Decision Rights: Freedom, Power, and Interference*

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Abstract

We propose a general model of decision-rights allocation and choice, formulated in the context of a dynamic psychological game. Decision rights are valued not only according to the value of the outcomes, but also according to the procedure by which outcomes are achieved. We introduce freedom, power, and interference as such procedural motivations. In a novel laboratory experiment, we separately measure freedom, power, and interference preferences. Interference aversion best explains participants' behavior. Most participants value decision rights not because they enjoy having freedom of choice or power over others, but because they dislike letting others interfere in their outcomes.
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1 Introduction

Economics has traditionally considered decision rights solely for their instrumental value, i.e., according to the expected utility associated with the outcomes achieved via the exercise of decision rights. This view has guided the study of what constitutes an optimal allocation of decision rights and, as a consequence, how organizations and markets can be designed to achieve efficient outcomes. More recently, however, the concept of procedural utility (Frey et al. 2004, Frey and Stutzer 2005) and procedural preferences (Chlaß et al. 2014) have been introduced into economics and experimental evidence has been found to be consistent with individuals valuing decision rights for their intrinsic value, i.e., beyond the expected utility associated with the achieved outcomes (Bohnet and Zeckhauser 2004, Bohnet et al. 2008, Fehr et al. 2013, Bartling et al. 2014, Owens et al. 2014, and Butler and Miller 2016, Granić and Wagner 2017).[1] [2] These recent developments build on previous literature in philosophy and social psychology that highlights the intrinsic value that humans attach to needs such as liberty (Mill 1963), power (McClelland 1975), freedom of choice (Sen 1985), and autonomy (Deci and Ryan 2000).

This paper aims to identify and measure the procedural preferences that generate the intrinsic valuation of decision rights. Doing so will ultimately allow theoretical and experimental work on decision rights to generate usable tools and insights that applied policy can build on. For example, consider the question of how to optimally structure an organization. Many organizational arrangements are possible, ranging from highly hierarchical to completely flat. Only knowing that individuals value decision rights *per se* does not necessarily inform on how different arrangements compare in terms of welfare. Each arrangement may influence several procedural aspects, to an extent determined by individuals' procedural preferences. Thus, identifying and measuring such procedural preferences is crucial.

In this paper we propose a general theoretical model of decision rights allocation and choice, formulated in the context of a dynamic psychological game[3]. Decision rights are valued not only according to the value of

[1]For a psychological foundation of procedural utility see self-determination theory (Deci and Ryan 2000).

[2]Experimental investigations of preferences for decision rights unrelated to their intrinsic value can be found in Bartling and Fischbacher (2011) and Hamman et al. (2011).

[3]According to Dufwenberg (2008) "the term 'game with belief-dependent motivation'

the outcomes, but also according to the procedure by which the outcomes are achieved. Among the procedural aspects individuals may care about[4], our model focuses on a specific aspect: individuals care about the cause of the outcomes. To describe procedural concerns about the cause of the outcomes, our model employs the concepts of freedom, power, and interference. Intuitively, freedom can be understood as having control over one's own life, power as having control over another person's life, and interference as being exposed to another person's control.

In order to define these concepts in game theoretic terms, it is useful to point out that caring about the cause of an outcome does not translate to simply caring about who takes the action which leads to the outcome. In fact, the freedom of choice literature (Dowding and van Hees 2009) highlights that an individual, even if he selects an action and achieves an outcome, may have no freedom. For example, the lack of diversity of the outcomes may render the choice over the outcomes meaningless, as already noted in Pattanaik and Xu (1990). We require that an individual has the possibility to do otherwise and to achieve other outcomes by doing so. Therefore, consistent with Jones and Sugden (1982) and Nehring and Puppe (1999), an individual has freedom only if, in a counterfactual scenario in which he has different preferences over the outcomes, he can select a different action and achieve a different outcome. Thus, freedom can be defined only in the context of a variation in preferences over the outcomes, or in game-theoretic terms, a variation in a player's type. Given this insight, describing procedural concerns about the cause of an outcome requires describing an outcome not in terms of its causal dependence on an individual's action but in terms of its causal dependence on an individual's type.

We employ the following terminology. An individual experiences *freedom* when his type is the cause of his outcome. An individual experiences *power* when his type is the cause of another individual's outcome. An individual experiences *interference* when his outcome is caused by another individ-

would be more descriptive than the term 'psychological game', but [...] the latter [..] has become established."

Throughout the paper we employ the terminology 'psychological game'. Motivations such as reciprocity (Dufwenberg and Kirchsteiger 2004, Falk and Fischbacher 2006, Sebald 2010), and guilt (Battigalli and Dufwenberg 2007, Bellemare et al. 2016) have been studied in the context of psychological games.

[4]For example, individuals may have procedural concerns for fairness (Rabin 1993, and Falk et al. 2008).

ual's type. As an example, consider two different organization structures: a hierarchical structure and a flat structure. For simplicity, consider a two-person organization (Individual 1 and Individual 2) in which two decisions need to be made, each influencing both individuals. Under the hierarchical structure Individual 1 is at the top of the organization and makes both decisions. Individual 2 has no decision right and simply implements Individual 1's decisions. According to our terminology, Individual 1 experiences freedom and power and does not experience interference, while Individual 2 does not experience either freedom or power and instead experiences interference. Under the flat structure each individual makes one decision. According to our terminology, both individuals experience some degree of freedom, power, and interference.

In our framework, individuals have not only preferences over outcomes, but also preferences over freedom, power, and interference. When facing a decision between two actions, a player may be influenced by his beliefs over how much freedom, power, or interference the different actions yield. In the context of a psychological game, beliefs over freedom, power, and interference are captured by the beliefs that a player has about the cause of the outcome of the game. Thus, a player with freedom, power, or interference preferences may change his behavior at an earlier stage of the game in anticipation of greater/lower freedom, power, or interference at later stages. In the rest of the paper, for simplicity, we use the term procedural preferences as synonymous of preferences over freedom, power, and interference.

The generality of the theoretical model makes it suitable to be applied to a wide range of strategic dynamic environments. In this paper we implement a simplified version of the model in a laboratory experiment which involves the allocation of a decision right via an auction mechanism and the subsequent exercise of the decision right. As an illustration of its generality, we also apply our theoretical framework to the delegation game between a principal and an agent studied by Fehr et al. (2013).[5] Our theoretical model, while providing a general framework to represent the role of freedom, power, and interference preferences, does not make predictions regarding the relative strength of each. Conducting a laboratory experiment allows us to address the empirical question whether individual behavior is best explained by freedom, power, or interference preferences.

[5]See Appendix B.

In the experiment, pairs of participants (Player 1 and Player 2) play a game that involves the allocation and the exercise of a decision right. First, Player 1 bids for the decision right via an auction mechanism. Second, if Player 1 receives the decision right, he exercises it; otherwise Player 2 exercises it. The exercise of the decision right consists of making a final choice, which generates payoff consequences for both players. Therefore, the decision right has both an instrumental value - due to the fact that the favored outcome is implemented - and an intrinsic value - due to the fact that the implemented outcome is determined by one's own type. Across treatments and rounds, we vary the degree to which the decision right delivers higher freedom, higher power and lower interference. If Player 1 has any preferences over freedom, power, or interference, his valuation of the decision right will vary accordingly. We estimate how Player 1's freedom, power, and interference preferences separately affect his valuation of the decision right, as revealed by his bid. A higher bid has two effects. First, it increases the probability that Player 1 will hold the decision right. Second, it decreases the payoff uncertainty for Player 1. Therefore, it is crucial to distinguish between two different motivations for a high bid: procedural preferences and risk aversion. By eliciting individual risk preferences in an additional game, we compare the actual bids with the bids implied by the elicited risk preferences.

Data from our experiment reveals two main findings. First, we find evidence of procedural preferences. The mean estimated intrinsic value of the decision right is approximately 20% of the stake size (i.e., the payoff difference between best outcome and worst outcome). Second, we find strong evidence of interference aversion and only weak evidence of preference for freedom or preference for power.[6] Across different specifications and treatments, we find that the share of participants whose behavior is best explained by a model of psychological payoff maximization driven by interference preferences ranges between 56 and 77%. Our results suggest that most participants value decision rights neither because they enjoy the

[6]This result suggests that a desire for power, as casually observed in politics or other institutional settings, may simply be driven by concerns for other components of well-being, such as status. The desire for power may also be more salient when no instrumental value is associated with decision rights as recently documented by Fatas and Restrepo Plaza (2017). These other concerns are beyond the scope of our theoretical model and experimental setup.

freedom of making a choice, nor because they enjoy having power over other individuals, but rather because they dislike letting other individuals interfere in their outcomes.

Our theoretical framework and experimental findings have implications for the experimental literature on the delegation of decision rights, social risk, and control premium. Specifically, they contribute to unify the existing disparate results of previous experiments. In previous works, evidence that principals tend not to delegate control to agents is interpreted as an aversion to giving up control to another individual (Fehr et al. 2013, Bartling et al. 2014), evidence that individuals tend to demand a social risk premium when interacting with others is interpreted as an aversion to being betrayed (Bohnet and Zeckhauser 2004, Bohnet et al. 2008) or an aversion to a counterparty's intentions (Butler and Miller 2016), and evidence that individuals are willing to incur a cost in order to keep control over their own outcomes is interpreted as a preference for payoff autonomy (Owen, Grossman and Fackler 2014). Our theoretical framework and experimental design allow to unpack the motivation driving participants' behavior in terms of freedom, power, and interference, and potentially to characterize the role of each driving force for a wide range of contexts. According to our framework, the reluctance to delegate a decision right, the social risk premium required to trust another person, and the control premium foregone to maintain payoff autonomy can all be interpreted as driven by a dislike for interference.

The paper proceeds as follows. In Section 2 we discuss how our paper relates and contributes to the existing literature. In Section 3, we present the theoretical framework. Section 4 describes the experimental design. We present the theoretical predictions of the model in Section 5 and the empirical strategy in Section 6. The results are given in Section 7. Section 8 concludes.

2 Related literature

This paper lies at the intersection of several literatures, both experimental and theoretical. On the experimental side, we discuss how our model relates to previous works (Fehr et al. 2013, Bartling et al. 2014, Bohnet and Zeckhauser 2004, Bohnet et al. 2008, Butler and Miller 2016, Owens et al. 2014) and can help explain their results. As an illustration, in Appendix B we provide the exact predictions of our model for the authority-delegation experiment conducted by Fehr et al. (2013).

In a principal-agent experiment, Fehr et al. (2013) find that principals often decide not to delegate a decision right to an agent even when delegation would provide large expected utility gains. Bartling et al. (2014) find that two game-specific characteristics affect the intrinsic value of decision rights. The intrinsic value of decision rights is higher when the stake size and the alignment of interests between the principal and the agent are higher. They argue that the intrinsic value of decision rights does not originate from risk preferences, social preferences, ambiguity aversion, loss aversion, illusion of control, preference reversal, reciprocity, or bounded rationality, but instead from an intrinsic preference for decision rights. Our paper confirms the existence of such intrinsic value, extending it from a delegation setting to a willingness-to-pay/auction setting, and tackles the unanswered question of what the ultimate drivers of a preference for decision rights are.[7]

Our paper is closely related to the experimental literature on social risk. According to Bohnet and Zeckhauser (2004) and Bohnet et al. (2008) an individual faces social risk when decisions by another individual are the primary source of uncertainty. Bohnet and Zeckhauser (2004) finds that the decision of a principal to trust an agent entails an additional risk premium compared to the decision to let a randomization device determine the final choice and payoff consequences.[8] They argue that the additional premium is due to betrayal aversion. However, as they acknowledge, their design cannot rule out that the additional premium is caused by an aversion to relinquishing control to another individual. Our findings suggest that aversion to interference may be driving their results.

Butler and Miller (2016) argues that the social risk perceived by a principal when interacting with an agent is not simply due to his aversion to ceding control to the agent, but is also influenced by the context, specifically by the agent's capacity in engaging in intentional action. The authors evaluate the hypothesis that the higher the degree to which outcomes re-

[7]Bartling et al. (2014) acknowledge: "our design does not allow disentangling whether a possible positive intrinsic value of decision rights stems from the desire to be able to affect someone else's payoffs (as is the case if the principal keeps control) or from the aversion to be affected by some else's decision (as in case of delegation to the agent), or both. Addressing this question is an interesting topic for future research."

[8]In their terminology, trusting someone means letting another individual make a final choice that has payoff consequences for both individuals.

flect the agent's intentions, the higher is the social risk premium required by the principal. According to their terminology, to have full intention, the agent must act voluntarily ('Act'), foresee the consequences of his actions ('Foresee'), and have preferences over these consequences ('Desire'). They manipulate the agent's ability to act intentionally within a trust game experiment.[9] Since our framework defines interference as the causal relationship between the agent's preferences and the principal's outcomes, the principal is exposed to interference when the agent's intentionality is full, and not exposed to interference when the agent's intentionality is limited. Consistently with their findings, our framework predicts that a principal averse to interference requires a larger premium under full intention than under limited intention.[10]

Owens et al. (2014) document experiment participants' willingness to pay a premium to control their own payoff.[11] Participants choose whether to bet on themselves or on a partner answering a quiz question correctly. Given elicited beliefs, participants bet on themselves more than expected-money maximizers would do.[12] Their environment differs from ours along two main features. First, their environment is not strategic. When participant i chooses to have his payoff depend on participant j's answer, participant j doesn't know that this is the case when answering the quiz. Second,

[9]They employ four treatments. Intentionality is full in their benchmark treatment *AFD*. Intention is instead limited in the other three treatments, either by preventing the agent from foreseeing the consequences of his action (treatment AxD), or by having the agent take an action without foreseeing its consequences nor knowing his preferences (treatment Axx), or by having the outcome determined by a randomizing device (treatment xxD).

[10]Our results are consistent with their following results about the risk premium r: *(1)* $r_{AFD} > r_{xxD}$, *(2)* $r_{AFD} > r_{AxD}$, *(3)* $r_{xxD} = r_{Axx}$. Our experimental design does not predict their finding that $r_{AxD} < r_{xxD}$. To explain this finding Butler and Miller (2016) make use of the concept of competence, which social psychology defines as the ability of pursue one's own preferences. They argue that the principal's perception of social risk may be determined not only by the agent's intentionality but also by the agent's competence, and that the effect of a reduced competence (such as in treatment AxD) may counterbalance or even overcome the effect of intentionality.

[11]Owens et al. (2014) acknowledge that '[...] the control premium is an umbrella term that is consistent with more than one specific motivation and there remains room for interpretation as to what underlies our participants' preference to bet on themselves. [...] While our research clearly has direct implications for our understanding of delegation decisions in risky environments, more research is necessary to unpack further the motivation driving our results and thus clarify the full range of contexts to which it is most relevant.'

[12]In Owens et al. (2014) each participant reports the probability that each question will be answered correctly: by herself if the question is taken from her own quiz and by her partner if the question is taken from the partner's quiz.

in their environment a participant does not choose whether to delegate a decision right, but instead simply whether to have his own payoff depend on his own behavior or the behavior of another participant.[13] Importantly, participants do not choose whether to influence someone else's payoff, nor ever know whether their behavior actually influences it. Differences aside, the control premium they document can be loosely interpreted within our framework as driven by a dislike for interference, if we extend its definition to represent the causal link from actions to outcomes.

Our paper builds on concepts and measures originally developed in the literature on freedom of choice (Barberà et al. 2004, Baujard 2007, Dowding and van Hees 2009), diversity (Nehring and Puppe 2009) and power indices (Penrose 1946, Shapley and Shubik 1954, Banzhaf 1965, Diskin and Koppel 2010). The measures we propose for freedom and interference are closely related to the concepts of positive and negative freedom, originally introduced in philosophy by Berlin (1958), though not in the context of strategic interaction.

While in our experiment players face uncertainty over their preferences (types), which are induced by moves of Nature, in the freedom of choice literature preferences are formed internally and are known at the time of decision making. In this literature, therefore, an individual may still perceive freedom even when he already knows his preferences. Freedom is then derived from hypothetical preferences, as in Jones and Sugden (1982). Our theoretical model can incorporate a definition of freedom based on hypothetical preferences by allowing for off-equilibrium beliefs about preferences. We argue that our experimental setup is conservative: if a liking for freedom affects behavior with preferences induced by moves of Nature, it is likely to do so also if preferences are formed internally and if freedom is based on hypothetical preferences.

We conclude by highlighting a concept that is related to the intrinsic valuation of decision rights but not to our framework: preference for flexibility (Kreps 1979). Preference for flexibility does not apply to our framework, nor to Fehr et al. (2013) and Bartling et al. (2014), since preference for flexibility is already captured in the behavior predicted in equilibrium for expected-

[13] In an environment involving the delegation of a decision right (as intended in our paper, in Fehr et al. 2013 and in Bartling et al. 2014), exercising the decision right implies influencing not only one's own payoff but also someone else's payoff.

utility maximizers. In our experimental design, players are informed about their preferences over outcomes after the decision right is assigned. In equilibrium, individuals anticipate at an earlier stage the value of being able at a later stage to make a final choice instead of receiving the outcome of a lottery. In other words, the value of flexibility is fully captured by the behavior predicted in equilibrium for expected-utility maximizers. Thus, the deviations, which we observe, cannot be explained by preference for flexibility.

3 Theoretical framework

In this section, we describe a model of decision rights allocation and choice. In Section 4 we implement a simplified version of the model in a laboratory experiment. In Appendix B, as an illustration, we apply our theoretical framework to the authority-delegation game of Fehr et al. (2013).

