy.

3. In the dominance extensions, the last digit of the row player's payoffs in the dominated strategy is different than the last digit of the other payoffs. In addition, the column player's payoff when the row player chooses the dominated option is 10 ILS lower than his lowest payoff in the base game. These features emphasize the domination relation and increase the likelihood that subjects will notice it.

4. In the compromise extensions, when the row player chooses the added strategy, the column player's payoff is equal to his lowest payoff in the base game.[16]

5. Payoffs are multiplications of 5 for clarity and simplicity.

[16]Due to a typographical error, in one of the compromise extensions (game 3) the column player's payoff in the added strategy was slightly below his lowest payoff.

	Base		Dominance Extension		Duplicates Extension		Compromise Extension	
	40,40	**50,80**	40,40	**50,80**	40,40	**50,80**	10,30	**80,30**
Game 1	**80,50**	30,30	35,20	45,20	40,40	**50,80**	40,40	50,80
			80,50	30,30	**80,50**	30,30	**80,50**	30,30
	60,100	50,50	**60,100**	50,50	**60,100**	50,50	**80,40**	20,40
Game 2	40,40	**100,60**	55,30	45,30	**60,100**	50,50	60,100	50,50
			40,40	**100,60**	40,40	**100,60**	40,40	**100,60**
	75,105	65,65	**75,105**	65,65	**75,105**	65,65	**95,45**	25,45
Game 3	55,55	**105,75**	70,45	60,45	**75,105**	65,65	75,105	65,65
			55,55	**105,75**	55,55	**105,75**	55,55	**105,75**
	55,55	**65,95**	55,55	**65,95**	55,55	**65,95**	35,45	**85,45**
Game 4	**95,65**	45,45	50,35	60,35	55,55	**65,95**	55,55	65,95
			95,65	45,45	**95,65**	45,45	**95,65**	45,45

Table A.1: Payoffs of coordination base games alongside their extensions. In every base game the row player's strategies are Top and Bottom while in the extensions, they are Top, Middle and Bottom. The column player has two options – Left or Right. Equilibria in each game are in bold.

	Base		Dominance Extension		Duplicates Extension		Compromise Extension	
	40,40	**50,50**	40,40	**50,50**	40,40	**50,50**	20,40	**60,40**
Game 5	80,80	30,90	35,30	45,30	40,40	**50,50**	40,40	50,50
			80,80	30,90	80,80	30,90	80,80	30,90
	55,55	**65,65**	55,55	**65,65**	55,55	**65,65**	25,55	**85,55**
Game 6	85,85	45,95	50,45	60,45	55,55	**65,65**	55,55	65,65
			85,85	45,95	85,85	45,95	85,85	45,95
	45,45	35,35	**45,45**	35,35	**45,45**	35,35	**55,35**	15,35
Game 7	25,85	75,75	40,25	30,25	**45,45**	35,35	45,45	35,35
			25,85	75,75	25,85	75,75	25,85	75,75
	70,70	60,60	**70,70**	60,60	**70,70**	60,60	**90,60**	20,60
Game 8	50,100	90,90	65,50	55,50	**70,70**	60,60	70,70	60,60
			50,100	90,90	50,100	90,90	50,100	90,90

Table A.2: Payoffs of single-equilibrium base games alongside their extensions. In every base game the row player's strategies are Top and Bottom while in the extensions, they are Top, Middle and Bottom. The column player has two options – Left or Right. Equilibria in each game are in bold.

Appendix A2: Order of Play

Game	Effect	Role	Question
1	Attraction	Row	1
5	Duplicate	Column	2
2	Compromise	Column	3
6	Base	Column	4
3	Duplicate	Row	5
7	Compromise	Column	6
U1	Base	Column	7
4	Base	Row	8
8	Attraction	Row	9
5	Base	Row	10
1	Compromise	Row	11
6	Duplicate	Row	12
7	Attraction	Column	13
U2	Base	Column	14
3	Base	Column	15
4	Attraction	Column	16
8	Compromise	Row	17
2	Base	Row	18
1	Base	Column	19
6	Attraction	Row	20
2	Duplicate	Column	21
3	Compromise	Row	22
U3	Base	Row	23
5	Attraction	Column	24
7	Duplicate	Column	25
4	Compromise	Column	26
8	Base	Column	27
1	Duplicate	Row	28
5	Compromise	Column	29
U4	Base	Column	30
2	Attraction	Column	31
6	Compromise	Row	32
8	Duplicate	Row	33
3	Attraction	Row	34
7	Base	Row	35
4	Duplicate	Column	36

Table A.3: Order of games for players in Group 1. Players in Group 2 played the same games in the same order but in the complement role (i.e., row instead of column or vice versa). Groups 3 and 4 played the same games in the same roles as Groups 1 and 2, respectively, but in reverse order (Version 2). Games U1-U4 were unrelated to our study and were added to make the task less repetitive.