As discussed in the introduction, an individual who cares about freedom, power, and interference cares non only about which outcome is achieved, but also about the way in which such outcome is achieved. For this reason, we need a game-theoretic model in which the perceived *psychological* payoffs can depend on players' beliefs about how the game is played in a more complex way than what is captured by expected *material* payoffs. Therefore, we require a more general model than standard extensive-form games of imperfect information.

We opt to make use of the framework of dynamic psychological games, for which Battigalli and Dufwenberg (2009) provide equilibrium existence results. However, defining a model of decision rights allocation and choice requires extending the original definition of dynamic psychological games. First, we need to consider psychological games of imperfect information. Second, since an individual's perceived freedom, power, and interference may depend on his anticipated future actions, we need to consider psychological games with own-plan dependence, in which a player's psychological payoffs depend not only on other players' plans but also on his own future plan. Both extensions are discussed in Battigalli and Dufwenberg (2009) and arguments are made how their equilibrium existence result extends to these cases. In what follows, we thus consider a psychological game of imperfect information with own-plan dependence and largely follow the notation of Battigalli and

Dufwenberg (2009).

3.1 Notation

Consider an own-plan dependent psychological game of imperfect information $\Gamma = (N, H, \mathcal{H}, P, \sigma_0, V)$. $N = \{0, 1, \ldots, n\}$ is a finite set of players with player 0 representing Nature. H is the finite set of histories. A history of length l is a sequence $h = (a^1, ..., a^l) = (a^t)_{t=1}^{l}$ where each $a^q = (a_1^q, ..., a_n^q)$ represents the profile of actions chosen at stage q $(1 \leq q \leq l)$. The empty history h^0 is an element of H and represents the start of the game. If $h'' = (a^q)_{q=1}^{l''}$ is in H, then any $h' = (a^q)_{q=1}^{l'}$ for $l' < l''$ is in H and we say that h' precedes h'', $h' \prec h''$. Let $A(h)$ be the set of actions available at history h, i.e., $a \in A(h)$ if and only if $(h, a) \in H$. $A(h)$ is empty if and only if h is a terminal history. Z denotes the set of terminal histories. Let $P : H \to N$ be the player function such that $i = P(h)$ denotes that Player i moves after history h. $\mathcal{H} = (\mathbf{H}_i)_{i \in N}$ is the set of information partitions for each player, where $\mathbf{H}_i$ is the partition of the finite set of histories H into information sets of Player i. We assume that the information partitions fulfill perfect recall. Moreover, for all $h, h' \in \mathbf{h} \in \mathbf{H}_i$ it holds that $P(h) = i$ and $A(h) = A(h') \equiv S_{\mathbf{h}}$.

A local pure strategy available at information set $\mathbf{h}$ is denoted by $s_{\mathbf{h}} \in S_{\mathbf{h}}$. The set of strategies of Player i is denoted by $S_i = \times_{\mathbf{h} \in H_i} S_{\mathbf{h}}$. The set of strategy profiles of all players is given by $S = \prod_{i \in N} S_i$. A strategy profile without the strategy at information set $\mathbf{h}$ is denoted by $s_{-\mathbf{h}}$ and the set of all strategy profiles without $S_{\mathbf{h}}$ is denoted by $S_{-\mathbf{h}}$. A local mixed strategy $\sigma_{\mathbf{h}}$ is a probability distribution over $S_{\mathbf{h}}$. σ_0 is the set of $\sigma_{0,\mathbf{h}}$ for all $\mathbf{h} \in \mathbf{H}_0$ containing the probability distributions of each move by Nature. Denote by $S(h)$ the set of pure strategy profiles consistent with history h. Let $S(H') = \bigcup_{h \in H'} S(h)$ denote the pure strategy profiles consistent with the set of histories $H' \subseteq H$. We will use the same notation for $S_{\mathbf{h}}$ and $S_{-\mathbf{h}}$. Moreover, let $z(s)$ be the terminal history reached by strategy profile s.

Player i's beliefs at information set $\mathbf{h}$ are given by $\mu_{i,\mathbf{h}} : B \to [0, 1]$ with $\mu_{i,\mathbf{h}} \in \Delta(S_{-\mathbf{h}})$ where B is the Borel sigma algebra of $S_{-\mathbf{h}}$ and $\Delta(S_{-\mathbf{h}})$ is the set of countably additive probability distributions over the sigma algebra. An assessment is a tuple (σ, μ) where $\sigma = \prod_{i \in N} \prod_{\mathbf{h} \in \mathbf{H}_i} \sigma_{\mathbf{h}}$ and $\mu = \prod_{i \in N \setminus \{0\}} \prod_{\mathbf{h} \in \mathbf{H}_i} \mu_{i,\mathbf{h}}$. An assessment (σ, μ) is consistent if there exists an infinite sequence of strictly positive strategy profiles $\sigma^1, \sigma^2, \ldots \to \sigma$ such that for all $i \in N\backslash\{0\}$, $\mathbf{h} \in \mathbf{H}_i$, $s_{-\mathbf{h}} \in S_{-\mathbf{h}}$:

$$\mu_{i,\mathbf{h}}(s_{-\mathbf{h}}) = \lim_{k\to\infty} \frac{\prod_{j\in N}\prod_{\mathbf{h}'\in\mathbf{H}_i\backslash\{\mathbf{h}\}}\sigma_{j,\mathbf{h}'}(s_{j,\mathbf{h}'})}{\sum_{s'_{-\mathbf{h}}\in S_{-\mathbf{h}}(\mathbf{h})}\prod_{j\in N}\prod_{\mathbf{h}'\in\mathbf{H}_i\backslash\{\mathbf{h}\}}\sigma^k_{j,\mathbf{h}'}(s'_{j,\mathbf{h}'})} \tag{1}$$

This condition requires that individuals update their beliefs according to Bayes' rule both on and off the equilibrium path. For a more detailed discussion, see Kreps and Wilson (1982).

We now describe the construction of the set of psychological payoff functions V. To distinguish cases when Player i has power from cases when Player i has freedom, we require player-specific outcomes. Let the set of possible material outcomes of Player i, denoted by O_i, be a partition of Z. Since we define Player i's freedom as the causal influence of i's preferences on i's outcomes, each player needs to hold more than one preference relation. We thus introduce a set of types T_i for each Player i, which are determined at the beginning of the game by the first move of Nature. For each Player i, let T_i be a partition of terminal histories such that for all $h, h' \in Z$:

$$\exists h'' \neq h^0 : h'' \prec h,\ h'' \prec h' \quad \Rightarrow \quad \exists t \in T_i : h, h' \in t \tag{2}$$

Thus, two terminal histories h, h' always belong to the same type if they are preceded by some identical history $h'' \neq h^0$, but may also belong to the same type if there does not exist such a history h''. Types are assumed to be independent across players, i.e., for all $t \in T_i$, $t' \in T_{j\neq i}$:

$$\sigma_{0,\{h^0\}}(S_{\{h^0\}}(t\cap t')) = \sigma_{0,\{h^0\}}(S_{\{h^0\}}(t)) \cdot \sigma_{0,\{h^0\}}(S_{\{h^0\}}(t')), \tag{3}$$

where $\sigma_{0,\{h^0\}}$ is Nature's mixed strategy at information set $\mathbf{h} = \{h^0\}$.

We can now write the beliefs that Player i holds over types T_i and outcomes O_i after playing strategy $s_{\mathbf{h}}$ at information set $\mathbf{h}$ as his beliefs over the terminal histories. Let $\theta_{i,\mathbf{h},s_{\mathbf{h}}} : 2^Z \to [0,1]$ represent Player i's belief over the terminal histories Z after playing $s_{\mathbf{h}}$ at information set $\mathbf{h}$. Let $\Theta = [0,1]^{2^Z}$ be the function space of all such possible beliefs.

For the beliefs over terminal histories to be coherent with beliefs over strategies we require for all $i \in N\backslash\{0\}, \mathbf{h} \in \mathbf{H}_i, z \subseteq Z, s_{\mathbf{h}} \in S_{\mathbf{h}}$:

$$\theta_{i,\mathbf{h},s_{\mathbf{h}}}(z) = \sum_{s_{-\mathbf{h}}\in S_{-\mathbf{h}}: z(s_{-\mathbf{h}},s_{\mathbf{h}})\in z} \mu_{i,\mathbf{h}}(s_{-\mathbf{h}}). \tag{4}$$

Thus, for any outcome $o \in O_i$ and type $t \in T_i$, Player i believes that, after playing $s_{\mathbf{h}}$ at information set $\mathbf{h}$, there is a probability equal to $\theta_{i,\mathbf{h},s_{\mathbf{h}}}(o \cap t)$ that his type is t and his material outcome at the end of the game is o. We will also use the notation for the conditional probabilities $\theta_{i,\mathbf{h},s_{\mathbf{h}}}(z|z') = \frac{\theta_{i,\mathbf{h},s_{\mathbf{h}}}(z \cap z')}{\theta_{i,\mathbf{h},s_{\mathbf{h}}}(z')}$.

In our model, individuals do not only care about the utility they derive from the outcome of the game but also have procedural preferences about how this outcome is obtained. The procedural preferences of Player i are represented by a psychological payoff function $V_i : \Theta \to \mathbb{R}$ and V is the set of all psychological payoff functions of all players except Nature. $V_i(\theta)$ represents the subjective value that Player i derives from the game given his beliefs θ about terminal histories.

3.2 Equilibrium

An assessment (σ, μ) is a psychological sequential equilibrium if it is consistent and for all $i \in N \backslash \{0\}, \mathbf{h} \in \mathbf{H}_i, s^*_{\mathbf{h}} \in S_{\mathbf{h}}$:

$$\sigma_{i,\mathbf{h}}(s^*_{\mathbf{h}}) > 0 \Rightarrow s^*_{\mathbf{h}} \in \arg\max_{s_{\mathbf{h}} \in S_{\mathbf{h}}} V_i(\theta_{i,\mathbf{h},s_{\mathbf{h}}}) \tag{5}$$

Battigalli and Dufwenberg (2009) show the existence of a sequential equilibrium for extensive-form games with observable actions in which payoffs depend on infinite belief hierarchies over the actions of other players. This allows for the model to capture intentions. Compared to Battigalli and Dufwenberg (2009), our model is on the one hand a simplification, since the psychological payoff function only depends on first-order beliefs, on the other hand an extension, since it assumes imperfect information and players' preferences are own-plan dependent.[14]

Naturally, our equilibrium definition corresponds to the sequential equilibrium of Kreps and Wilson (1982) if for all joint probability distributions $\theta \in \Theta$, $V_i(\theta)$ coincides with expected utility $EU_i(\theta)$:

$$EU_i(\theta) = \sum_{t \in T_i} \sum_{o \in O_i} \theta(o \cap t) u_i(o \cap t). \tag{6}$$

[14]In Section 6 of Battigalli and Dufwenberg (2009), it is argued that their results on the existence of sequential equilibria can be extended to games of imperfect information and own-plan dependent preferences.

where $u_i : Z \to \mathbb{R}$ is the utility function of Player i over outcomes. We call an equilibrium a sequential equilibrium if it is a psychological sequential equilibrium with $V_i = EU_i$. Instead, we define the psychological payoff function V_i to include also the procedural (dis)utility from freedom, power, and interference. Thus, individuals may change their behavior at earlier stages of the game in anticipation of greater/lower freedom, power, or interference at later stages. Given the multifaceted nature of these concepts, we do not claim to fully capture all intricacies of these concepts. Like a game theoretical model is a simplification of interactions, the following definitions are simplifications of the defined concepts. We use the following terminology.

Freedom. Player i has *freedom* if he causally influences his own outcomes. Thus, for any $\theta \in \Theta$ freedom is measured by the degree to which Player i's own type determines his own outcomes, as

$$F_i(\theta) = \sum_{t \in T_i} \sum_{o \in O_i} g(o,t)\theta(o \cap t) \log_2 \frac{\theta(o|t)}{\theta(o)}, \tag{7}$$

where $\theta(o|t) = \frac{\theta(o \cap t)}{\theta(t)}$ and $\log_2 \frac{\theta(o|t)}{\theta(o)}$ is the causal influence measure, which captures how far the distribution of outcome o conditional on type t is from the unconditional distribution. Freedom is measured by the expectation of these terms across all type-outcome combinations. For example, take two outcomes A and B and an individual who prefers either A or B; i.e., he has type t^A or t^B. If $\theta(A|t^A) = \theta(A) = 1 - \theta(B)$, the fact that he prefers A or B makes no difference on whether the outcome is A or B. This is captured by the causal influence measure via $\log_2 \frac{\theta(o|t)}{\theta(o)} = 0$ for all $o \in \{A, B\}$ and $t \in \{t^A, t^B\}$. However, if the individual has some influence, then $\theta(A|t^A) > \theta(A)$, and this results in a positive causal influence. Freedom captures Berlin's definition of positive freedom as "[t]he freedom which consists in being one's own master" (1958, p.8) and other concepts from the literature on freedom of choice.

The measure is a generalization of the mutual information (a statistical measure of correlation) of types and outcomes. Mutual information has several desirable properties for a measure of freedom. First, if there is a one-to-one relation between types and outcomes, i.e., the individual has perfect control, the freedom measure is increasing in the number of outcomes. This property is desirable because it conforms to the intuition that freedom increases in the number of outcomes an individual with perfect control can achieve, in case that these outcomes are favored by some type. Second, splitting a type into two types which are behaviorally equivalent leaves the freedom measure unchanged. This property is also desirable because it prevents the measure from being arbitrarily inflated by the simple inclusion of more types. Further, the measure fulfills the following recursivity condition. If an individual can choose between two actions, after which two distinct subgames will be played, then this individual's freedom equals the freedom of choosing between two outcomes plus the expected freedom gained from the two subgames. For details on the axiomatic characterization of freedom, see Rommeswinkel (2018).

The mutual information between types and outcomes is weighted by a function $g(o,t)$ to capture the qualitative value of the causal influence between each type and each outcome. Doing so enables to adequately represent cases where, as intuition suggests, an individual perceives the value of freedom to be low because the achievable outcomes are qualitatively very similar. In such cases a qualitative diversity metric for $g(o,t)$ may be employed (Nehring and Puppe 2002, Nehring and Puppe 2009). We discuss in Section 5, in the context of our experiment, two sensible specifications of $g(o,t)$.

Analogously to the definition of freedom, we define interference and power as follows.

Interference. Player i experiences *interference* if other players causally influence his outcomes. For any $\theta \in \Theta$, interference is measured by the degree to which other players' types determine Player i's own outcomes. Thus, interference is measured by

$$I_i(\theta) = \sum_{j \in N \setminus \{0,i\}} \sum_{t \in T_j} \sum_{o \in O_i} g(o,t)\theta(o \cap t) \log_2 \frac{\theta(o|t)}{\theta(o)}. \tag{8}$$

We loosely associate Interference with Berlin's definition of negative freedom as "not being interfered with by others"(1958, p.3).

Power. Player i has *power* if he causally influences the outcomes of other players. For any $\theta \in \Theta$, power is measured by the degree to which Player

i's own type determines other players' outcomes, as

$$P_i(\theta) = \sum_{j\in N\setminus\{0,i\}} \sum_{t\in T_i} \sum_{o\in O_j} g(o,t)\theta(o\cap t)\log_2 \frac{\theta(o|t)}{\theta(o)}. \tag{9}$$

Power is related to the voting power measure by Diskin and Koppel (2010). It generalizes their measure by extending it to dynamic games and by introducing player-specific outcomes and a weighting function $g(o,t)$.

If Player i cares about freedom, interference, or power, the psychological payoff function $V_i(\theta)$ can be written alternatively as

$$V_i(\theta) = \alpha_i F_i(\theta) + EU_i(\theta), \tag{10}$$

or

$$V_i(\theta) = \beta_i I_i(\theta) + EU_i(\theta), \tag{11}$$

or

$$V_i(\theta) = \gamma_i P_i(\theta) + EU_i(\theta), \tag{12}$$

respectively. Parameters α_i, β_i, and γ_i represent Player i's freedom, interference, and power preference parameters, respectively.

4 Experimental design

The experiment implements a dynamic psychological game in which we can estimate freedom, power, and interference preferences, i.e., the coefficients from Equations 10-12. Two players, Player 1 and Player 2, play a card game involving the selection of a card from one of two boxes, Box L and Box R. Box L and Box R each contain two cards, Card A and Card B. Each card has two sides, Side 1 and Side 2. The instructions are reported in Appendix H.

The game consists of two stages: a bidding stage and a choice stage. The bidding stage serves to determine which player has the decision right in the choice stage. In the choice stage, the player with the decision right selects a card. The decision right is allocated via a Becker-DeGroot-Marschak (BDM) mechanism (Becker et al. 1964). Player 1 is required to bid (at the singleton information set $\mathbf{h}_b$) for the decision right by choosing an integer between 0 and 100, $y = s_{\mathbf{h}_b} \in \{0,\ldots,100\}$. The computer then randomly draws an integer between 1 and 100 with uniform probability, $r = s_{\mathbf{h}_r} \in \{1, \ldots, 100\}$. If $y \geq r$, Player 1 has the decision right: he will select a card from Box L in the choice stage and pay a fee equal to r. Otherwise, Player 2 has the decision right: he will select a card from Box R in the choice stage, and no fee is paid by either player.

In each box independently, the colors of the sides of the cards are determined via a random draw from the four cases represented in Figure 1. Each case has a priori equal probability. The color of Side 1 is payoff-relevant for Player 1, and the color of Side 2 is payoff-relevant for Player 2. Green is associated with higher payoff; i.e., $\pi_i^{high,K} > \pi_i^{low,K}$, where $\pi_i^{high,K}$ denotes Player i's payoff if Side i of the card selected from box K is green, and $\pi_i^{low,K}$ denotes Player i's payoff if Side i of the card selected from box K is red, and $K \in \{L, R\}$. Each side of each card can be green or red with equal probability. Moreover, Side i of Card A and Side i of Card B are always a different color, which guarantees that Player i prefers either Card A or Card B. If Side 1 and Side 2 of a given card are the same color, then the players prefer the same card. Otherwise, the players prefer different cards.[15] We can interpret the random draw from the four cases in Figure 1 as a move by Nature, which randomly determines players' types. Let t_i^c be the set of terminal nodes in which Player i prefers card c. The sets of types are then given by $T_1 = \{t_1^A, t_1^B\}$ and $T_2 = \{t_2^A, t_2^B\}$, as discussed in Section 3.

The order of events is shown in Figure 2. As the bidding stage starts, players are informed about the values of $\pi_i^{high,K}$ and $\pi_i^{low,K}$ for $i = 1, 2$ and $K \in \{L, R\}$. Thus, they know, for each player and for each box, what the payoff associated with green and the payoff associated with red are. At this moment, neither player knows, for either box, whether he prefers Card A or B, or whether the other player prefers Card A or B. As the choice stage starts, players receive additional information. Within the box, from which the card will be selected, each player can finally observe the actual colors on his side of the two cards. Player 1 observes Side 1 of Card A and Side 1 of Card B, and Player 2 observes Side 2 of Card A and Side 2 of Card B. Therefore, each player at this stage knows which card gives him the high payoff, i.e., which card he prefers. However, no player observes the colors on

[15]As shown in Figure 1, in case 1, both players prefer Card B; in case 2, Player 1 prefers Card B and Player 2 prefers Card A; in case 3, Player 1 prefers Card A and Player 2 prefers Card B; in case 4, both players prefer Card A.

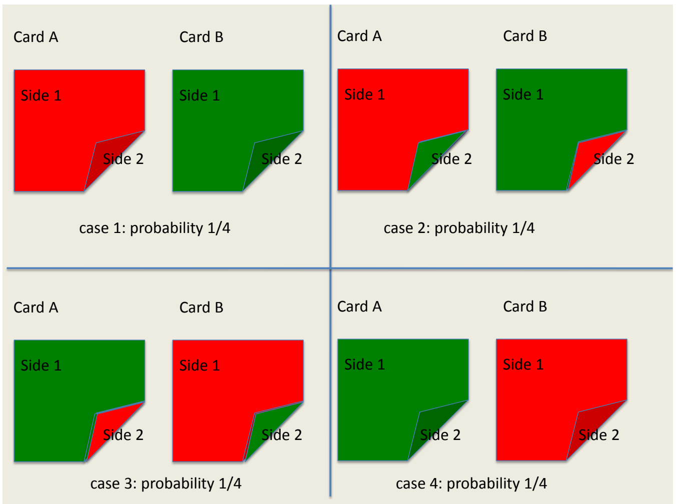


Figure 1: Card colors in Box $K = L, R$

the other side of the two cards. Therefore, no player knows which card the other player prefers. This design feature allows us to avoid thorny confounds with social preferences.[16]

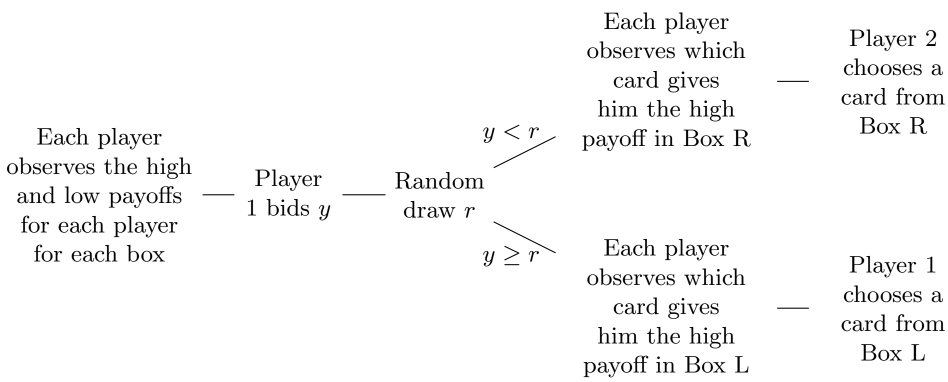


Figure 2: Order of events

To represent freedom, power, and interference preferences we must define the set of outcomes. Let $o_1(r, i, c) \subseteq Z$ denote Player 1's outcome where the randomly drawn number is r and Player i has the decision right and chooses card c. For Player 2 the number r is never relevant, so let $o_2(i, c) \subseteq Z$ denote Player 2's outcome where Player i has the decision right and chooses card

[16]Further discussion on the potential implication of this feature can be found in Section 7.4.

c.[17]

The payoff structure of the game is always common knowledge. Payoffs vary across rounds and treatments, as described in detail in Sections 4.1-4.2. Table 1 provides the general payoff structure. Player 1's payoff is $\pi_1(o_1(r,i,c),t_1^A)$ if he prefers Card A and $\pi_1(o_1(r,i,c),t_1^B)$ if he prefers Card B. Analogously, Player 2's payoff is $\pi_2(o_2(i,c),t_2^A)$ if he prefers Card A and $\pi_2(o_2(i,c),t_2^B)$ if he prefers Card B. Moreover, Player 1 and Player 2 start the game holding endowments w_1 and w_2, respectively.

	$i=1$		$i=2$	
	$c=A$	$c=B$	$c=A$	$c=B$
$\pi_1(o_1(r,i,c),t_1^A)$	$w_1+\pi_1^{high,L}-r$	$w_1+\pi_1^{low,L}-r$	$w_1+\pi_1^{high,R}$	$w_1+\pi_1^{low,R}$
$\pi_1(o_1(r,i,c),t_1^B)$	$w_1+\pi_1^{low,L}-r$	$w_1+\pi_1^{high,L}-r$	$w_1+\pi_1^{low,R}$	$w_1+\pi_1^{high,R}$
$\pi_2(o_1(i,c),t_2^A)$	$w_2+\pi_2^{high,L}$	$w_2+\pi_2^{low,L}$	$w_2+\pi_2^{high,R}$	$w_2+\pi_2^{low,R}$
$\pi_2(o_1(i,c),t_2^B)$	$w_2+\pi_2^{low,L}$	$w_2+\pi_2^{high,L}$	$w_2+\pi_2^{low,R}$	$w_2+\pi_2^{high,R}$

Table 1: Payoff structure

4.1 Rounds

The card game is played repeatedly for 20 rounds. Across rounds, we vary the values for Player 2's payoffs $\pi_2^{high,L}$ and $\pi_2^{low,L}$ to account for situations in which the decision right gives Player 1 power or does not. Γ^{np} are games where $\pi_2^{high,L}=\pi_2^{low,L}$. In these games, therefore, when Player 1 has the decision right and selects a card from Box L, he does not have power since his type cannot influence Player 2's outcomes: Player 2 is indifferent between the cards since $\pi_2^{high,L}=\pi_2^{low,L}$. Γ^p are games where $\pi_2^{high,L}>\pi_2^{low,L}$, so the decision right gives Player 1 power. In both Γ^{np} and Γ^p games, we have $\pi_2^{high,R}>\pi_2^{low,R}$: Player 2 is never indifferent between the cards when he has the decision right. For Player 1 payoffs are $\pi_1^{high,L}=\pi_1^{high,R}=\pi_1^{high}$ and $\pi_1^{low,L}=\pi_1^{low,R}=\pi_1^{low}$. Across the 20 rounds, participants play 10 Γ^{np} games and 10 Γ^p games. As shown in Table 2, within Γ^{np} and Γ^p games, the rounds differ in expected payoff and in stake size, the latter defined as the difference between high payoff and low payoff. The order in which the

[17]The outcomes of Player 2 are a coarsening of the outcomes of Player 1. Since Player 2 has never control over the finer distinctions made by o_1, the following analysis could be presented without assuming player-specific outcomes. However, the theory must also be able to accommodate for more complicated differences between player-specific outcomes, e.g. Gaertner et al. (1992).

rounds are played is randomized across pairs of players.

		Box L		Box R	
		Player 1	Player 2	Player 1	Player 2
game	round	Green/Red	Green/Red	Green/Red	Green/Red
		π_1^{high}/π_1^{low}	$\pi_2^{high,L}/\pi_2^{low,L}$	π_1^{high}/π_1^{low}	$\pi_2^{high,R}/\pi_2^{low,R}$
Γ^{np}	1	100/30	70/70	100/30	100/30
Γ^{np}	2	90/40	70/70	90/40	90/40
Γ^{np}	3	80/50	70/70	80/50	80/50
Γ^{np}	4	85/15	70/70	85/15	85/15
Γ^{np}	5	75/25	70/70	75/25	75/25
Γ^{np}	6	65/35	70/70	65/35	65/35
Γ^{np}	7	70/0	70/70	70/0	70/0
Γ^{np}	8	60/10	70/70	60/10	60/10
Γ^{np}	9	50/20	70/70	50/20	50/20
Γ^{np}	10	100/0	70/70	100/0	100/0
Γ^{p}	11	75/25	85/15	75/25	85/15
Γ^{p}	12	75/25	75/25	75/25	75/25
Γ^{p}	13	75/25	65/35	75/25	65/35
Γ^{p}	14	75/25	90/40	75/25	90/40
Γ^{p}	15	75/25	60/10	75/25	60/10
Γ^{p}	16	85/15	75/25	85/15	75/25
Γ^{p}	17	65/35	75/25	65/35	75/25
Γ^{p}	18	90/40	75/25	90/40	75/25
Γ^{p}	19	60/10	75/25	60/10	75/25
Γ^{p}	20	100/0	100/0	100/0	100/0

Table 2: Payoffs in each round

Treatment	Endowments	Cards	Games	decision right affects		
	w_1, w_2	in Box L		freedom	interference	power
1	100,100	A, B	Γ_1^{np}	*yes*	*yes*	*no*
			Γ_1^{p}	*yes*	*yes*	*yes*
2	100,0	A, B	Γ_2^{np}	*yes*	*yes*	*no*
			Γ_2^{p}	*yes*	*yes*	*yes*
3	100,0	C	Γ_3	*no*	*yes*	*no*

Table 3: Treatments

4.2 Treatments

We conducted the experiment under three treatments, in which we modified key features of the game. Games are denoted Γ_1, Γ_2, and Γ_3 in Treatment 1, 2, and 3, respectively. In the benchmark Treatment 1, both players receive an endowment ($w_1 = w_2 = 100$). In Treatment 2, only Player 1 receives an endowment ($w_1 = 100$, $w_2 = 0$). In all other aspects, Treatment 1 and 2 are identical. Specifically, payoffs in each round are as reported in Table

2. The variation in endowments allows to verify whether inequity aversion plays a role. Specifically, Player 1's bid may be affected by his aversion to advantageous or disadvantageous inequity. We explore the role of inequity aversion in Appendix F.

In Treatment 3, $w_1 = 100$ and $w_2 = 0$, as in Treatment 2, but Box L contains only one card (Card C), which is green on Side 1 and is either red or green on Side 2. Therefore, in Box L payoffs in each round correspond to π_1^{high} for Player 1 and either $\pi_2^{high,L}$ or $\pi_2^{low,L}$ for Player 2, as reported in Table 2.

In Treatment 3, payoffs in each round are as reported in Table 2 and in box L, Player 1 receives automatically the high payoff. Under this modified design, the decision right allocation affects interference, but not freedom or power. Similarly to the other treatments, if Player 1 has the decision right, he is not interfered with, since Player 2's type cannot influence Player 1's outcome. However, Player 1 does not have freedom since his type cannot influence his own outcome: Box L contains only Card C. Moreover, Player 1 has no power since his type cannot influence Player 2's outcome. Treatment 3 allows to distinguish a liking for freedom from an aversion to interference, which are not distinguishable in Treatment 1 and 2.

Table 3 summarizes the characteristics of each treatment.[18] Note that the distinction between games Γ^{np} and games Γ^{p} is relevant for Treatment 1 and 2, but not for Treatment 3, which never involves power.

4.3 Procedures

We conducted eight sessions: three sessions of Treatment 1, three sessions of Treatment 2, and two sessions of Treatment 3. The sessions took place over two consecutive days in October 2013 at the Cologne Laboratory for Economic Research (CLER).[19] Each session lasted approximately 1.5 hours. In

[18]The level of power provided to Player 1 by the decision right is varied according to a within-subject design. A within-subject design has advantages and disadvantages compared to a between-subject design. On the one hand, in within-subject designs internal validity does not depend on random assignment. On the other hand, within-subject designs are more likely to lead to so-called 'demand effects', according to which participants interpret the experimenter's intentions and change their behavior accordingly, either consciously or not. Our findings of a weak evidence of preference for power, however, suggests that participants were not affected by demand effects. For a discussion on between- and within-subject design, see Charness et al. (2008).

[19]The experiment was conducted at a German University, where institutional review boards or committees are not mandatory (see guidelines of the German Psychological Soci-

total, 244 subjects participated: 86 in Treatment 1, 96 in Treatment 2, and 62 in Treatment 3.[20] Participants were recruited via ORSEE (Greiner 2004) and consisted of students at the University of Cologne. The experiment was implemented in zTree (Fischbacher 1999). Each session was divided into three parts. Participants received instructions for each part only after completing the previous part.

In Part 1, subjects play the card game described above. At the start, half of the subjects are randomly assigned the role of Player 1 and the other half of the subjects the role of Player 2. Each Player 1 is randomly matched with a Player 2. The roles and the matches are then fixed for the entire duration of Part 1. Subjects play a trial round (which does not count for their earnings) and then play 20 rounds (10 games Γ^{np} and 10 games Γ^{p}). Rounds are played in random order, and feedback regarding each round is given only at the end of the session (i.e., end of Part 3). At the end of the session, one round of the card game is randomly selected, and each subject is paid according to the payoff earned in that round only.

Option A	Option B	your choice
30	85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability	A ☐ B ☐
35	85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability	A ☐ B ☐
40	85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability	A ☐ B ☐
45	85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability	A ☐ B ☐
50	85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability	A ☐ B ☐
55	85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability	A ☐ B ☐
60	85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability	A ☐ B ☐
65	85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability	A ☐ B ☐
70	85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability	A ☐ B ☐
75	85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability	A ☐ B ☐
80	85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability	A ☐ B ☐

Table 4: The first set of questions in the lottery-choice questionnaire. The values (85,15) are replaced by (75,25) in the second set and by (65,35) in the third set.

Part 2 and Part 3 involve individual decisions, with no interaction among subjects. In Part 2, subjects answer a lottery-choice questionnaire, which

ety: http://www.bdp-verband.org/bdp/verband/ethic.shtml; particularly section C.II.4). Treatment of participants was in agreement with the ethical guidelines of the German Research Foundation (Deutsche Forschungsgemeinschaft) and the German Psychological Society (DGP).

[20]One session had 22 participants, one session 30 participants, and six sessions 32 participants.

implements the elicitation of participants' risk preferences via a Multiple Price List (MPL) method. The MPL method is one of the prevailing methods for eliciting risk preferences and was popularized by Holt and Laury (2002).[21] Each question in the questionnaire involves the choice between a safe lottery (Option A) that yields prize π^A with certainty and a risky lottery (Option B) yielding a high prize $\pi^{B,high}$ with probability 0.5 and a low prize $\pi^{B,low}$ with probability 0.5. The lotteries of Part 2 are designed to resemble the implicit lotteries faced by the players in the card games of Part 1. Prize π^A resembles the certain payoff that a player receives when he has the decision right, while prizes $\pi^{B,high}$ and $\pi^{B,low}$ resemble the payoffs that a player may receive when the other player has the decision right. As discussed later in Section 5, an expected-utility-maximizer Player 1 who chooses bid y^* in a card game of Part 1 should choose the safe Option A in the corresponding lottery-choice question of Part 2 (with $\pi^{B,high} = \pi_1^{high}$, $\pi^{B,low} = \pi_1^{low}$) if and only if $\pi^A \geq \pi^{B,high} - y^*$.

The questionnaire consists of 3 sets of 11 questions each. Each set is presented on a single computer screen. The values of $(\pi^{B,high}, \pi^{B,low})$ are varied across sets: (85,15) in the first set, (75,25) in the second set, and (65,35) in the third set. Within each set, as shown in Table 4, π^A takes values from 30 to 80 in steps of 5 points. If participants understand the instructions and prefer more money to less, the common pattern of behavior (for all but the most risk-averse and the most risk-seeking individuals) is to choose Option B for the first decision and to switch over to Option A at some point before the last decision.[22] The switch point is used as the measure of the participant's risk preferences. At the end of the session, one lottery-choice question is randomly selected. Each subject has his chosen option played out and is paid accordingly.

[21] Charness et al. (2013) reviews the prevailing methods for eliciting risk preferences and outlines the advantages and disadvantages of each. The methods proposed by Gneezy and Potters (1997) and by Eckel and Grossman (2002) require participants to make only one decision and are therefore simpler to implement than the Multiple Price List (MPL) method. However, these methods are not appropriate for our investigation because they cannot distinguish either between risk-seeking and risk-neutral preferences (Gneezy and Potters 1997) or between different degrees of risk-seeking behavior (Eckel and Grossman 2002).

[22] The reader could be concerned that a significant fraction of participants may fail to understand the MPL procedure because of its complexity, and thus make inconsistent decisions by switching more, making 'backward' choices (starting with Option A and switching to Option B), or choosing a dominated lottery. Out of 244 participants, 12 (6 with Player 1 role and 6 with Player 2 role) displayed such inconsistencies.