Appendix A3: Instructions

Welcome to the experiment

You are about to participate in an interactive decision making experiment. Please follow the instructions carefully.

In the experiment you may earn a significant amount of money. For your participation you will receive 20 ILS. You may earn an additional substantial amount based on your decisions and the decisions of the other participants in this room.

During the experiment you will play 36 games. In each game you will be randomly matched with another participant as the opponent against whom you will play the game. The game will be presented on your screen and the interaction between you and your opponent will take place through the computer. The identity of your opponents will not be revealed to you during the experiment or after it is completed. In every game you may earn different sums of money depending on your choice and the choice of your opponent. **Upon completion of the experiment, the computer will randomly draw one of the 36 games you played and the amount of money that you earned in that game will be paid to you. Each participant may have a different game chosen for payment.** The choices of your opponent and payoffs will not be presented during the experiment but only upon its completion. Upon completion, you will learn your payoff in each game and which game was chosen for payoff.

Note that since nobody (not even the experimenters) know which game will be chosen for payment purposes, it is best for you to treat every game as if it is the one that counts. The total amount of earnings in the experiment (participation fee and the amount earned in the randomly drawn game) will be paid to you privately in cash immediately after the experiment is completed. We will move on to the payment stage only after all participants finish marking their choices in all games.

It is not allowed to talk during the experiment or to look at other participants' screens. If you have any questions please raise your hand and one of the experimenters will be happy to answer. In most games you will see a table of the following type:

	Left	Right
Up	50,40	10,20
Down	70,20	30,60

One of the participants will be considered the row player and the other participant will be considered the column player. In the game's instructions it will be mentioned if you are playing as the row player or the column player in that game.

The actions described in the rows are the actions that the row player can choose from. In the above table, these are Up and Down.

The actions described in the columns are the actions that the column player can choose from. In the above table, these are Left and Right.

Each player will be asked choose an action without knowing the other player's chosen action. In games in which you are the row player, another participant sees the same table and plays against you as the column player. When you are playing the role of the column player, another participant is playing against you as the row player.

The numbers in the cells of the table represent the ILS amount that each one of you will receive for any combination of your choices. In each cell, the payoff for the row player always appears on the left and the payoff to the column player always appears on the right.

For example, if the row player chose Up and the column player chose Left then the row player will receive a payoff of 50 ILS and the column player will receive a payoff of 40 ILS. If the row player chose Down and the column player chose Right then the row player will receive a payoff of 30 ILS and the column player will receive a payoff of 60 ILS.

In some games you will play the role of the row player and in some games you play the role of the column player.

In any game that you will play, regardless of your role, your payoffs will always be in blue while the payoffs of the other player will be in black. The purpose of the colors is simply to assist you in recognizing your own payoffs. Remember the rule: **Blue is mine, Black is the opponent's**.

A few games in the experiment will be described verbally and will not include a payoff table.

5 Training Games

In the first part of the experiment, you will play 5 training games to make sure that you understand the instructions. You will not receive payoffs for your choices in this training session. Following the training session, you will move on to the 36 games in which you may earn payoffs.

Appendix B: Additional Results

Appendix B1: Dominated Strategy Effects Including All Observations

In this section, we reproduce the dominance-extension analysis when we do not exclude the choices of the decoy strategy. Table B1 reproduces Table 3 from Section 4 and shows similar patterns of behavior: The absolute percentages of choices of the target strategy moderately increase in all coordination extended games (2%-10%) and weakly increase in single-equilibrium extended games (0%-6%). Table B2 reports the regressions with the dominance extension dummy variable for coordination games (specifications (1)-(3)) and single-equilibrium games (specifications (4)-(6)).[17] The results are qualitatively similar to those reported in the main text, albeit the coefficient on the dominance extension variable is of lower significance.[18]

Table B1: Percentages of Target Choices by Row Players (All Observations)

	Coordination				*Single-Equilibrium*			
	1	2	3	4	5	6	7	8
Base Game	59	51	59	56	46	44	54	49
Dominance Extension	61	61	61	61	50	50	54	52

[17] As in the analysis in the main body of the paper, we run three specifications for each type of game: (i) non-clustered errors, (ii) clustered errors at the subject level, and (iii) clustered errors at the subject level alongside subject fixed effects.

[18] Note that the levels of significance for the dominance extension's coefficients in all specifications rely on a one-sided hypothesis due to regularity. If one takes the more conservative theory-free, two-sided test, then the corresponding p-values of the coefficient of the dominance extension in the three specifications of the coordination games are: (1) 0.166 (2) 0.113 (3) 0.126, while the coefficient of the dominance extension in the three specifications of the single-equilibrium games are: (4) 0.297 (5) 0.181 (6) 0.175.