Finally, in Part 3, subjects complete a Locus of Control Test (Rotter 1966, Levenson 1981, Krampen 1981).[23] In personality psychology, locus of control refers to the extent to which an individual believes that he can control events that affect him. A person's locus is internal or external, depending on whether he believes that events in his life derive primarily from his own actions or from factors which he cannot influence. The test measures three separate scales. The Internal Scale (I-scale) measures the degree to which individuals believe that they control their lives. The Powerful Others External Scale (P-scale) measures the degree to which individuals believe that other persons control their lives. Finally, the Chance External Scale (C-scale) measures the degree to which individuals believe that chance controls their lives. There may be several reasons why attitudes toward locus of control may be related to attitudes toward freedom and interference. For example, subjects who believe that other individuals control their lives may be more freedom-seeking and/or more interference-averse. However, as reported in Appendix G, we do not find strong evidence that attitudes toward locus of control are systematically correlated with freedom and interference preferences.

At the end of the session, participants answer a socio-demographic questionnaire. All payoffs in the experiment are expressed in points. The conversion rate is €1 = 12 points. Participants earned, on average, €10.97 in Part 1 and €4.90 in Part 2. In addition, they received €2.50 for participation. Part 3 does not involve any payment.

5 Theoretical predictions

In this section we present the theoretical predictions for behavior at the bidding stage and at the choice stage in the card game described in Section 4. In doing so, we distinguish the predictions according to sequential equilibrium from the predictions according to psychological sequential equilibrium. Recall that we denote with $\mathbf{h}_b$ the information set at which Player 1 chooses his bid $y = s_{\mathbf{h}_b}$. We denote with $\mathbf{h}_{i,t}$ the information set at which Player i is of type $t \in T_i$ and chooses a card $s_{\mathbf{h}_{i,t}}$.

The sequential equilibrium predictions assuming $V_i(\theta) = EU_i(\theta)$ are straightforward if the utility function u_i is linear in payoffs. At information

[23] The questionnaire is reported in Appendix G.

set $\mathbf{h}_{i,t}$, Player i with the decision right selects the risk-neutral sequential equilibrium (RNSE) choice $s^{*RNSE}_{\mathbf{h}_{i,t}} = A \Leftrightarrow t = t^A_i$ and $s^{*RNSE}_{\mathbf{h}_{i,t}} = B \Leftrightarrow t = t^B_i$. Thus, he simply chooses whichever card gives him the greater payoff. In the bidding stage, it is optimal for Player 1 at $\mathbf{h}_b$ to bid his true valuation of the decision right. Player 1's expected payoff is π_1^{high} when he has the decision right and $(\pi_1^{high} + \pi_1^{low})/2$ when he does not have the decision right. Therefore, the optimal bid of a risk-neutral Player 1 is $y^{*RNSE} = (\pi_1^{high} - \pi_1^{low})/2$.

Allowing for risk aversion, while keeping $V_i(\theta) = EU_i(\theta)$, does not affect behavior in the choice stage: Player i with the decision right selects the sequential equilibrium (SE) choice $s^{*SE}_{\mathbf{h}_{i,t}} = A \Leftrightarrow t = t^A_i$ and $s^{*SE}_{\mathbf{h}_{i,t}} = B \Leftrightarrow t = t^B_i$. However, in the bidding stage, Player 1 is influenced by the fact that Box R involves the risky lottery $(\frac{1}{2}, \pi_1^{high}; \frac{1}{2}, \pi_1^{low})$ while Box L involves the safe lottery $(1, \pi_1^{high})$.[24] Therefore, the optimal bid y^{*SE} satisfies the following condition:

$$u_1(w_1 - y^{*SE} + \pi_1^{high}) = \frac{1}{2}u_1(w_1 + \pi_1^{high}) + \frac{1}{2}u_1(w_1 + \pi_1^{low}). \qquad (13)$$

Defining the certainty equivalent CE of the risky lottery as

$$CE\left(\frac{1}{2}, \pi_1^{high}; \frac{1}{2}, \pi_1^{low}\right) = c \quad \text{if} \quad u_1(c) = \frac{1}{2}u_1(\pi_1^{high}) + \frac{1}{2}u_1(\pi_1^{low}), \qquad (14)$$

we can rewrite Equation 13 in terms of the certainty equivalent as

$$w_1 - y^{*SE} + \pi_1^{high} = CE\left(\frac{1}{2}, w_1 + \pi_1^{high}; \frac{1}{2}, w_1 + \pi_1^{low}\right). \qquad (15)$$

We now come to the psychological sequential equilibrium predictions. To predict the behavior of a participant with procedural preferences, we need to determine freedom, power, and interference conditional on Player 1's bid y: the measures F_1, P_1, and I_1 introduced in Section 3. Before doing so, we must determine the functional form of $g(o, t)$ in Equations 7-9.

We consider two specifications. First and most simply, we set $g(o, t) = 1$, assuming that the value of freedom, interference, or power is independent of the outcome and the utility of the outcome. According to this specifi-

[24] $(\frac{1}{2}, \pi_1^{high}; \frac{1}{2}, \pi_1^{low})$ is the lottery yielding π_1^{high} with probability 0.5 and π_1^{low} with probability 0.5. $(1, \pi_1^{high})$ is the lottery yielding π_1^{high} with probability 1.

cation, we index the measures as F_1^c, I_1^c, and P_1^c. Second, we set $g(o,t) = \Delta\pi_i = \pi_i^{high} - \pi_i^{low}$. While the logarithmic terms in Equations 7-9 account for the probabilistic causal influence of types on outcomes, the distance in payoffs $\Delta\pi_i$ measures the qualitative effect on utility of such causal influence (Nehring and Puppe 2002).[25] For example, the decision between two outcomes yielding very similar payoffs may be seen as having a smaller qualitative effect than a decision between two outcomes yielding very different payoffs. Thus, freedom, power, and interference may become more important, as the alternative outcomes differ more in terms of the payoffs they yield. We must use $\Delta\pi_1$, the qualitative impact on Player 1's payoffs, for freedom and interference, and $\Delta\pi_2$, the qualitative impact on Player 2's payoffs, for power. According to this specification, we index the measures as F_1^d, I_1^d, and P_1^d.

Decisions in the choice stage are unaffected by procedural preferences. Since a Player i with the decision right knows at information set $\mathbf{h}_{i,t}$ his type t and the outcome o resulting from each action $s_{\mathbf{h}_{i,t}}$, we have $\theta_{i,\mathbf{h}_{i,t},s_{\mathbf{h}_{i,t}}}(o \cap t) = 1$, so the causal influence measures $\log_2 \frac{\theta_{i,\mathbf{h}_{i,t},s_{\mathbf{h}_{i,t}}}(o|t)}{\theta_{i,\mathbf{h}_{i,t},s_{\mathbf{h}_{i,t}}}(o)}$ are equal to zero. This is intuitive: while the individual has control over the outcome at the moment of making the decision, he does not have such control anymore after the decision is made. Since terminal histories do not involve any freedom, power, or interference, the choice over terminal histories is therefore unaffected by procedural preferences. Thus, an individual i with procedural preferences in Equations 10-12 chooses according to the psychological sequential equilibrium $s^*_{\mathbf{h}_{i,t}} = A \Leftrightarrow t = t_i^A$ and $s^*_{\mathbf{h}_{i,t}} = B \Leftrightarrow t = t_i^B$, just as in the sequential equilibrium. In the bidding stage, instead, Player 1's bid is affected by procedural preferences. Derivations of all measures (F_1^c, F^d, I_1^c, I_1^d, P_1^c, P_1^d) for Treatments 1, 2, and 3 are given in Appendix A, and a summary is presented in Table 5.[26]

As an example, let us analyze the decision problem in Treatment 1 of a Player 1 with freedom preferences under the F^c specification. Intuitively, freedom under this specification is equal to the probability of having the

[25] It can be shown that, if an individual has full control over his outcomes, the freedom measure is equal to the qualitative and quantitative diversity over which the individual has control, as measured in Nehring and Puppe (2009). Similar convergence results hold for the power and interference measures.

[26] Since games Γ^p differ from games Γ^{np} only because of a positive payoff difference for Player 2, $\Delta\pi_2 = \pi_2^{high,L} - \pi_2^{low,L}$, we consider only the specification P^d for power.

Game	Specification	Measure
Γ_1, Γ_2	F^c	$\frac{y}{100}$
Γ_3	F^c	0
Γ_1, Γ_2	F^d	$\frac{y}{100}\left(\pi_1^{high} - \pi_1^{low}\right)$
Γ_3	F^d	0
Γ_1, Γ_2, Γ_3	I^c	$\frac{100-y}{100}$
Γ_1, Γ_2, Γ_3	I^d	$\frac{100-y}{100}\left(\pi_1^{high} - \pi_1^{low}\right)$
Γ_1^p, Γ_2^p	P^d	$\frac{y}{100}\left(\pi_2^{high} - \pi_2^{low}\right)$
Γ_1^{np}, Γ_2^{np}, Γ_3	P^d	0

Table 5: Measures of freedom, power, and interference as a function of Player 1's bid y, Player 1's payoffs π_1^{high} and π_1^{low}, and Player 2's payoffs π_2^{high} and π_2^{low}

decision right. This is because, if Player 1 has the decision right, then

$$\begin{aligned} g(o_1(r,1,A),t_1^A)\log_2\frac{\theta(o_1(r,1,A)|t_1^A)}{\theta(o_1(r,1,A))} \\ &= g(o_1(r,1,B),t_1^B)\log_2\frac{\theta(o_1(r,1,B)|t_1^B)}{\theta(o_1(r,1,B))} \\ &= \log_2\frac{1}{1/2} = 1. \end{aligned} \tag{16}$$

If Player 1 does not have the decision right, then $g(o,t)\log_2\frac{\theta(o|t)}{\theta(t)} = 0\ \forall o,t$. Thus, a Player 1 with freedom preferences chooses his bid to solve

$$\max_{y\in S_{\mathbf{h}_b}} V_1(\theta_{i,\mathbf{h}_b,y}) = \max_y \alpha_1\frac{y}{100} + EU_1(\theta_{i,\mathbf{h}_b,y}). \tag{17}$$

The optimal bid condition then becomes

$$\alpha_1 + u_1(w_1 - y^{*F} + \pi_1^{high}) = \frac{1}{2}u_1(w_1 + \pi_1^{high}) + \frac{1}{2}u_1(w_1 + \pi_1^{low}). \tag{18}$$

In Equation 18, compared to Equation 13, the psychological payoff generated by having the decision right is increased by a constant α_1. In Treatment 3, instead, in which by design Card C is the outcome of the game if Player 1 has the decision right, it would be $g(C,t)\log_2\frac{\theta(C|t)}{\theta(C)} = g(C,t)\log_2(1) = 0$ for all t, so there is no gain in freedom from having the decision right.

6 Empirical strategy

Equation 18 gives an especially simple way of measuring Player 1's freedom preferences in a game of Treatment 1. The parameter α_1 can be inferred from a regression of the difference in estimated expected utilities from Box L and Box R, $\Delta EU_1 = u_1(w_1 - y + \pi_1^{high}) - \frac{1}{2}u_1(w_1 + \pi_1^{high}) - \frac{1}{2}u_1(w_1 + \pi_1^{low})$, on a constant.[27] A similar approach can be also applied to measure Player 1's power and interference preferences. For simplicity, since we consider only Player 1's behavior, we drop the subscript 1. For each subject k playing as Player 1, we consider three alternative estimation equations:

$$\Delta EU_{k,m} = -\alpha_k \Delta F_{k,m} + \epsilon_{k,m} \tag{19}$$

$$\Delta EU_{k,m} = -\beta_k \Delta I_{k,m} + \epsilon_{k,m} \tag{20}$$

$$\Delta EU_{k,m} = -\gamma_k \Delta P_{k,m} + \epsilon_{k,m} \tag{21}$$

where k stands for the subject, m for the round of play, and $\Delta F_{k,m}$ ($\Delta I_{k,m}$, $\Delta P_{k,m}$) is the difference in freedom (interference, power) between having the decision right and not having the decision right. Notice that overbidding for the decision right, i.e., bidding more than what predicted by expected utility maximization, translates into $\Delta EU < 0$. Since holding the decision right can increase freedom ($\Delta F > 0$), decrease interference ($\Delta I < 0$), or increase power ($\Delta P > 0$), overbidding can be driven by a liking for freedom ($\alpha > 0$), an aversion to interference ($\beta < 0$), or a liking for power ($\gamma > 0$).

Table 6 gives an overview of the empirical implementation of the freedom, interference, and power measures. As discussed above, in Treatment 1, the freedom measure F^c corresponds to a constant. The same holds in Treatment 2. In Treatment 3, instead, freedom is excluded by design.[28] Therefore, estimating freedom preferences under the specification F^c corresponds to running a regression on a dummy variable that equals 1 in Treatments 1 and 2 and 0 in Treatment 3, denoted $1_{[\Gamma_1,\Gamma_2]}$. Under the specification F^d, the dummy is interacted with the payoff distance $\Delta\pi_1 = \pi_1^{high} - \pi_1^{low}$.

[27]The estimated utility from Box L in ΔEU_1 is computed setting $r = y$.

[28]In Treatment 3, Box L contains only 1 card, so even if his bid is successful, Player 1 does not select a card and thus has no freedom.

$$\begin{aligned}\Delta F^c =& 1_{[\Gamma_1,\Gamma_2]}\\ \Delta F^d =& 1_{[\Gamma_1,\Gamma_2]}\Delta\pi_1\\ \Delta I^c =& -1\\ \Delta I^d =& -\Delta\pi_1\\ \Delta P^d =& 1_{[\Gamma_1^p,\Gamma_2^p]}\Delta\pi_2\end{aligned}$$

Table 6: Empirical implementation of the freedom, interference, and power measures. $1_{[\Gamma,\Gamma']} = 1$ if game is Γ or Γ' and $= 0$ otherwise.

Unlike freedom, interference is present in all treatments.[29] Therefore, estimating interference preferences under the specification I^c corresponds to running a regression on a constant. The specification I^d takes into account the payoff distance $\Delta\pi_1$.

Power is present only in games Γ^p in Treatments 1 and 2, denoted Γ_1^p and Γ_2^p.[30] We focus on the specification P^d since games Γ^p differ from games Γ^{np} only because of a positive payoff distance for Player 2, $\Delta\pi_2 = \pi_2^{high,L} - \pi_2^{low,L}$. Thus, estimating power preferences under the specification P^d corresponds to running a regression on $\Delta\pi_2$ times a dummy variable that equals 1 in games Γ^p in Treatments 1 and 2 and 0 otherwise.

7 Results

7.1 Allocation and exercise of decision rights

Before turning to the results obtained via the empirical strategy described in the previous section, we briefly present descriptive results on the bids submitted by Players 1, and on the card selections made by the players with the decision right (Players 1 or 2).

First, we inspect whether bids differ across treatments. Table 12 in Appendix C reports the median bids for each treatment and each round. For

[29] In Treatment 3, Player 2 affects the outcomes of Player 1 if the bid is not successful; therefore, a successful bid protects Player 1 from interference.

[30] In Treatment 3, Box L contains only 1 card, so even if his bid is successful, Player 1 does not select a card and thus has no power over Player 2. In games Γ^{np} in Treatments 1 and 2, Player 2's payoffs in box L are equal, $\pi_2^{high,L} = \pi_2^{low,L}$, so Player 1 has no power over Player 2. In games Γ^p in Treatments 1 and 2, in contrast, Player 2's payoffs in box L differ, $\pi_2^{high,L} > \pi_2^{low,L}$, so Player 1 has power over Player 2.

most rounds, bids in Treatment 3, in which having the decision right protects Player 1 from interference, are significantly higher than in Treatment 1, in which the decision right additionally gives freedom (in games Γ^{np}) or power and freedom (in games Γ^{p}). At first sight, this finding may suggest a predominant freedom or power aversion in specific rounds. However, when aggregating across all rounds and accounting for individual risk preferences, as done in Section 7.3, we instead predominantly find evidence of interference aversion.

Second, we inspect whether bids in games that do not involve power differ from those in games that involve power. We perform a Wilcoxon signed rank sum test on observations paired at the participant level. We make pair-wise comparisons across rounds in which each Player 1 faces the same pair of values of π_1^{high} and π_1^{low}.[31] We perform the test separately for Treatment 1 and Treatment 2.[32] We do not find statistically significant differences in bidding. This result suggests that considerations regarding power may be less relevant than considerations regarding freedom and interference. We further investigate this aspect in Section 7.3.

Once the decision right is allocated, the player with the decision right selects a card. Recall from Section 4 that, if Player 1 has the decision right, he chooses a card from Box L, knowing which card gives him the highest payoff. Similarly, if Player 2 has the decision right, he chooses a card from Box R, knowing which card gives him the highest payoff. Pooling all data together, we find that, as Table 13 in Appendix C shows, in more than 98 percent of the observations, the decision right is exercised by selecting the card that gives the decision-maker his highest payoff.

7.2 Certainty equivalents

We now turn to analyze whether individuals value decision rights intrinsically, i.e., whether their bids are higher than expected-utility-maximizing bids. Ex ante, it is not clear whether such behavior would occur, since, compared to Fehr et al. (2013) and Bartling et al. (2014), which report evidence

[31]We compare the following pairs of rounds: 2 and 18, 4 and 16, 5 and 12, 6 and 17, 8 and 19, and 10 and 20.

[32]We perform these pair-wise tests for participants in Treatments 1 and 2 only. In Treatment 3, as highlighted in Section 4.2, all rounds involve interference but do not involve either freedom or power. Therefore, distinguishing between Γ^{np} and Γ^{p} games in Treatment 3 is not meaningful.

of intrinsic valuation of decision rights in a principal-agent setting, the game structure is simpler and the expected-utility-maximizing strategies easier to find.

To verify whether Players 1 behave according to expected utility maximization, we compare the certainty equivalent in each lottery-choice in Part 2, $CE_{lottery}(L)$ with $L = (\frac{1}{2}, \pi_1^{high}; \frac{1}{2}, \pi_1^{low})$, to the certainty equivalent implied by the bid in the corresponding card game in Part 1 (i.e., involving the same π_1^{high} and π_1^{low}):

$$\pi_1^{high} - y = CE\left(\frac{1}{2}, \pi_1^{high}; \frac{1}{2}, \pi_1^{low}\right). \tag{22}$$

Denote ΔCE as

$$\Delta CE = \pi_1^{high} - y - CE_{lottery}\left(\frac{1}{2}, \pi_1^{high}; \frac{1}{2}, \pi_1^{low}\right). \tag{23}$$

Overbidding occurs if ΔCE is negative: the subject exhibits more risk aversion in the bidding choice than in the lottery choice. Underbidding occurs if ΔCE is positive: the subject exhibits more risk aversion in the lottery choice than in the bidding choice.[33]

If the only error in ΔCE is due to the imprecise measurement of the certainty equivalent (which is measured at intervals of 5 payoff units), we should expect ΔCE to be distributed uniformly with mean 0 and standard deviation $(25/12)^{1/2} \approx 1.44$. We find instead that the mean is too low (-14.11) and the standard deviation is too high (25.41).[34] Both deviations are significant at the 1% level. We therefore reject the hypothesis of expected-utility-maximizing behavior.

[33] We are aware of a caveat. When subjects answered the lottery-choice questionnaire in Part 2, they already knew their endowment in Part 1 (w_1), but they did not know their earnings in Part 1 yet. Therefore, if there are significant income effects on risk aversion, we cannot expect Equation 15 to be identical to Equation 22. However, previous experimental evidence suggests that income/wealth effects do not cause a statistically significant change in certainty equivalents in risk-preferences elicitation, either within a Becker-DeGroot-Marschak (1964) method (Kachelmeier and Shehata 1992) or within the Holt and Laury (2002) Multiple Price List method (Laury 2012).

[34] The empirical distribution of ΔCE over 1132 observations has mean -14.11, median -12.50, 25% percentile -27.5, 75% percentile 2.5, and standard deviation 25.41.

7.3 Freedom, power, and interference preferences

In Section 7.2 we established that in the card game Players 1 on average overbid with respect to the risk aversion revealed in the lottery-choice questionnaire. We now turn to investigate *(1)* whether overbidding can be explained by a model of psychological payoff maximization which captures procedural preferences, and if so, *(2)* whether overbidding is mostly driven by a liking for freedom, an aversion to interference, or a liking for power, and *(3)* whether the predominant procedural preferences generate an economically sizable overbidding.

Among the variables defined in Section 6, $\Delta EU_{k,m}$ requires knowledge of an individual's utility function over payoffs, $u_k(\pi)$. We approximate $u_k(\pi)$ by a CRRA utility function $u_{k,CRRA}(\pi) = \frac{\pi^{1-\rho_k}-1}{1-\rho_k}$. The results are reported in Appendix D. As a robustness check, we also approximate $u_k(\pi)$ by a CARA utility function $u_{k,CARA}(\pi) = 1 - \frac{e^{-r_k \pi}}{r_k}$ and estimate the corresponding CARA parameter $r_{k,MPL}$.

We consider two classes of models: maximization of expected utility EU (i.e., excluding procedural preferences) and maximization of the psychological payoff function V (i.e., including procedural preferences). Specifically, we consider the following alternative models: (1) expected utility maximization, with risk aversion coefficients $\hat{\rho}_{MPL}$ estimated using choice-lottery data, (2) expected utility maximization, with a risk aversion coefficient $\hat{\rho}_{bid}$ estimated using bidding data), (3) expected payoff maximization, i.e., expected utility maximization under risk neutrality, (4) psychological payoff maximization driven by freedom preferences, (5) psychological payoff maximization driven by interference preferences, (6) psychological payoff maximization driven by power preferences. In models 4-6 we consider the constant and the proportional specifications introduced in Section 6 and we employ, as in model 1, the risk aversion coefficients estimated via the choice-lottery data.

Estimation is conducted via nonlinear least squares under the assumption of a CRRA utility function.[35] As a criterium for model selection, we employ both the residual sum of squares (RSS) and the Bayesian information criterion (BIC).[36] Table 7 reports the results. We find that the behavior

[35] For the analysis of procedural preferences, we exclude one individual which had no variation in the bids ($y = 0$).

[36] The BIC requires the specification of the number of parameters and data points. There are two possibilities: We can either treat the lottery questionnaire and the bidding data as one dataset with 23 observations or focus on the bidding data and treat $\hat{\rho}_{MPL}$ as

of the majority of participants is best explained by a model of psychological payoff maximization driven by interference preferences (according to BIC, between 56% and 77.2%) and that the behavior of the second-largest fraction of participants is best explained by expected utility maximization (according to BIC, between 22.8% and 39.2%). Moreover, we find only weak evidence of freedom or power preferences. These findings hold across alternative treatments, specifications and selection criteria. Inspecting closely Table 7, it is important to notice that in Treatments 1 and 2 the effect of freedom and interference preferences on bidding is not separately identifiable. For this reason, if an individual's behavior is best explained by freedom preferences, then it is also best explained by interference preferences. In Treatment 3, instead, the effect of interference preferences on bidding is separately identifiable: freedom and power preferences do not play a role since the decision right by design only affects interference.

Model	risk aversion	specification	Treatments 1 and 2 84 subjects % RSS	 % BIC	Treatment 3 22 subjects % RSS	 % BIC
Expected utility (*excl.* procedural preferences)						
	$\hat{\rho}_{MPL}$		0.0	5.9	0.0	13.6
	$\hat{\rho}_{bid}$		35.7	25	9.1	4.6
	0		(3.6)	8.3	(0.0)	4.6
Psychological payoff (*incl.* procedural preferences)						
Freedom or Interference	$\hat{\rho}_{MPL}$	*constant*	26.2	27.4		
		proportional	29.8	28.6		
Interference	$\hat{\rho}_{MPL}$	*constant*			59.1	54.5
		proportional			31.8	22.7
Power	$\hat{\rho}_{MPL}$	*proportional*	8.3	4.8		

Table 7: Percentage of experiment participants whose bidding behavior is best explained by each model, under the assumption of a CRRA utility function. Note that, if the RSS criterion is maximized by the model 'expected utility maximization' with risk aversion $\rho = 0$, it is also maximized by the model 'expected utility maximization' with risk aversion $\rho = \hat{\rho}_{bid}$. For this reason, the corresponding values are reported in parenthesis.

In order to provide further support to our claim that most participants' behavior is driven by interference preferences as opposed to freedom preferences, we compare bidding behavior in Treatments 1 and 2, in which the

part of the data with which we explain the lottery choices. We choose the latter for two reasons: first, it simplifies estimation and second, it is relatively conservative in the sense that it favors expected utility maximization according to $\hat{\rho}_{bid}$.

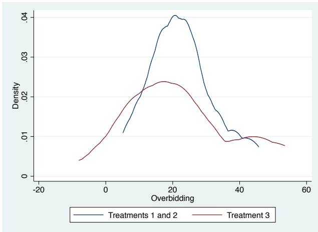
decision right affects both interference and freedom, to bidding behavior in Treatment 3, in which the decision right affects only interference. In order to highlight the monetary size of the effect of procedural preferences, we compute a measure of overbidding, defined as the difference between the bid predicted by Model 5 (psychological payoff maximization driven by interference preferences) and the bid predicted by Model 1 (expected utility maximization with risk aversion coefficients $\hat{\rho}_{MPL}$). The existence of a strong preference for freedom would translate into a higher overbidding in Treatments 1 and 2 compared to Treatment 3. Figure 3 reports the density function of the overbidding across individuals.[37] Density functions are reported across two subsamples (individuals best explained by interference preferences or all individuals) and under two specifications of interference (constant or proportional). A visual inspection of Figure 3 suggests that our subject pool is not characterized by a strong preference for freedom. In order to assess whether the difference in overbidding is statistically significant, we run a simple linear regression in which overbidding is regressed over a constant and a dummy variable which equals 1 in Treatment 3 and 0 otherwise.[38] Table 8 shows that overbidding in Treatment 3 is not statistically different from overbidding in Treatments 1 and 2. Therefore, the monetary effect of freedom preferences is not statistically significant. Since treatment assignment is random, we interpret this result as evidence that also in Treatments 1 and 2 individual's behavior is driven by interference preferences.

The collection of results reported above is evidence that most experiment participants value decision rights according to procedural preferences and do so driven by interference aversion. We now turn to ask whether interference preferences are economically meaningful. Table 9 reports the mean overbidding across all participants for each of the 20 rounds. Across rounds the mean overbidding value is sizable, corresponding to approximately 20% of the stake size.

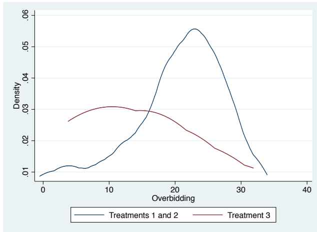
We conclude this section by highlighting results from a series of robustness checks. In Appendix E, we show that our results are robust to a change in the functional form of the utility function from CRRA to CARA. In Ap-

[37]Figure 3 and Table 8 use data from round 5. Results are analogous in other rounds.

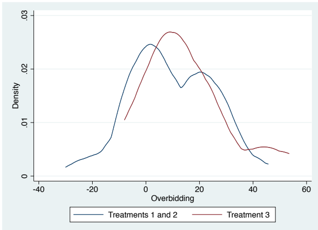
[38]The regression is performed using the same subsamples and specifications used in Figure 3.



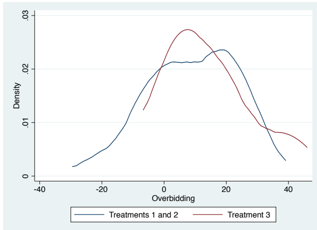
(a) Individuals best explained by interference preferences. Specification 'constant'.



(b) Individuals best explained by interference preferences. Specification 'proportional to payoff difference'.



(c) All individuals. Specification 'constant'.



(d) All individuals. Specification 'proportional to payoff difference'.

Figure 3: Overbidding, defined as the difference between the bid predicted by Model 5 and the bid predicted by Model 1. Density functions across different subsamples and under different specifications with Epanechnikov kernel and bandwidth 8. Data is from round 5, in which Player 1 faces a stake size of 50 and an expected payoff of 50 ($\pi_1^{high} = 75$ and $\pi_1^{low} = 25$).

specification of 'interference' to define:		regressors		obs
dependent variable	subsample	Treatment 3 dummy	constant	
constant	*constant*	0.15	22.77***	35
		(5.61)	(2.14)	
proportional	*proportional*	-4.69	19.43***	29
		(4.84)	(1.80)	
constant	*constant or proportional*	-0.30	19.21***	64
		(4.37)	(1.71)	
proportional	*constant or proportional*	-1.50	19.03***	64
		(3.63)	(1.30)	

Table 8: Linear regression. The dependent variable is overbidding, defined as the difference between the bid predicted by Model 5 and the bid predicted by Model 1. Data is from round 5, in which Player 1 faces a stake size of 50 and an expected payoff of 50 ($\pi_1^{high} = 75$ and $\pi_1^{low} = 25$). Standard errors are given in parentheses. *, **, *** indicate significant at the 5%, 1% and 0.1% levels, respectively.

pendix F we explore the role of inequity aversion. While we find weak evidence of aversion to advantageous inequity, we confirm that the main

round	stake	constant specification			proportional specification		
round	size	mean	% of stake	sd	mean	% of stake	sd
1	70	10.80	15	16.97	13.47	19	21.81
2	50	10.84	22	17.11	9.81	20	15.86
3	30	11.38	38	16.16	6.03	20	9.63
4	70	10.75	15	15.61	13.95	20	20.14
5	50	10.70	21	15.91	10.03	20	14.73
6	30	11.00	37	15.45	6.09	20	8.99
7	70	10.57	15	14.64	14.36	21	19.28
8	50	10.57	21	14.85	10.29	21	13.92
9	30	10.73	36	14.66	6.21	21	8.43
10	100	10.65	11	14.83	17.97	18	24.96
11	50	10.70	21	15.91	10.03	20	14.73
12	50	10.70	21	15.91	10.03	20	14.73
13	50	10.70	21	15.91	10.03	20	14.73
14	50	10.70	21	15.91	10.03	20	14.73
15	50	10.70	21	15.91	10.03	20	14.73
16	70	10.75	15	15.61	13.95	20	20.14
17	30	11.00	37	15.45	6.09	20	8.99
18	50	10.84	22	17.11	9.81	20	15.86
19	50	10.57	21	14.85	10.29	21	13.92
20	100	10.65	11	14.83	17.97	18	24.96
all	50	10.76	22	15.63	10.82	20	16.75

Table 9: Overbidding in each round, as a percentage of the stake size $\pi_1^{high} - \pi_1^{low}$. Distribution across all participants. Overbidding is defined as the difference between the bid predicted by Model 5 and the bid predicted by Model 1.

driver for overbidding is interference aversion. In Appendix G, we examine the correlation between overbidding and locus of control. Out of the six correlations we measure (using three locus of control scales and two specifications of interference), we find only one to be statistically significant. Thus, overbidding due to interference aversion cannot be fully explained by locus of control.[39] Finally, we inspect whether demographic characteristics such as gender and age are correlated with overbidding due to interference aversion. We do not find statistically significant differences.[40,41] To sum up,

[39]Owens et al. (2014) find little evidence of correlation between the willingness-to-pay for control and the Desirability of Control index (Burger and Cooper 1979), which measures individual preferences for control under several facets: the desire to make decisions for oneself, the desire to take leadership roles, the desire to avoid situations where others are in control, and the desire to plan or prepare to maintain control over future situations.

[40]Details are available upon requests.

[41]Ertac et al. (2016) studies experimentally the willingness to pay to make decisions for oneself or on behalf of others. According to their terminology, a positive willingness to pay to make one's own decision is interpreted it as demand for autonomy and a positive willingness to pay to make a decision on behalf of another person is interpreted it as a demand for responsibility. Their definition of autonomy relates to our definition of freedom and interference, while their definition of responsibility relates to our definition of power. They find that the demand for autonomy is significantly positive, the demand for responsibility is also significantly positive but lower than that for autonomy, and the

interference aversion is not clearly correlated to personality traits such as locus of control and demographic characteristics such as gender and age. Therefore, our experimental design captures the behavioral effect of individual preferences that would not be captured otherwise.

7.4 Discussion

In this section we discuss how results presented above relate to the experimental design. First, the weak evidence of power preferences may be driven partly by the experimental setting, in which each player is informed about his own type but is never informed about the other player's type. While this design feature allows us to avoid thorny confounds with social preferences, we are aware that a Player 1 with a liking for power may not find the exercise of power over Player 2 particularly satisfying because he does not know how he can influence Player 2. However, the effect of interference in our setting is similarly large as the effect found by Fehr et al. (2013), where Player 1 knows the payoff impact of his choice on Player 2. Therefore, it seems unlikely that relaxing this information constraint would strongly affect the bidding behavior in our setting. We consider relaxing such information constraint an interesting direction for further research.

Second, interference is present in all treatments. Therefore, it is only identified via the difference in behavior between the card game (Part 1) and the lottery-choice questionnaire (Part 2). Possibly, the coefficient of interference preferences captures not only the effect of interference itself but also the effects of all other factors which differ between Part 1 and Part 2. The same limitation is present in Fehr et al. (2013) and Bartling et al. (2014). However, given that the existence of intrinsic valuation is reported in both our bidding game and their delegation games, it seems implausible that the effect of interference preferences in our experiment is an artifact of the game structure.

Third, some readers may perceive interference aversion as driven by ambiguity aversion. If Player 1 believes that Player 2, when he has the decision right, will not necessarily choose the option in his best interest, then Player

willingness to pay for autonomy and responsibility is lower among women. Our results are consistent with theirs in that we find significant and strong interference aversion. Our results differ from theirs in that we do not find a clear correlation between interference aversion and gender.

1 perceives strategic uncertainty with respect to the types of Player 2. However, our data does not to support this conjecture. Almost all participants choose the card providing them the highest payoff. Behaving in such way when he has the decision right, Player 1 is unlikely to believe that Player 2 will behave differently when she has the decision right.[42] Thus, to fully explain the extent of interference aversion, we would need to posit either very strong ambiguity aversion or beliefs about other players that are too far from the actual behavior to be plausible.[43]

Lastly, the reader may be concerned that interference aversion is driven by regret aversion.[44] In the card game Player 1 perceives regret if he does not hold the decision right and receives a low payoff as a consequence of Player 2's action. In the lottery-choice questionnaire Player 1 perceives regret if he chose the risky lottery and received the low payoff. We argue that regret aversion cannot explain our results. Regret theory does not distinguish between regret experienced as a consequence of Nature's action and regret experienced as a consequence of another player's action. Thus, Player 1's regret aversion should be similar in the card game and in the lottery-choice questionnaire.

8 Conclusions

This paper proposes a general theoretical model of decision rights allocation and choice, formulated in the context of a dynamic psychological game. In our model individuals value decision rights not only according to the value

[42]Experimental evidence from previous works suggests that participants in our experiment not only choose the option in their best interest but also believe that other participants do the same. Iriberri and Rey-Biel (2013) find that selfish individuals, i.e., individuals who always choose the self-payoff maximizing choice, 'systematically state that they believe other individuals take selfish actions, while other preferences types are more aware of the existent heterogeneity in actions'.