Table B2: Logistic Regression Models: Dominance Extension with All Observations

	Dependent variable: Target Choice					
	Coordination			Single-Equilibrium		
	(1)	(2)	(3)	(4)	(5)	(6)
Dominance Extension	0.183*	0.183*	0.296*	0.136	0.136*	0.294*
	(0.132)	(0.115)	(0.193)	(0.130)	(0.102)	(0.216)
Version	-0.0497	-0.0497		0.125	0.125	
	(0.133)	(0.169)		(0.132)	(0.190)	
Gender (male=1)	-0.102	-0.102		0.219*	0.219	
	(0.133)	(0.168)		(0.131)	(0.190)	
correct	0.135	0.135		0.152*	0.152	
	(0.0882)	(0.145)		(0.0902)	(0.107)	
$game_2$	-0.156	-0.156	-0.239			
	(0.186)	(0.165)	(0.279)			
$game_3$	0	0	0			
	(0.187)	(0.181)	(0.303)			
$game_4$	-0.0351	-0.0351	-0.0346			
	(0.187)	(0.162)	(0.273)			
$game_6$				-0.0682	-0.0682	-0.152
				(0.184)	(0.150)	(0.318)
$game_7$				0.221	0.221	0.466
				(0.184)	(0.153)	(0.324)
$game_8$				0.0846	0.0846	0.170
				(0.184)	(0.130)	(0.274)
Constant	-0.612	-0.612	-0.0793	-1.598**	-1.598*	0.858***
	(0.731)	(1.155)	(0.209)	(0.746)	(0.893)	(0.194)
Observations	952	952	664	952	952	532

Notes: Numbers represent coefficients (β), Std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

Appendix B2: Accounting for the Effect of Experience

In this section we examine whether the effects of the added strategies that were reported in the main text vary with subjects' experience. Although subjects did not receive any feedback on the outcome of play after each game, experience may affect subjects' behavior. For example, it is possible that it takes time to understand the underlying structure of the games and the potential gains that may arise by following the behavioral cues in the extended games. To explore this possibility, we leverage a feature of our experimental design- subjects were randomly assigned to one of two versions with two opposite orders of the 32 games. Thus, the set of the first 16 games for one group of subjects is identical to the set of the last 16 games for another group of subjects. We define a dummy variable, Early, that receives 1 if the game appeared in the first 16 games that the subject encountered and 0 otherwise. We rerun the main regressions that appeared in the main text but this time we add Early as an explanatory variable, as well as an interaction between Early and Extension (i.e., the dummy for the extended game). Our main interest in this section lies in the coefficient of the interaction variable which captures the difference in the effect of the extensions across early and late games. Our findings are reported in the six tables below. The first two tables describe row players' choices in coordination games and single-equilibrium games, respectively. These are followed by the regressions for the column players' choices. Finally, we report the corresponding regressions of the compromise extensions.

The tables show that in most instances, the coefficient of the interaction variable is not significantly different from zero. In other words, the effect of the extensions was relatively similar across early and late games. There are three instances (out of 12) in which the coefficient of the interaction variable is significant at the 5% or the 10% level. For example, Table B3 suggests that the dominance extension has a stronger effect on row players' choices in the later stages of the experiment compared to the earlier stages.

Overall, we conclude that experience did not play a crucial role in our experiment; In most games the impact of extensions does not significantly differ between early and late stages. In the instances in which such a difference does show up, the behavior in the later games is the one that sets the tone for the overall effect that showed up in our main analysis.

Table B3: Logistic Regression Models: Row Players' Choices in Coordination Games

	Dependent variable: Target Choice					
	Dominance Extension			Duplicates Extension		
	(1)	(2)	(3)	(4)	(5)	(6)
Extension	0.52***	0.52***	0.78***	0.80***	0.80***	1.29***
	(0.20)	(0.17)	(0.30)	(0.21)	(0.19)	(0.32)
Early	0.12	0.12	0.06	0.13	0.13	0.03
	(0.20)	(0.20)	(0.36)	(0.20)	(0.20)	(0.36)
Early X Extension	-0.47*	-0.47*	-0.64	-0.18	-0.18	-0.22
	(0.28)	(0.25)	(0.45)	(0.32)	(0.28)	(0.47)
Version	-0.01	-0.01		-0.01	-0.01	
	(0.15)	(0.18)		(0.16)	(0.19)	
Gender (male=1)	-0.10	-0.10		0.01	0.01	
	(0.14)	(0.17)		(0.14)	(0.18)	
correct	0.12	0.12		0.07	0.07	
	(0.09)	(0.14)		(0.09)	(0.13)	
$game_2$	-0.17	-0.17	-0.29	-0.12	-0.12	-0.20
	(0.19)	(0.17)	(0.29)	(0.20)	(0.17)	(0.30)
$game_3$	-0.01	-0.01	- 0.02	0.03	0.03	0.06
	(0.19)	(0.18)	(0.31)	(0.20)	(0.19)	(0.30)
$game_4$	0.04	0.04	0.06	-0.23	-0.23	0.40
	(0.19)	(0.17)	(0.29)	(0.19)	(0.18)	(0.31)
Constant	-0.59	-0.59	-0.19	-0.30	-0.30	-0.42
	(0.77)	(1.14)	(0.27)	(0.78)	(1.05)	(0.28)
Observations	935	935	639	952	952	644

Notes: Numbers represent coefficients (β), std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

Table B4: Logistic Regression Models: Row Players' Choices in Single-Equilibrium Games

	Dependent variable: Target Choice					
	Dominance Extension			Duplicates Extension		
	(1)	(2)	(3)	(4)	(5)	(6)
Extension	0.11	0.11	0.24	-0.10	-0.10	-0.22
	(0.19)	(0.13)	(0.27)	(0.18)	(0.12)	(0.28)
Early	-0.07	-0.07	-0.18	-0.07	-0.07	-0.20
	(0.19)	(0.15)	(0.33)	(0.18)	(0.15)	(0.34)
Early X Extension	0.16	0.16	0.42	0.41	0.41**	0.91**
	(0.26)	(0.19)	(0.42)	(0.26)	(0.19)	(0.43)
Version	0.16	0.16		0.12	0.12	
	(0.13)	(0.19)		(0.13)	(0.19)	
Gender (male=1)	0.23*	0.23		0.16	0.16	
	(0.13)	(0.19)		(0.13)	(0.20)	
correct	0.14	0.14		0.06	0.06	
	(0.09)	(0.11)		(0.09)	(0.11)	
$game_6$	-0.04	-0.04	-0.10	-0.05	-0.05	-0.12
	(0.19)	(0.15)	(0.32)	(0.18)	(0.14)	(0.31)
$game_7$	0.19	0.19	0.38	0.27	0.27*	0.56*
	(0.19)	(0.16)	(0.34)	(0.19)	(0.15)	(0.34)
$game_8$	0.08	0.08	0.14	0.11	0.11	0.21
	(0.19)	(0.13)	(0.28)	(0.18)	(0.15)	(0.34)
Constant	-1.51**	-1.51*	0.88***	-0.88	-0.88	0.99***
	(0.76)	(0.91)	(0.26)	(0.74)	(0.95)	(0.24)
Observations	939	939	510	952	952	528

Notes: Numbers represent coefficients (β), std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

Table B5: Logistic Regression Models: Column Players' Choices in Coordination Games

	Dependent variable: Target Choice					
	Dominance Extension			Duplicates Extension		
	(1)	(2)	(3)	(4)	(5)	(6)
Extension	0.53***	0.53***	1.00***	1.14***	1.14***	2.00***
	(0.19)	(0.17)	(0.30)	(0.21)	(0.19)	(0.35)
Early	-0.01	-0.01	0.10	0.00	0.00	0.05
	(0.20)	(0.20)	(0.36)	(0.20)	(0.20)	(0.34)
Early X Extension	0.05	0.05	-0.04	-0.14	-0.14	-0.41
	(0.27)	(0.25)	(0.44)	(0.31)	(0.30)	(0.51)
Version	0.07	0.07		0.09	0.09	
	(0.14)	(0.18)		(0.16)	(0.19)	
Gender (male=1)	0.19	0.19		0.06	0.06	
	(0.13)	(0.17)		(0.14)	(0.17)	
correct	-0.03	-0.03		0.01	0.01	
	(0.09)	(0.09)		(0.09)	(0.08)	
$game_2$	0.36*	0.36**	0.68**	0.32	0.32*	0.50*
	(0.19)	(0.16)	(0.28)	(0.19)	(0.17)	(0.30)
$game_3$	0.36*	0.36**	0.63**	0.03	0.03	0.05
	(0.19)	(0.18)	(0.30)	(0.19)	(0.18)	(0.30)
$game_4$	0.40**	0.40**	0.74***	0.34*	0.34*	0.53*
	(0.19)	(0.16)	(0.28)	(0.19)	(0.18)	(0.31)
Constant	-0.44	-0.44	0.11	-0.58	-0.58	-2.76***
	(0.76)	(0.77)	(0.21)	(0.79)	(0.72)	(0.38)
Observations	952	952	680	952	952	704

Notes: Numbers represent coefficients (β), std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