[43]Owens et al. (2014) considers ambiguity aversion as a factor potentially driving the control premium they document. They find mixed results as to whether reducing ambiguity reduces the control premium.

[44]Sjöström et al. (2016) studies experimentally how autonomy influences effort. They define autonomy as the right to choose an alternative (a project) from a given feasible set (a menu). They find a significant pure motivation effect: autonomy has a significant positive effect on effort. Moreover, such effect is found to be consistent with aversion to anticipated regret, but not with standard expected-utility maximization. Their experiment differs from ours in that there is no strategic interaction and decision rights are exogenously assigned. Thus, their experimental design cannot identify an intrinsic valuation of decision rights.

of the outcomes, but also according to the procedure by which the outcomes are achieved. Specifically, individuals care about the cause of the outcomes. To describe such procedural motivations, our model introduces freedom, power, and interference.

We implement our theoretical model in a laboratory experiment which involves the allocation of a decision right via an auction mechanism and the subsequent exercise of the decision right. The experimental design allows to separately measure freedom, power, and interference preferences. We find that participants' behavior is best explained by interference aversion. This result suggests that most experiment participants value decision rights neither because they enjoy the freedom of making a choice, nor because they like having power over other individuals, but rather because they dislike letting other individuals interfere in their outcomes.

Our theoretical framework and experimental findings contribute to unify the existing disparate results in the experimental literature on the delegation of decision rights, social risk, and control premium. According to our framework, the reluctance to delegate a decision right, the social risk premium required to trust another person, and the control premium foregone to maintain payoff autonomy can all be interpreted as driven by interference aversion.

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Appendices For Online Publication

A Derivation of the measures of freedom, power, and interference

In this appendix we present the derivation of the measures of freedom F_1, interference I_1, and power P_1 for each treatment, which allows to construct Table 5 in Section 5.

The freedom measure F_1 at information set $\mathbf{h}_b$ given bid y under Treatment 1 (Γ_1) for a general function g is:

$$F_1(\theta_{1,\mathbf{h}_b,y}) =$$
$$\sum_{r\leq y}\sum_{t\in T_1}\sum_{c\in\{A,B\}} g(o(r,1,c),t)\theta_{1,\mathbf{h}_b,y}(o(r,1,c)\cap t)\log_2\frac{\theta_{1,\mathbf{h}_b,y}(o(r,1,c)|t)}{\theta_{1,\mathbf{h}_b,y}(o(r,1,c))}+$$
$$+\sum_{r>y}\sum_{t\in T_1}\sum_{c\in\{A,B\}} g(o(r,2,c),t)\theta_{1,\mathbf{h}_b,y}(o(r,2,c)\cap t)\log_2\frac{\theta_{1,\mathbf{h}_b,y}(o(r,2,c)|t)}{\theta_{1,\mathbf{h}_b,y}(o(r,2,c))}, \tag{24}$$

where we use the fact that $\sum_{o\in O_i} f(o) = \sum_{r=1}^{100}\sum_{i\in\{1,2\}}\sum_{c\in\{A,B\}} f(o(r,i,c))$ for any function $f(o)$ and that $y \geq r$ implies $\theta_{1,\mathbf{h}_b,y}(o(r,2,c)) = 0$. Moreover, $\theta_{1,\mathbf{h}_b,y}(o(r,2,c)|t) = \theta_{1,\mathbf{h}_b,y}(o(r,2,c))$ since if Player 2 has the decision right, the outcome is independent of Player 1's type. Since $\log_2 1 = 0$, the measure simplifies to:

$$F_1(\theta_{1,\mathbf{h}_b,y}) =$$
$$\sum_{r\leq y}\sum_{t\in T_1}\sum_{c\in\{A,B\}} g(o(r,1,c),t)\theta_{1,\mathbf{h}_b,y}(o(r,1,c)\cap t)\log_2\frac{\theta_{1,\mathbf{h}_b,y}(o(r,1,c)|t)}{\theta_{1,\mathbf{h}_b,y}(o(r,1,c))}. \tag{25}$$

The remaining probabilities are as follows:

$$\begin{aligned}
\forall t\in T_1:&\quad \theta_{1,\mathbf{h}_b,y}(t) = 1/2\\
\forall t\in T_1:\forall r\leq y:&\quad \theta_{1,\mathbf{h}_b,y}(o(r,1,A)|t) = \begin{cases}\frac{1}{100}, & t=t_1^A\\ 0, & \text{else}\end{cases}\\
\forall t\in T_1:\forall r\leq y:&\quad \theta_{1,\mathbf{h}_b,y}(o(r,1,B)|t) = \begin{cases}\frac{1}{100}, & t=t_1^B\\ 0, & \text{else}\end{cases}\\
\forall r\leq y:&\quad \theta_{1,\mathbf{h}_b,y}(o(r,1,A)) = 1/200\\
\forall r\leq y:&\quad \theta_{1,\mathbf{h}_b,y}(o(r,1,B)) = 1/200.
\end{aligned} \tag{26}$$

The freedom measure therefore simplifies to:

$$F_1(\theta_{1,\mathbf{h}_b,y}) = \frac{1}{200}\sum_{r\leq y}(g(o(r,1,A),t_1^A) + g(o(r,1,B),t_1^B)). \tag{27}$$

Since Treatment 2 differs from Treatment 1 only in that Player 2's endowment w_2 equals 0 instead of 100, it follows that freedom in both treatments is equal. For Treatment

3 (Γ_3), instead:

$$
\begin{aligned}
&F_1(\theta_{1,\mathbf{h}_b,y}) = \\
&\sum_{r\leq y}\sum_{t\in T_1}\sum_{c\in\{C\}} g(o(r,1,c),t)\theta_{1,\mathbf{h}_b,y}(o(r,1,c)\cap t)\log_2\frac{\theta_{1,\mathbf{h}_b,y}(o(r,1,c)|t)}{\theta_{1,\mathbf{h}_b,y}(o(r,1,c))} \\
&+\sum_{r>y}\sum_{t\in T_1}\sum_{c\in\{A,B\}} g(o(r,2,c),t)\theta_{1,\mathbf{h}_b,y}(o(r,2,c)\cap t)\log_2\frac{\theta_{1,\mathbf{h}_b,y}(o(r,2,c)|t)}{\theta_{1,\mathbf{h}_b,y}(o(r,2,c))}. \qquad (28)
\end{aligned}
$$

As in (24), $\theta_{1,\mathbf{h}_b,y}(o(r,2,c)|t) = \theta_{1,\mathbf{h}_b,y}(o(r,2,c))$: if Player 2 has the decision right, the outcome is independent of Player 1's type. In addition, $\theta_{1,\mathbf{h}_b,y}(o(r,1,C)|t) = \theta_{1,\mathbf{h}_b,y}(o(r,1,C))$: if Player 1 has the decision right, then only Card C is available, so the outcome is independent of Player 1's type. Since $\ln_2 1 = 0$, the measure equals $F_1(\theta_{1,\mathbf{h}_b,y}) = 0$. This concludes the derivations for freedom F.

The power measure P_1 is largely analogous to F_1. In games Γ^p in Treatments 1 and 2, it simplifies to:

$$
P_1(\theta_{1,\mathbf{h}_b,y}) = \frac{1}{200}\sum_{r\leq y}(g(o(r,1,A),t_1^A) + g(o(r,1,B),t_1^B)), \qquad (29)
$$

and in games Γ^{np} in Treatments 1 and 2, and well as in Treatment 3, $P_1(\theta_{1,\mathbf{h}_b,y}) = 0$.

The interference measure I_1 for a general function g is:

$$
\begin{aligned}
&I_1(\theta_{1,\mathbf{h}_b,y}) = \\
&\sum_{r\leq y}\sum_{t\in T_2}\sum_{c\in\{A,B\}} g(o(r,1,c),t)\theta_{1,\mathbf{h}_b,y}(o(r,1,c)\cap t)\log_2\frac{\theta_{1,\mathbf{h}_b,y}(o(r,1,c)|t)}{\theta_{1,\mathbf{h}_b,y}(o(r,1,c))} \\
&+\sum_{r>y}\sum_{t\in T_2}\sum_{c\in\{A,B\}} g(o(r,2,c),t)\theta_{1,\mathbf{h}_b,y}(o(r,2,c)\cap t)\log_2\frac{\theta_{1,\mathbf{h}_b,y}(o(r,2,c)|t)}{\theta_{1,\mathbf{h}_b,y}(o(r,2,c))}. \qquad (30)
\end{aligned}
$$

In all treatments, $\theta_{1,\mathbf{h}_b,y}(o(r,1,c)|t) = \theta_{1,\mathbf{h}_b,y}(o(r,1,c))$: if Player 1 has the decision right, the outcome is independent of Player 2's type.

Thus, I_1 can be written, for all treatments, as:

$$
\begin{aligned}
&I_1(\theta_{1,\mathbf{h}_b,y}) = \\
&\sum_{r>y}\sum_{t\in T_2}\sum_{c\in\{A,B\}} g(o(r,2,c),t)\theta_{1,\mathbf{h}_b,y}(o(r,2,c)\cap t)\log_2\frac{\theta_{1,\mathbf{h}_b,y}(o(r,2,c)|t)}{\theta_{1,\mathbf{h}_b,y}(o(r,2,c))}. \qquad (31)
\end{aligned}
$$

The remaining probabilities are as follows:

$$
\begin{aligned}
\forall t\in T_2: &\quad \theta_{1,\mathbf{h}_b,y}(t) = 1/2 \\
\forall t\in T_2: \forall r\leq y: &\quad \theta_{1,\mathbf{h}_b,y}(o(r,2,A)|t) = \begin{cases}\frac{1}{100}, & t = t_2^A \\ 0, & \text{else}\end{cases} \\
\forall t\in T_2: \forall r\leq y: &\quad \theta_{1,\mathbf{h}_b,y}(o(r,2,B)|t) = \begin{cases}\frac{1}{100}, & t = t_2^B \\ 0, & \text{else}\end{cases} \\
\forall r\leq y: &\quad \theta_{1,\mathbf{h}_b,y}(o(r,2,A)) = 1/50 \\
\forall r\leq y: &\quad \theta_{1,\mathbf{h}_b,y}(o(r,2,B)) = 1/50. \qquad (32)
\end{aligned}
$$

The interference measure therefore simplifies to:

$$I_1(\theta_{1,\mathbf{h}_b,y}) = \frac{1}{400} \sum_{r>y} \sum_{t \in T_2} (g(o(r,2,A),t) + g(o(r,2,B),t)). \tag{33}$$

Given the above results, Table 5 is obtained by substituting in Equations (27) and (33) the chosen specification of function $g(o,t)$, either $g = 1$ or $g = |\pi^{high} - \pi^{low}|$.

B Predictions for the authority-delegation game

In this section, we apply the theoretical framework presented in Section 3 to the authority-delegation game conducted by Fehr et al. (2013). In the authority-delegation game two matched participants, Player 1 and Player 2, play a game involving the selection of a card out of 36 available cards. The selected card has payoff consequences for both players. A randomization device (Nature) randomly determines the player's preferences over the 36 cards. One default card is known to give a fixed known payoff $\bar{\pi}$ to each player, but the preferences over the remaining 35 cards are unknown to both players at the beginning of the game. One of these cards gives a high payoff $\hat{\pi}_1$ to Player 1 and a lower payoff $\check{\pi}_2$ to Player 2. Another card gives a high payoff $\hat{\pi}_2$ to Player 2 and a lower payoff $\check{\pi}_1$ to Player 1. All other cards give an extremely low payoff $\not\pi$ to deter the player with the decision right to randomly choose a card. Payoffs for each Player i are ordered as follows: $\hat{\pi}_i > \check{\pi}_i > \bar{\pi} > \not\pi$.

In stage 1, Player 1 (the Principal) can choose to delegate or not the decision right to Player 2 (the Agent). In stage 2, both players can simultaneously invest effort (payoff) to raise the probability with which they are informed about their preferences over the 35 cards in the following stage. Let p_i be the probability that the player with the decision right observes his preferences and q_j be the probability that the player without the decision right observes his preferences. After players are informed about their preferences with the given probabilities (stage 4), the player without the decision right can make a suggestion to the other player (stage 5).[45] In the last stage (stage 6) the player with the decision right selects one of the cards as the outcome of the game. The outcomes for the players are then given by $O_1 = \{o_{1,0}, \ldots, o_{1,35}\}$ and $O_2 = \{o_{2,0}, \ldots, o_{2,35}\}$.

Let $T_1 = \{t_{1,1}, \ldots, t_{1,35}\}$ represent the possible types of the Principal where type $t_{1,k} \in T_1$ has a favorite card outcome $o_{1,k}$. Similarly, let $T_2 = \{t_{2,1}, \ldots, t_{2,35}\}$ represent the possible types of the Agent. In this example, players are assumed to be risk neutral and have identical freedom, power, and interference preferences.[46]

The game can be solved using backward induction. In stage 6 (card selection stage), behavior is not influenced by procedural preferences, since it is the last stage. If Player i (with the decision right) knows his type, he chooses the card giving payoff $\hat{\pi}_i$ to himself and $\check{\pi}_j$ to the other player. If he does not know his type, but the other player has made a suggestion, he follows the suggestion if he believes it is the card giving him payoff $\check{\pi}_i$ (in equilibrium, this is the case). In all other cases, Player i chooses the default card giving payoff $\bar{\pi}$.

In stage 5, strategies for Player j (without the decision right) are similarly simple since his recommendation is not influenced by procedural preferences. If Player j knows his type, he recommends the card giving payoff $\hat{\pi}_j$ to himself and $\check{\pi}_i$ to the other player. If he does not know his type, he recommends the card giving payoff $\bar{\pi}$.

In stage 4, Nature determines randomly whether the players observe their types. These observations happen with the probabilities determined in stage 2: p_i for the player with the decision right and q_j for the player without the decision right.

In stage 2 (effort decision), procedural preferences can influence behavior, and therefore sequential equilibrium and psychological sequential equilibrium predict different optimal efforts. The risk neutral sequential equilibrium (RNSE) predicts that the following optimal efforts will be chosen:

[45] In stage 3 beliefs are elicited.

[46] It has already been verified by Fehr et al. (2013) that the players' measured risk/loss aversion cannot explain the behavior in the game.

$$p_i^{*RNSE} = \arg\max_{p_i} p_i \hat{\pi}_i + (1-p_i)(q_j^{*RNSE} \breve{\pi}_i + (1-q_j^{*RNSE})\bar{\pi}) - c(p_i) \tag{34}$$

$$q_j^{*RNSE} = \arg\max_{q_j} p_i^{*SE} \breve{\pi}_j + (1-p_i^{*RNSE})(q_j \hat{\pi}_i + (1-q_j)\bar{\pi}) - c(q_j). \tag{35}$$

In the psychological sequential equilibrium (PSE), instead, to determine efforts we need to measure the freedom, power, and interference that would be achieved after effort has been invested. Let $\mathbf{h}_{i,D}$ ($\mathbf{h}_{j,D}$) be the information set at which Player i (j) with (without) the decision right chooses his effort level p_i (q_j) after the delegation decision $D \in \{0,1\}$ has been made. Let $\theta_{i,\mathbf{h}_{i,D},p_i,q_i}$ denote the beliefs of Player i playing p_i at information set $\mathbf{h}_{i,D}$ and believing that Player j will play q_j with certainty and that subsequently in stage 4 and 5 the game will be played as discussed above.

Freedom for Player i with the decision right is:

$$F_{i,dr}(\theta_{i,\mathbf{h}_{i,D},p_i,q_j}) = \sum_{c\in\{1,\ldots,35\}} \frac{p_i}{35} g(o_{i,c}, t_{i,c}) \ln\left(\frac{35p_i}{p_i+(1-p_i)q_j}\right) + \sum_{c\in\{1,\ldots,35\}} \sum_{d\in\{1,\ldots,35\}\setminus c} \frac{(1-p_i)q_j}{35\cdot 34} g(o_{i,c}, t_{i,d}) \ln\left(\frac{35(1-p_i)q_j}{34(p_i+(1-p_i)q_j)}\right), \tag{36}$$

where subscript dr denotes that Player i has the decision right. Equation (36) follows from Player i having correct beliefs about the strategy of Player j and the fact that outcome $o_{i,0}$ is independent of all types. In (36), the first part is a sum over all states where Player i obtains his preferred outcome, and the second part is a sum over all cases where Player j obtains his preferred outcome.

Interference avoided by Player i with the decision right is:

$$I_{i,dr}(\theta_{i,\mathbf{h}_{i,D},p_i,q_j}) = \sum_{c\in\{1,\ldots,35\}} \frac{(1-p_i)q_j}{35} g(o_{i,c}, t_{j,c}) \ln\left(\frac{35(1-p_i)q_j}{p_i+(1-p_i)q_j}\right) + \sum_{c\in\{1,\ldots,35\}} \sum_{d\in\{1,\ldots,35\}\setminus c} \frac{p_i}{35\cdot 34} g(o_{i,c}, t_{j,d}) \ln\left(\frac{35p_i}{34(p_i+(1-p_i)q_j)}\right). \tag{37}$$

Power for Player i with the decision right is:

$$P_{i,dr}(\theta_{i,\mathbf{h}_{i,D},p_i,q_j}) = \sum_{c\in\{1,\ldots,35\}} \frac{p_i}{35} g(o_{j,c}, t_{i,c}) \ln\left(\frac{35p_i}{p_i+(1-p_i)q_j}\right) + \sum_{c\in\{1,\ldots,35\}} \sum_{d\in\{1,\ldots,35\}\setminus c} \frac{(1-p_i)q_j}{35^2} g(o_{j,c}, t_{i,d}) \ln\left(\frac{35(1-p_i)q_j}{34(p_i+(1-p_i)q_j)}\right). \tag{38}$$

Freedom for Player j without the decision right is:

$$F_{j,ndr}(\theta_{j,\mathbf{h}_{j,D},q_j,p_i}) = \sum_{c\in\{1,\ldots,35\}} \sum_{d\in\{1,\ldots,35\}\setminus c} \frac{p_i}{35\cdot 34} g(o_{j,c}, t_{j,d}) \ln\left(\frac{35p_i}{34(p_i+(1-p_i)q_j)}\right) + \sum_{c\in\{1,\ldots,35\}} \frac{(1-p_i)q_j}{35} g(o_{j,c}, t_{j,c}) \ln\left(\frac{35(1-p_i)q_j}{p_i+(1-p_i)q_j}\right), \tag{39}$$

where subscript ndr denotes that Player j does not have the decision right.