Table B6: Logistic Regression Models: Column Players' Choices in Single-Equilibrium Games

	Dependent variable: Target Choice					
	Dominance Extension			Duplicates Extension		
	(1)	(2)	(3)	(4)	(5)	(6)
Extension	-0.22	-0.22	-0.50	0.07	0.07	0.18
	(0.19)	(0.14)	(0.31)	(0.19)	(0.13)	(0.29)
Early	-0.36*	-0.36**	-0.78**	-0.38**	-0.38***	-0.85**
	(0.19)	(0.15)	(0.32)	(0.19)	(0.15)	(0.34)
Early X Extension	0.54**	0.54**	1.20***	0.16	0.16	0.32
	(0.27)	(0.20)	(0.44)	(0.26)	(0.17)	(0.40)
Version	-0.40***	-0.40*		-0.38***	-0.38*	
	(0.13)	(0.20)		(0.13)	(0.20)	
Gender (male=1)	0.16	0.16		0.16	0.16	
	(0.13)	(0.20)		(0.13)	(0.20)	
correct	-0.35***	-0.35**		-0.28***	-0.28**	
	(0.10)	(0.15)		(0.10)	(0.13)	
$game_6$	0.27	0.27*	0.61*	-0.09	-0.09	-0.17
	(0.19)	(0.14)	(0.32)	(0.19)	(0.13)	(0.30)
$game_7$	-0.11	-0.11	-0.24	-0.51***	-0.51***	-1.15***
	(0.19)	(0.14)	(0.32)	(0.19)	(0.15)	(0.36)
$game_8$	0.10	0.10	0.20	-0.34*	-0.34**	-0.74**
	(0.19)	(0.13)	(0.29)	(0.19)	(0.16)	(0.37)
Constant	3.30***	3.30***	1.38***	3.07***	3.07***	2.03***
	(0.83)	(1.18)	(0.25)	(0.81)	(1.08)	(0.38)
Observations	952	952	524	952	952	504

Notes: Numbers represent coefficients (β), std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

Table B7: Logistic Regression Models: Compromise Extension in Coordination Games

	Dependent variable: Target Choice					
	Row Players			Column Players		
	(1)	(2)	(3)	(4)	(5)	(6)
Compromise Extension	-0.105	-0.105	-0.442	0.47**	0.47**	0.75**
	(0.199)	(0.179)	(0.339)	(0.19)	(0.18)	(0.30)
Early	0.12	0.12	-0.05	0.02	0.02	0.09
	(0.20)	(0.20)	(0.39)	(0.20)	(0.19)	(0.31)
Compromise X Early	0.13	0.13	0.58	-0.12	-0.12	-0.22
	(0.28)	(0.27)	(0.50)	(0.27)	(0.25)	(0.40)
Version	0.02	0.02		0.13	0.13	
	(0.15)	(0.19)		(0.14)	(0.16)	
Gender (male=1)	-0.27**	-0.27		0.04	0.04	
	(0.14)	(0.18)		(0.13)	(0.16)	
correct	0.05	0.05		-0.13	-0.13	
	(0.09)	(0.11)		(0.09)	(0.08)	
$game_2$	-0.19	-0.19	-0.39	0.41**	0.41**	0.58**
	(0.19)	(0.17)	(0.32)	(0.19)	(0.18)	(0.29)
$game_3$	0.22	0.22	0.38	0.30	0.30*	0.48*
	(0.19)	(0.18)	(0.33)	(0.19)	(0.17)	(0.27)
$game_4$	-0.02	-0.02	-0.04	0.17	0.17	0.20
	(0.19)	(0.17)	(0.27)	(0.19)	(0.17)	(0.27)
Constant	-0.09	-0.09	1.26***	0.42	0.42	0.47**
	(0.78)	(0.90)	(0.30)	(0.77)	(0.74)	(0.20)
Observations	887	887	562	952	952	708

Notes: Numbers represent coefficients (β), Std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

Table B8: Logistic Regression Models: Compromise Extension in Single-Equilibrium Games