Interference experienced by Player j without the decision right is:

$$I_{j,ndr}(\theta_{j,\mathbf{h}_{j,D},q_j,p_i}) = \sum_{c\in\{1,\dots,35\}} \sum_{d\in\{1,\dots,35\}\setminus c} \frac{(1-p_i)q_j}{35\cdot 34} g(o_{j,c},t_{i,d}) \ln\left(\frac{35(1-p_i)q_j}{34(p_i+(1-p_i)q_j)}\right) + \sum_{c\in\{1,\dots,35\}} \frac{p_i}{35} g(o_{j,c},t_{i,c}) \ln\left(\frac{35p_i}{p_i+(1-p_i)q_j}\right). \tag{40}$$

Power for Player j without the decision right is:

$$P_{j,ndr}(\theta_{j,\mathbf{h}_{j,D},q_j,p_i}) = \sum_{c\in\{1,\dots,35\}} \sum_{d\in\{1,\dots,35\}\setminus c} \frac{p_i}{35\cdot 34} g(o_{i,c},t_{j,d}) \ln\left(\frac{35p_i}{34(p_i+(1-p_i)q_j)}\right) + \sum_{c\in\{1,\dots,35\}} \frac{(1-p_i)q_j}{35} g(o_{i,c},t_{j,c}) \ln\left(\frac{35(1-p_i)q_j}{p_i+(1-p_i)q_j}\right). \tag{41}$$

As in the rest of the paper, we use two different specifications for $g(o,t)$. First, we set $g(o,t)=1$, yielding measures F^c, I^c, and P^c. Second, we set $g(o,t)=\Delta\pi_i=\hat{\pi}_i-\check{\pi}_i$ for Player i's freedom and interference and $g(o,t)=\Delta\pi_j=\hat{\pi}_j-\check{\pi}_j$ for Player i's power, yielding measures F^d, I^d, and P^d.

Note that a stronger liking for freedom and power and a stronger aversion to interference will give qualitatively similar predictions: a lower delegation rate and a higher equilibrium effort by the player with the decision right. Since Fehr et al. (2013) do not have a treatment where having the decision right gives a fixed outcome without a choice stage, we cannot distinguish among freedom, power and interference qualitatively, but only quantitatively in the fit of the optimal efforts predicted by the psychological sequential equilibrium, p_i^{*PSE} and q_i^{*PSE}. The psychological sequential equilibrium (PSE) predicts optimal efforts p_i^{*PSE} and q_i^{*PSE} given by:

$$\begin{aligned} p_i^{*PSE} = \arg\max_{p_i} \quad & V_{i,dr}(\theta_{i,\mathbf{h}_{i,D},p_i,q_j^{*PSE}}) = \\ \arg\max_{p_i} \quad & EU_i(\theta_{i,\mathbf{h}_{i,D},p_i,q_j^{*PSE}}) \\ & + \alpha\cdot F_{i,dr}(\theta_{i,\mathbf{h}_{i,D},p_i,q_j^{*PSE}}) \\ & + \beta\cdot I_{i,dr}(\theta_{i,\mathbf{h}_{i,D},p_i,q_j^{*PSE}}) \\ & + \gamma\cdot P_{i,dr}(\theta_{i,\mathbf{h}_{i,D},p_i,q_j^{*PSE}}) \end{aligned} \tag{42}$$

$$\begin{aligned} q_j^{*PSE} = \arg\max_{q_j} \quad & V_{j,ndr}(\theta_{j,\mathbf{h}_{j,D},q_j,p_i^{*PSE}}) = \\ \arg\max_{q_j} \quad & EU_j(\theta_{j,\mathbf{h}_{j,D},q_j,p_i^{*PSE}}) \\ & + \alpha\cdot F_{j,ndr}(\theta_{j,\mathbf{h}_{j,D},q_j,p_i^{*PSE}}) \\ & + \beta\cdot I_{j,ndr}(\theta_{j,\mathbf{h}_{j,D},q_j,p_i^{*PSE}}) \\ & + \gamma\cdot P_{j,ndr}(\theta_{j,\mathbf{h}_{j,D},q_j,p_i^{*PSE}}). \end{aligned} \tag{43}$$

For both players, marginal utility from effort has increased, but even more so for Player i. Player j will only gain from his knowledge of his preferred card with probability $1-p_i$, i.e., if Player i is not informed about his preferred card. Therefore, we should expect p_i^{*PSE} to be higher if both players have $\alpha>0$, $\beta<0$, or $\gamma>0$ than if they maximize expected utility with parameters $\alpha = \beta = \gamma = 0$.

In stage 1 (delegation stage), risk neutral sequential equilibrium (RNSE) predicts:

$$D^{*RNSE} = \mathbb{1}(p_1^{*RNSE}\hat{\pi}_1 + (1 - p_1^{*RNSE})(q_2^{*RNSE}\check{\pi}_1 + (1 - q_2^{*RNSE})\bar{\pi}) - c(p_1^{*RNSE}) < p_2^{*RNSE}\check{\pi}_1 + (1 - p_2^{*RNSE})(q_1^{*RNSE}\hat{\pi}_1 + (1 - q_1^{*RNSE})\bar{\pi}) - c(q_1^{*RNSE})), \quad (44)$$

with $\mathbb{1}$ being the indicator function. Player 1 simply compares his expected utility in the situation in which he has the decision right and plays the optimal p_1^{*RNSE} to his expected utility in the situation in which he does not have the decision right and plays the optimal q_1^{*RNSE}, given that Player 2 plays the optimal p_2^{*RNSE} and q_2^{*RNSE}. Instead, psychological sequential equilibrium (PSE) predicts that in the delegation stage Player 1 chooses:

$$D^{*PSE} = \mathbb{1}\left(V_{1,dr}(\theta_{1,\mathbf{h}_{1,0},p_1^{*PSE},q_2^{*PSE}}) < V_{1,ndr}(\theta_{1,\mathbf{h}_{1,1},q_1^{*PSE},p_2^{*PSE}})\right), \quad (45)$$

where we use the fact that Player 1 has correct beliefs about p_i^{*PSE} and q_i^{*PSE}, and that p_i^{*PSE} and q_i^{*PSE} do not depend on the types. The above condition can be interpreted as follows. Player 1 compares his psychological payoff (which includes expected utility, freedom, interference, and power) if he has the decision right ($V_{1,dr}$) after he has not delegated ($D = 0$) and has played p_1^{*PSE} and Player 2 has played q_2^{*PSE} to his psychological payoff if he does not have the decision right ($V_{1,ndr}$) after he has delegated ($D = 1$) and has played q_1^{*PSE} and Player 2 has played p_2^{*PSE}. Given Equations (36)-(41), a player with a strong liking for freedom, a strong liking for power and/or a strong aversion to interference (i.e., with a large, positive α, γ and/or low, negative β) requires much larger gains in expected payoffs in order to delegate, compared to a player maximizing expected utility (i.e, with $\alpha = \beta = \gamma = 0$). Therefore, a psychological sequential equilibrium predicts lower delegation rates.

Treatment	$\hat{\pi}_1$	$\check{\pi}_2$	$\check{\pi}_1$	$\hat{\pi}_2$	$\bar{\pi}$	$\not{\pi}$
PLOW	40	35	20	40	10	0
LOW	40	20	20	40	10	0
HIGH	40	35	35	40	10	0
PHIGH	40	20	35	40	10	0

Table 10: Payoffs in each treatment

Using the same payoff and cost functions employed by Fehr et al. (2013), we predict the effect of procedural preferences on the behavior of a representative player.[47] In Table 11 we report the predicted strategies for the effort decisions p_1, q_2, p_2, and q_1 and the delegation decision D for various specifications of the parameters α, β, and γ given $g(o,t) = 1$ and $g(o,t) = \Delta\pi$. For simplicity, we only allow one parameter to differ from 0 in each panel of the table. We set the parameters to minimize the squared error of the p_i choices, since for the q_j choices Fehr et al. (2013) presume additional motivation effects, which we cannot capture without additional data and assumptions. On the lowest panel of Table 11, we report the average strategies observed by Fehr et al. (2013).

Due to the inclusion of an additional parameter, the fit is naturally better for models which allow for procedural preferences. A liking for freedom or power and an aversion to interference all lead to a better fit of the effort decisions. We find that freedom and power preferences, compared to interference preferences, provide a better fit of the effort decision but a worse fit of the delegation decision. Indeed, to match the delegation pattern using

[47]Payoffs are reported in Table 10 and the cost function for all players was $c(p) = 25 \cdot p^2$.

freedom or power under specification $g(o,t) = 1$, we would need parameters α and γ that lead to predictions of $p_i^* = 100$ and $q_i^* = 0$. The better fit of the delegation decision under interference aversion can be explained as follows. For Player i with the decision right, freedom and power are strongly influenced by his effort decision p_i, since it directly affects his ability of making an informed card selection. Instead, interference is strongly influenced by the effort decision of the other player q_j. Therefore, a comparably stronger interference aversion is needed to match the observed effort decisions p_i. Moreover, the delegation decision strongly influences the other player's effort q_j and, therefore, the probability with which the other player will exercise interference. Thus, at the delegation stage, the principal will be reluctant to give up the decision right.

This preliminary analysis suggests that interference aversion is the main driver of the reluctance to delegate. We acknowledge that a more detailed comparison of the datasets would be necessary to verify this result.

treatment	p_1 %	q_2 %	p_2 %	q_1 %	D	(α,β,γ)	$g(o,t)$
PLOW	54.5	27.3	42.9	34.3	0	*(0,0,0)*	$g=1$
LOW	54.5	27.3	54.5	27.3	0		
HIGH	42.9	34.3	42.9	34.4	1		
PHIGH	42.9	34.3	54.5	27.3	1		
PLOW	66.5	21.2	56.1	28.5	0	*(0.941,0,0) or*	$g=1$
LOW	66.5	21.2	66.5	21.2	0	*(0,0,0.941)*	
HIGH	56.1	28.5	56.1	28.5	1		
PHIGH	56.1	28.5	66.5	21.2	1		
PLOW	64.7	32.2	57.6	36.3	0	*(0,-5.823,0)*	$g=1$
LOW	64.7	32.2	64.7	32.2	0		
HIGH	57.6	36.3	57.6	36.3	0		
PHIGH	57.6	36.3	64.7	32.2	0		
PLOW	65.5	21	43.6	37.2	0	*(0.043,0,0)*	$g=\Delta\pi$
LOW	65.3	21.9	65.3	21.9	0		
HIGH	45.5	33.5	45.5	33.5	1		
PHIGH	43.6	37.2	65.5	21	1		
PLOW	68.4	24.9	48.9	48.8	0	*(0,-0.581,0)*	$g=\Delta\pi$
LOW	72.9	35.5	72.9	35.5	0		
HIGH	51.1	34.9	51.1	34.9	0		
PHIGH	48.9	48.8	68.4	24.9	0		
PLOW	57.8	28.	62.4	23.1	0	*(0,0,0.062)*	$g=\Delta\pi$
LOW	70.4	18.8	70.4	18.8	0		
HIGH	46.7	33	46.7	33	1		
PHIGH	62.4	23.1	57.8	28	1		
PLOW	55.7	22.8	68.1	16.5	0.163	*observed*	
LOW	66.1	14.3	68.3	16.2	0.139		
HIGH	48.2	26.5	58.7	19.6	0.355		
PHIGH	58.2	17.3	65.1	20.7	0.427		

Table 11: Strategies: predicted effort and delegation decisions (upper panels), observed effort decisions and delegation frequencies (lowest panel)

C Allocation and exercise of decision rights: tables

Round	Treatment 1	2	3	all	1 vs 2	2 vs 3	1 vs 3
1	50	52	69	60			-2.492 (0.0127)
2	48	40	45	44		-2.357 (0.0184)	
3	28	30	30	30			-1.709 (0.0874)
4	45	40	60	50		-3.073 (0.0021)	-2.884 (0.0039)
5	40	40	45	40			-1.831 (0.0671)
6	30	30	30	30			-1.781 (0.0749)
7	50	40	70	50		-2.968 (0.0030)	-3.000 (0.0027)
8	30	36	45	35			-2.198 (0.0280)
9	20	30	30	30	-2.489 (0.0128)		-2.893 (0.003)
10	66	68	80	70		-1.945 (0.0518)	
11	40	40	45	40			-2.043 (0.0411)
12	35	36	45	40		-1.703 (0.0886)	-1.977 (0.0481)
13	35	40	50	40		-2.296 (0.0217)	-2.430 (0.0151)
14	33	35	43	40		-1.719 (0.0856)	-1.909 (0.0562)
15	30	30	45	40		-1.706 (0.0880)	-1.941 (0.0523)
16	50	40	65	50		-2.586 (0.0097)	-2.916 (0.0035)
17	25	30	30	30			-2.411 (0.0159)
18	40	47	50	48		-1.860 (0.0628)	-2.614 (0.0089)
19	30	31	35	33			
20	80	70	70	72			
all	40	40	50	40			

Table 12: Median bids. Results of a Mann-Whitney-Wilcoxon rank-sum test (p-values in parentheses) are reported only for statistically significant cases.

Treatment	Player 1		Player 2	
	has decision right	chooses card with highest payoff	has decision right	chooses card with highest payoff
1	0.41	1	0.59	0.98
2	0.4	0.99	0.6	0.99
3	0.55	1	0.45	0.94
all	0.44	1	0.56	0.98

Table 13: Decision rights and choice behavior conditional on having the decision right. Fraction of observations.

D CRRA utility estimation

In this appendix we approximate $u_k(\pi)$ by a CRRA utility function $u_{k,CRRA}(\pi) = \frac{\pi^{1-\rho_k}-1}{1-\rho_k}$. In the context of our lottery-choice questionnaire, which adopts a Multiple Price List (MPL) method, the number of times an individual k chooses the safe lottery (Option A) determines an interval $[\overline{\rho}, \underline{\rho}]$ where the CRRA parameter $\rho_{MPL,k}$ must lie if his behavior is consistent with CRRA expected utility maximization. The midpoint of such interval is taken as the point estimate $\hat{\rho}_{MPL,k}$ for individual k's risk aversion coefficient. Out of 244 participants, we exclude 15 individuals from all further analysis because they either chose dominated switching points or had multiple switching points.[48] Among our participants, the mean estimated CRRA parameter is equal to 0.58.[49]

In order to assess the degree to which each individual behavior is matched by the behavior prescribed by his estimated risk aversion coefficient, we count how many mistakes each individual is predicted to make. A mistake is equal to ξ if the difference between the question at which an individual is predicted to switch to the safe lottery and the question at which he actually switches to the safe lottery is equal to ξ. Since ξ may be negative or positive, we define the number of absolute mistakes (as the sum of the absolute values of the mistakes) as well as the number of relative mistakes (as the sum of the actual values of the mistakes). Taking into account absolute (relative) mistakes, 70 (216) out of 229 individuals behaved perfectly consistent with CRRA utility maximization. Table 14 reports the estimated CRRA coefficient corresponding to each type of behavior in the lottery-choice questionnaire, along with the summary statistics of the estimated coefficients.

As a robustness check, we also approximate $u_k(\pi)$ by a CARA utility function $u_{k,CARA}(\pi) = 1 - \frac{e^{-r_k \pi}}{r_k}$ and estimate the corresponding CARA parameter $r_{k,MPL}$.[50] Results are reported in Appendix E.

[48] 3 subjects chose dominated switching points (one of which is a Player 1) and 12 subjects had multiple switching points (6 of which are Player 1).

[49] Our estimates are consistent with evidence from field experiments. Harrison et al. (2007) estimate individual risk attitudes using controlled experiments in the field in Denmark. They report a mean CRRA coefficient is 0.67, weighted to reflect the Danish population.