	Dependent variable: Target Choice					
	Row Players			Column Players		
	(1)	(2)	(3)	(4)	(5)	(6)
Compromise Extension	-0.19	-0.19	-0.07	0.29	0.29**	0.61**
	(0.19)	(0.15)	(0.32)	(0.19)	(0.14)	(0.30)
Early	-0.06	-0.06	-0.18	-0.36*	-0.36**	-0.75**
	(0.19)	(0.15)	(0.34)	(0.19)	(0.15)	(0.31)
Compromise X Early	-0.07	-0.07	-0.17	-0.05	-0.05	-0.14
	(0.28)	(0.21)	(0.46)	(0.26)	(0.20)	(0.42)
Version	0.12	0.12		-0.16	-0.16	
	(0.14)	(0.20)		(0.13)	(0.19)	
Gender (male=1)	0.13	0.13		0.08	0.08	
	(0.14)	(0.20)		(0.13)	(0.19)	
correct	0.03	0.03		-0.28***	-0.28	
	(0.09)	(0.10)		(0.10)	(0.18)	
$game_6$	-0.12	-0.12	-0.35	0.15	0.15	0.43
	(0.20)	(0.17)	(0.35)	(0.19)	(0.16)	(0.34)
$game_7$	0.33*	0.33**	0.64*	-0.16	-0.16	-0.21
	(0.19)	(0.17)	(0.37)	(0.19)	(0.15)	(0.32)
$game_8$	0.21	0.21	0.26	-0.03	-0.03	-0.11
	(0.20)	(0.15)	(0.31)	(0.19)	(0.15)	(0.32)
Constant	-0.62	-0.62	1.17***	2.59***	2.59	0.07
	(0.78)	(0.88)	(0.29)	(0.82)	(1.43)	(0.26)
Observations	868	868	469	952	952	552

Notes: Numbers represent coefficients (β), Std. errors in parentheses.
*p<0.1; **p<0.05; ***p<0.01.

Appendix C: Theoretical Models

Appendix C1: The Generalized Cognitive Hierarchy Model

Irrelevant Strategies and the Generalized Cognitive Hierarchy Model.

In this section, we make use of the Generalized Cognitive Hierarchy (GCH) Model (Chong et al., 2016), with one slight adjustment, to shed light on our findings. We think of this exercise as a formal illustration of one potential channel through which coordination may increase in the presence of irrelevant strategies. Throughout this section, we focus on the qualitative difference in the model's predictions between the base games and their extensions.

The GCH model is a generalization of Cognitive Hierarchy (CH) theory (Camerer et al., 2004). In CH, level-k players, for $k \geq 1$, do not best respond to level-$(k-1)$ players, as in the standard level-k model, but rather to the population of lower-level players whose types are drawn from a Poisson distribution; level-0 players choose each action with equal probability. GCH generalizes this model in two respects. First, it allows players to use "stereotypes," i.e., assign a disproportional higher weight to frequently occurring lower-level types. Second, it modifies the behavior of level-0 players: While in the standard level-k model, they choose each strategy with equal probability, in GCH they are more likely to choose from a set of strategies that never yield the minimal payoff given any strategy of the opponent (which is dubbed the "never worst set" of strategies). If this set is empty, then they choose randomly with equal probabilities as in CH and the standard level-k model.

Coordination Games.

According to the GCH model, **level-**0 **row players** are more likely to choose the target in the dominance extensions, where it belongs to the never worst set of strategies, than in the corresponding base games. They also increase their choice probability of the duplicated strategy but for a different reason: Since there are no strategies that are never worst, each strategy is played with equal probability. As a result, the duplicated strategy is chosen by level-0 players with a probability of 2/3 (compared to 1/2 in the base game). **Level-**0 **column players** behave the same across base games and extensions since their never-worst set is not affected by the addition of the dominated and duplicated strategies.

Let us now move to the next level of cognitive hierarchy. We start with **level-1 column players** who best respond to level-0 row players. In the base games, their action depends on their level of risk aversion. If they are risk-neutral (or risk-seeking), they will only choose the target (given the payoffs and the fact that level-0 row players choose randomly with equal probabilities). This is where we introduce our adjustment to the GCH model:

We assume that players of level-k ($k \geq 1$) hold heterogeneous risk preferences.[19] More specifically, we require that, at least some of these players, exhibit risk aversion. A risk-averse level-1 column player may choose the other strategy (not the target) in the base game. This means that in the extensions, moderately risk-averse level-1 column players may switch to play the target given the increased choice probability of the target by level-0 row players. Note that **level-1 row players** do not alter their behavior when the base games are extended since level-0 column players' behavior remains the same as noted above.

Level-2 row players react to level-1 and level-0 column players. The latter do not change their behavior across base games and extensions while the former do - they tend to choose the target more often in the extensions. Thus, level-2 row players choose the target strategy in the extensions with a higher probability than in the base games (the extent to which the target strategy's choice probability increases depends on their own risk preferences as well as their belief regarding the proportion of the lower hierarchies that they are playing against). Finally, **level-2 column players** may also choose the target more frequently in the extensions as long as they believe that they are playing a non-negligible proportion of level-0 row players (since level-1 row players do not alter their behavior). Notice that since the target strategies support an equilibrium, higher levels choose the strategies that constitute that equilibrium with a higher probability in the extension than in the base game.

Single-Equilibrium Games.

Level-0 **row players** tend to choose their target more often in the extensions compared to the base games just like in coordination games. **Level-**0 **column players** have a dominating strategy in the base games and in the extensions (which belongs to the never-worst set) and hence they make the same choices across base games and extensions.[20]

Level-1 row players react to level-0 column players and therefore do not change their behavior across base games and extensions. **Level-1 column players** have a dominant strategy and therefore their behavior also doesn't change in the extensions compared to the base games. Finally, **level-2 row players** will also choose similarly since the behavior of the lower-level column players remains the same, while **level-2 column players** will once again stick with their dominating strategy. The same arguments apply for higher levels.

[19] Level-0 players act according to minimum aversion and therefore there is no room for them to express risk preferences.

[20] The strictly dominating strategy for the column player in the base game becomes weakly dominant in the dominance and duplicates extensions. Formally, according to the GCH model, this should lower the probability that a level-0 column player will choose the target. We take a more lenient interpretation of the model and assume that the target is still in the never worst set and therefore chosen with the same probability in the single-equilibrium base games and their extensions. Following the model's formal definition in a strict sense does not significantly change the predictions. It would lead to less target choices, the extent of which depends on the model's parameters. Specifically, this would depend on the ratio of choices of the dominating strategy to the dominated one in the base game.

Taking Stock - Predictions of GCH.

The GCH model predicts more choices of the target strategy by row players in both coordination games and single-equilibrium games. In the former, this is due to level-0 players' reaction to the extension as well as level-2 row players while in the latter this is only due to level-0 players' reaction. As for the column players, with some degree of risk aversion of players, the model predicts more choices of the target in coordination games but no difference in their behavior in single-equilibrium games.

Thus, the model predicts the findings well with one caveat - we do not find more choices of the target by row players in single-equilibrium games. In order to reconcile this gap within the framework of the GCH model, one possibility is to consider that there is a very small amount of level-0 players in our pool of participants. This is consistent with some studies of the level-k models that found that level-0 exists only in the minds of higher types (Costa-Gomes and Crawford, 2006; Crawford and Iriberri, 2007). Taking this consideration into account, we get a very minor effect of the extensions on row players in the single-equilibrium games but an effect remains for coordination games (due to the effect on players of level-2). Put differently, accepting that our sample comprises only a negligible proportion of level-0 players and that the remaining participants exhibit some level of risk aversion, GCH provides a comprehensive explanation for our findings.

Relevant Strategies and the GCH Model.

Coordination Games.

According to the GCH model, the compromise strategy (Middle) belongs to the never-worst set and therefore its choice share relative to Bottom increases (compared to the base game) by **level-**0 **row players**' behavior.[21] **Level-**0 **column players** choose randomly (50-50) as in the base game since no strategy belongs to the never worst set. Consequently, **level-1 row players** will behave as in the base game and will choose the strategy that fits their level of risk aversion. **Level-1 column players** with some degree of risk aversion will react to the shift in behavior of level-0 row players and the model predicts a higher share of target choices in the extension with the extreme strategy (the same applies to **level-2 column players** who react to both level-1 and level-0 row players). Finally, **level-2 row players**' behavior may be affected in the direction of more choices of the extreme strategy by their reaction to level-1 column players.

Taking the two considerations that we took earlier–some degree of risk aversion and a

[21] It is hard to determine what would happen in terms of absolute choice percentages since it depends on how much more frequently strategies in the never-worst set are chosen compared to those not in this set. However, as far as our analysis goes for the addition of the relevant strategy, we only examine the relative shares.

negligible amount of level-0 players–we obtain a reaction from the column players leading to more target choices in the presence of the extreme strategy but a weak to negligible reaction to its presence by row players. These predictions fit quite well with our finding as there is no direct effect of the added strategy on row players but some positive effect on the column players, i.e., an indirect effect.

Single-Equilibrium Games.

Level-0 **row players** react to this addition similarly to their reaction in coordination games. **Level-**0 **column players** do not react since they simply choose their dominant strategy which belongs to the never-worst set.[22] **Level-1 row players** act similarly to the base game since nothing changes in the behavior of level-0 column players. **Level-1 column players** don't alter their behavior since they have a dominant strategy (which also holds true for **level-2 column players**). Finally, **level-2 row players** do not change their behavior due to the unchanged behavior of the lower-level column players.

Overall, the model predicts no difference in the behavior of either player due to the addition of the extreme strategy in the single-equilibrium games. This holds true in the data for the row players but is at odds with the observed behavior of the column players. They choose their dominant strategy more frequently in the presence of the extreme strategy compared to the base game. While this may seem puzzling, keep in mind that in the base game, there is a non-trivial trade-off between following the dominant strategy and choosing the action that may lead to the surplus maximizing payoff. The presence of the extreme strategy makes choosing the dominated strategy harder to justify for the column player since it may lead to the surplus minimizing payoff. This may be the force that pushes the column players away from this strategy. Note that the above considerations are outside the scope of the GCH model (or any other model that ignores other-regarding preferences).

[22] As in footnote 18, there may be a decline in the choice probabilities of the target since it is not only weakly dominant but we assume that it is still seen as dominant and chosen at the same frequency as it was in the base game.

Appendix C2: Additional Theoretical Models

We discuss three more models that allow seemingly irrelevant strategies to affect behavior. Following a brief outline of each model's main components, we examine to what extent it is able to accommodate the choice patterns that show up in our experiment. That is, we check whether it predicts an increase in target choices by both players when an irrelevant strategy is added to coordination games but no effect of such an addition in single-equilibrium games. While the first presented model, an adjusted level-k model, is successful in explaining our findings, the latter two approaches, QRE and sampling equilibrium, are not.

An Adjusted Level-k model. A standard level-k model, where each level responds only to level-$k-1$ may also explain our findings as long as the level-0 types are attracted to the salient features that appear in our games' extensions. Taking this approach is in line with a substantial strand of the level-k literature that assumes a level-0 type who is attracted to salient strategies (e.g., Crawford and Iriberri, 2007; Arad, 2012; Arad and Rubinstein, 2012; Hargreaves Heap et al., 2014; Alaoui and Penta, 2016). A simple exercise, that we exclude for brevity, shows that under the same assumptions (risk aversion and a negligible amount of level-0 players) this model derives predictions that are similar to those derived above for the GCH model.[23]

Quantal Response Equilibrium (QRE) (McKelvey and Palfrey, 1995). This concept is a generalization of Nash Equilibrium that allows for errors in players' optimizations. Given an error structure, a player's probability of choosing a given action is equal to the probability that the action is optimal given his belief regarding his opponents' strategies. In a QRE, the players' beliefs are correct.

In most of the theory's applications, players' errors are assumed to be i.i.d across strategies, and every error is drawn from an extreme value distribution. This specification leads to the logistic quantal response function in which the probability of player i choosing strategy j is given by

$$p_{ij} = \frac{e^{\lambda \bar{u}_{ij}(p_{-i})}}{\sum\limits_{k} e^{\lambda \bar{u}_{ik}(p_{-i})}}$$

where $\bar{u}_{ij}(p_{-i})$ is the utility for player i when he chooses action j given that other players are playing according to the probability distribution p_{-i}.

The QRE model with the above response function accommodates some of our findings. For example, it predicts that in coordination games a strategy will be chosen more often when it is duplicated compared to when it is not. However, consider a duplicated strategy

[23]The attraction to salience according to this approach does not precisely define saliency and hence, while it is more broad, it is less formal than the definition used in the GCH model. This lack of formalism is raised by Chong et al. (2016) as one of the reasons for their formal definition of *minimum avoidance salience*.

in a single-equilibrium game. The data shows that the column player in the duplicates extension maintains similar choice probabilities between Left and Right as in the base game. If the model is required to fit the column players' observed behavior, then it must predict that the row players choose the target strategy more often in the duplicates extension (i.e., Up or Middle) than in the base game (Up), in contrast to our findings. Thus, the model cannot account for our findings as a whole in the single-equilibrium games. In addition, the logistic response function assigns a non-negligible probability to choosing the added dominated strategy in the dominance extensions (especially when the dominated strategy yields payoffs which are only slightly lower than those of the dominating strategy as in our experiment). This feature of the model is at odds with our findings, as row players almost never chose the added dominated strategies.

Sampling Equilibrium (Osborne and Rubinstein, 1998). According to this concept, a player behaves as if he sampled each of his actions once, observed the outcome of playing the sampled action against a random player from the population, and chose the strategy which was associated with the highest payoff. In a sampling equilibrium, the probability with which a player chooses an action is the probability with which that action achieves the highest payoff.

This procedure is unable to generate precise predictions in our setup as it allows for multiple equilbria in our base coordination games and in their extensions. For example, in the duplicates extension, the row player choosing Up with probability p and the column player playing Right with probability p is a sampling equilibrium of the coordination base games, for any $p \in [0, 1]$. In their duplicates extension, we get a similar set of equilibria: Row players choose Up and Middle, each with probability $p/2$, and the column players choose right with probability p. Thus, this multiplicity of equilibria may explain the pattern of our comparative statics, but it may also explain any other pattern. At a broader level, this equilibrium concept is better suited for situations involving repetition and learning, where individuals can explore their own strategies to understand the optimal course of action. For instance, it is akin to searching for the fastest route to the workplace by experimenting with different routes every day. However, in our experiment, participants do not receive feedback, making the model less appropriate for this specific context.