[50] Taking into account absolute mistakes, 70 out of 229 individuals behave perfectly consistent with CARA utility maximization. The overlap between the 70 individuals consistent with CARA utility maximization and the 70 individuals consistent with CRRA utility maximization is almost complete. There is only one individual who is consistent with CARA utility maximization but not with CRRA utility maximization and another individual who is consistent with CRRA utility maximization but not with CARA utility maximization. Taking into account relative mistakes, 215 out of 229 individuals behave perfectly consistent with CARA utility maximization.

coefficient		switching points
range	midpoint	
(-10.43,-9.05]	-9.74	7, 9, 10
(-9.05,-7.60]	-8.32	7, 8, 10
(-7.60,-4.54]	-6.07	6, 8, 10
(-4.54,-3.81]	-4.17	6, 8, 9
(-3.81,-2.56]	-3.18	6, 7, 9
(-2.56,-2.50]	-2.53	6, 7, 8
(-2.50,-1.93]	-2.22	5, 7, 8
(-1.93,-1.54]	-1.73	5, 6, 8
(-1.54,-0.88]	-1.21	5, 6, 7
(-0.88,-0.83]	-0.86	5, 6, 6
(-0.83,-0.40]	-0.61	5, 5, 6
(-0.40,0]	-0.20	5, 5, 5
0	0	(*)
(0,0.35]	0.18	4, 4, 4
(0.35,0.69]	0.52	4, 4, 3
(0.69,0.74]	0.72	4, 4, 2
(0.74,1.05]	0.90	4, 3, 2
(1.05,1.48]	1.26	4, 3, 1
(1.48,1.53]	1.50	4, 3, 0
(1.53,2.24]	1.89	4, 2, 0
(2.24,2.58]	2.41	3, 2, 0
(2.58,4.71]	3.64	3, 1, 0
(4.71,5.82]	5.27	3, 0, 0
mean	0.58	
median	0.18	
std	1.54	
obs.	229	

Table 14: The estimated CRRA coefficients corresponding to individual's behavior in the lottery-choice questionnaire. A switching point in the lottery-choice questionnaire is the question at which an individual switches from choosing the risky lottery (Option B) to choosing the safe lottery (Option A). In each of the three sets of questions of the lottery-choice questionnaire questions are numbered from 1 to 11. (∗) An estimated coefficient equal to 0 is associated to any combination of switching points equal to '5' and '4', such as (5,5,4), (5,4,5), (4,5,5), (4,4,5), (4,5,4), (5,4,4).

E Robustness check: CARA utility

For robustness, we replicate all results presented in Section 7 under the assumption of CARA utility function. Tables 15, 16, 17, and 18 are analogous to Tables 14, 7, 8, and 9, respectively. Figure 4 is analogous to Figure 3. The difference between the CRRA results and the CARA results can be explained by the inverse of the CARA utility function $u_{CARA}^{-1}(x)$ being defined only for values $x < 1$. In some cases, the specification of freedom, power, and interference as constant variables (ΔF^c, ΔI^c) and as variables proportional to the payoff difference (ΔF^d, ΔI^d, and ΔP^d) led to utility values for a player without the decision right which did not respect this boundary and thus violated the model.

coefficient		switching points
range	midpoint	
(-0.1386,-0.1384]	-0.1385	7, 9, 10
(-0.1384,-0.1352]	-0.1368	7, 8, 10
(-0.1352,-0.0685]	-0.1005	6, 8, 10
(-0.0685,-0.0656]	-0.0671	6, 8, 9
(-0.0656,-0.0481]	-0.0569	6, 7, 9
(-0.0481,-0.0430]	-0.0456	5, 7, 9
(-0.0430,-0.0360]	-0.0395	5, 7, 8
(-0.0360,-0.0281]	-0.0321	5, 6, 8
(-0.0281,-0.0173]	-0.0227	5, 6, 7
(-0.0173,-0.0165]	-0.0169	5, 6, 6
(-0.0165,-0.0083]	-0.0124	5, 5, 6
(-0.0083,0]	-0.0041	5, 5, 5
0	0	(*)
(0, 0.0083]	0.0042	4, 4, 4
(0.0083,0.0164]	0.0124	4, 4, 3
(0.0164,0.0173]	0.0169	4, 3, 3
(0.0173,0.0281]	0.0227	4, 3, 2
(0.0281,0.0360]	0.0321	4, 3, 1
(0.0360,0.0430]	0.0395	4, 2, 1
(0.0430,0.0481]	0.0456	4, 2, 0
(0.0481,0.0656]	0.0569	3, 2, 0
(0.0656,0.1352]	0.1004	3, 1, 0
(0.1352,0.1384]	0.1368	2, 1, 0
mean	0.014	
median	0.004	
std	0.031	
obs	229	

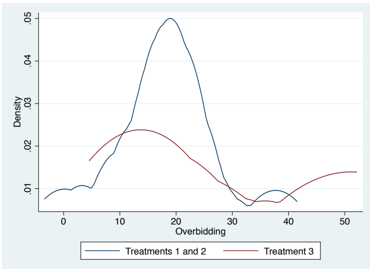
Table 15: The estimated CARA coefficients corresponding to individual's behavior in the lottery-choice questionnaire. A switching point in the lottery-choice questionnaire is the question at which an individual switches from choosing the risky lottery (Option B) to choosing the safe lottery (Option A). In each of the three sets of questions of the lottery-choice questionnaire questions are numbered from 1 to 11. ($*$) An estimated coefficient equal to 0 is associated to any combination of switching points equal to '5' and '4', such as (5,5,4), (5,4,5), (4,5,5), (4,4,5), (4,5,4), (5,4,4).

Model	risk aversion	specification	Treatments 1 and 2 84 subjects		Treatment 3 22 subjects	
			% RSS	% BIC	% RSS	% BIC
Expected utility (*excl.* procedural preferences)						
	$\hat{\rho}_{MPL}$		0.0	8.3	0.0	4.5
	$\hat{\rho}_{bid}$		64.3	48.8	54.5	40.9
	0		2.4	14.3	0.0	13.6
Psychological payoff (*incl.* procedural preferences)						
Freedom or Interference	$\hat{\rho}_{MPL}$	*constant*	19.0	17.9		
		proportional	11.9	10.7		
Interference	$\hat{\rho}_{MPL}$	*constant*			31.8	27.3
		proportional			13.6	13.6
Power	$\hat{\rho}_{MPL}$	*proportional*	4.8	2.4		

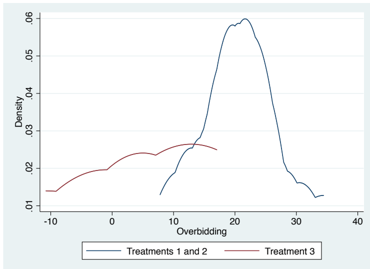
Table 16: Percentage of experiment participants whose bidding behavior is best explained by each model, under the assumption of a CARA utility function. Note that, if the RSS criterion is maximized by the model 'expected utility maximization' with risk aversion $\rho = 0$, it is also maximized by the model 'expected utility maximization' with risk aversion $\rho = \hat{\rho}_{bid}$. The two individuals who behaved exactly according to expected payoff maximization also created a similar overlap of 2.4% under the BIC criterion. Thus, the first and second columns do not sum to 100.

specification of 'interference' to define: dependent variable	subsample	regressors Treatment 3 dummy	constant	obs
constant	*constant*	7.89	18.31***	21
		(8.46)	(2.86)	
proportional	*proportional*	-15.72	20.72***	12
		(7.83)	(2.60)	
constant	*constant or proportional*	-0.36	19.79***	33
		(6.70)	(2.04)	
proportional	*constant or proportional*	-8.23	24.36***	33
		(7.46)	(4.61)	

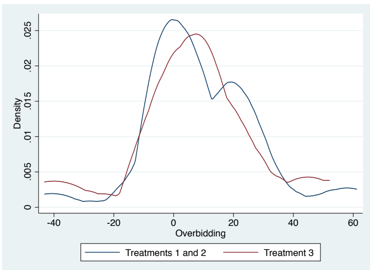
Table 17: Linear regression. The dependent variable is overbidding, defined as the difference between the bid predicted by the model 'psychological payoff maximization driven by interference preferences' and the bid predicted by the model 'expected utility maximization' with risk aversion estimated using choice-lottery data. The regression is run for round 5, in which Player 1 faces a stake size of 50 and an expected payoff of 50 ($\pi_1^{high} = 75$ and $\pi_1^{low} = 25$). CARA utility function is assumed. Standard errors are given in parentheses. *, **, *** indicate significant at the 5%, 1% and 0.1% levels, respectively.



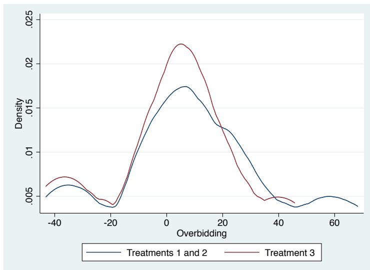
(a) Individuals best explained by interference preferences. Constant specification.



(b) Individuals best explained by interference preferences. Proportional specification.



(c) All individuals. Constant specification.



(d) All individuals. Proportional specification.

Figure 4: Overbidding, defined as the difference between the bid predicted by the model 'psychological payoff maximization driven by interference preferences' and the bid predicted by the model 'expected utility maximization' with risk aversion estimated using choice-lottery data. Density functions across different subsamples and under different specifications. Data from round 5, in which Player 1 faces a stake size of 50 and an expected payoff of 50 ($\pi_1^{high} = 75$ and $\pi_1^{low} = 25$).

round	stake	constant specification			proportional specification		
	size	mean	% of stake	sd	mean	% of stake	sd
1	70	6.52	9	21.09	5.69	8	31.80
2	50	8.47	17	21.00	8.67	17	28.40
3	30	10.77	36	21.42	10.16	34	26.57
4	70	6.58	9	20.16	6.15	9	31.83
5	50	8.81	18	19.65	8.45	17	27.49
6	30	10.93	36	20.51	9.74	32	25.70
7	70	7.31	10	20.18	7.88	11	34.40
8	50	9.67	19	20.45	9.36	19	28.44
9	30	12.32	41	21.88	9.82	33	24.96
10	100	3.40	3	22.05	-0.60	- 1	39.35
11	50	8.81	18	19.65	8.45	17	27.49
12	50	8.81	18	19.65	8.45	17	27.49
13	50	8.81	18	19.65	8.45	17	27.49
14	50	8.81	18	19.65	8.45	17	27.49
15	50	8.81	18	19.65	8.45	17	27.49
16	70	6.58	9	20.16	6.15	9	31.83
17	30	10.93	36	20.51	9.74	32	25.70
18	50	8.47	17	21.00	8.67	17	28.40
19	50	9.67	19	20.45	9.36	19	28.44
20	100	3.40	3	22.05	-0.60	- 1	39.35
all	50	8.39	19	20.59	7.54	17	29.79

Table 18: Overbidding in each round, as a percentage of the stake size $\pi_1^{high} - \pi_1^{low}$.

F Inequity aversion

Our experimental design also allows for the estimation of fairness preferences. We implement the Fehr and Schmidt (1999) model, which gives the following optimal bid condition:

$$y - \frac{\pi_1^{high} - \pi_1^{low}}{2} = \lambda V^{dis} + \mu V^{adv} \tag{46}$$

$$V^{dis} = \max\left(0, \frac{\pi_2^{high,L} + \pi_2^{low,L}}{2} + w_2 - \pi_1^{high} - w_1 + y\right) - \max\left(0, \pi_2^{high,R} + w_2 - \frac{\pi_1^{high} + \pi_1^{low}}{2} - w_1\right)$$

$$V^{adv} = \max\left(0, \pi_1^{high} + w_1 - y - \frac{\pi_2^{high,L} + \pi_2^{low,L}}{2} - w_2\right) - \max\left(0, \frac{\pi_1^{high} + \pi_1^{low}}{2} + w_1 - \pi_2^{high,R} - w_2\right)$$

where V^{dis} stands for the difference in disadvantageous inequity between having and not having the decision right, and V^{adv} stands for the difference in advantageous inequity between having and not having the decision right. An individual behaving according to the above model compares not only the utility values resulting from having or not having the decision right, but also the expected payoff inequalities resulting from having or not having the decision right. Note that whether Player 1 experiences advantageous or disadvantageous inequity depends not only on the payoff levels but also on the bid chosen by Player 1.

For better readability, we define:

$$\eta_1 = \pi_1^{high} - \frac{\pi_1^{high} + \pi_1^{low}}{2} \tag{47}$$

$$\eta_2 = \frac{\pi_1^{high} + \pi_1^{low}}{2} - \pi_1^{high} \tag{48}$$

$$\eta_L = \pi_1^{high} - \frac{\pi_2^{high,L} + \pi_2^{low,L}}{2} \tag{49}$$

$$\eta_R = \frac{\pi_1^{high} + \pi_1^{low}}{2} - \pi_2^{high,R} \tag{50}$$

$$\eta_w = w_1 - w_2 \tag{51}$$

The optimal bid y^* is then implicitly defined via:

$$y^*(\lambda, \mu) = \begin{cases} \eta_1 - \frac{\lambda}{1+\lambda}\eta_2 & \text{if } (\eta_L + \eta_w < y^*) \wedge (\eta_R + \eta_w < 0) \\ \frac{1}{1+\lambda}[\eta_1 + \lambda(\eta_w + \eta_L) + \mu(\eta_w + \eta_R)] & \text{if } (\eta_L + \eta_w < y^*) \wedge (\eta_R + \eta_w > 0) \\ \eta_1 + \frac{\mu}{1-\mu}\eta_2 & \text{if } (\eta_L + \eta_w > y^*) \wedge (\eta_R + \eta_w > 0) \\ \frac{1}{1-\mu}[\eta_1 - \mu(\eta_w + \eta_L) + \lambda(\eta_w + \eta_R)] & \text{if } (\eta_L + \eta_w > y^*) \wedge (\eta_R + \eta_w < 0) \end{cases} \tag{52}$$

Which case in Equation 52 is relevant depends on the round and the parameters λ and μ. The optimal bid is nonlinear in λ and μ. We estimate the parameters λ and μ via nonlinear least squares on the bids. We include a constant β to account for interference preferences.[51] The estimated model is:

$$y_{i,t} = y^*_{i,t}(\lambda, \mu) + \beta + \epsilon_{i,t}. \tag{53}$$

λ	.013038	(.0514239)
μ	-.0886128*	(.044491)
β	-12.44203***	(1.783147)
obs	2440	
subjects	122	
R^2	0.7604	

Table 19: Estimation results of the model from Equation 53. We use a grid of 10^3 starting points for the three parameters and obtained standard errors via bootstrapping with clusters at the individual level and 100 repetitions. Standard errors are shown in parenthesis: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

We find only weak evidence of aversion to advantageous inequity and no evidence of aversion to disadvantageous inequity. The main explanation for overbidding relative to the sequential equilibrium predictions is still interference aversion.

There are several reasons why inequity aversion seems to play a minor role in explaining the data. First, in more complex decision tasks individuals may focus more strongly on their own payoffs than on inequity concerns. Second, unlike decision problems such as the dictator game, the decision problem in our experiment is not clearly framed as one where individuals are morally obliged to share. Finally, experiment participants may not have been aware of the effect that their bids had on the payoffs of the other player.

[51] Technically, this is not quite the same definition of interference as in the main body of the paper, where the model additionally accounts for risk attitudes. Since in both the risk-neutral and the risk-averse case there is strong evidence of interference aversion, we interpret this as an additional robustness result.

G Locus of control

We implement the Levenson Multidimensional Locus of Control Test as designed by Levenson (1981) and translated from English to German by Krampen (1981). In personality psychology, locus of control refers to the extent to which individuals believe that they can control events that affect them. A person's locus is either internal (i.e., the person believes that events in his life derive primarily from his own actions) or external (i.e., the person believes that events in his life derive primarily from external factors, such as chance and other people's actions, which he cannot influence). Three separate scales are used to measure locus of control: Internal Scale (I scale), Powerful Others External Scale (P scale), and Chance External Scale (C scale). The I-scale measures the degree to which individuals believe that they control their lives. The P-scale measures the degree to which individuals believe that other persons control their lives. Finally, the C-scale measures the degree to which individuals believe that chance plays a role in their lives.

The questionnaire is reported in Table 22. There are eight items on each of the three scales, which are presented to the subject as one unified attitude scale of 24 items. The specific content areas mentioned in the items are counterbalanced so as to appear equally often for all three dimensions. To score each scale, the points of the answers for the items appropriate for that scale (from 1 for strongly disagree to 6 for strongly agree) are added up. The possible range on each scale is from 0 to 48. Each subject receives three scores indicative of his or her locus of control on the three dimensions of I, P, and C. Table 20 reports summary statistics of the three scales across all participants. Since the empirical distribution does not differ across treatments, Table 20 pools all treatments together.

scale	No.	mean	standard deviation	min	25% percentile	median	75% percentile	max
I-scale	244	36	4	16	33	36	38	46
P-scale	244	24	5	10	21	24	27	38
C-scale	244	25	5	11	22	25	28	39

Table 20: Locus of Control: summary statistics of each scale.

	Locus of Control		
	I-scale	C-scale	P-scale
overbidding			
constant specification	0.1831	-0.1001	-0.2005^{*}
proportional specification	0.1396	-0.0453	-0.1681

Table 21: Correlation between locus of control (I,C, and P scales) and overbidding (constant and proportional specifications of interference). *: $p < 0.05$, **: $p < 0.01$,***: $p < 0.001$.

We assess whether attitudes toward locus of control are correlated with interference preferences. As a monetary measure of interference preferences we employ the measure of overbidding defined in Section 7.3 as the difference between the bid predicted by psychological payoff maximization driven by interference preferences and the bid predicted by expected utility maximization (with risk aversion coefficient $\hat{\rho}_{MPL}$). Table 21 reports the correlation between each locus of control scale and overbidding. Only the correlation computed using the P-scale and the constant specification of interference is statistically significant at the 5% level. Thus, we conclude that attitudes toward locus of control appear to be unrelated to interference preferences.

1. (I) Whether or not I get to be a leader depends mostly on my ability.
2. (C) To a great extent my life is controlled by accidental happenings.
3. (P) I feel like what happens in my life is mostly determined by powerful people.
4. (I) Whether or not I get into a car accident depends mostly on how good a driver I am.
5. (I) When I make plans, I am almost certain to make them work.
6. (C) Of ten there is no chance of protecting my personal interests form bad luck happenings.
7. (C) When I get what I want, it is usually because I'm lucky.
8. (P) Although I might have good ability, I will not be given leadership responsibility without appealing to those positions of power.
9. (I) How many friends I have depends on how nice a person I am.
10. (C) I have often found that what is going to happen will happen.
11. (P) My life is chiefly controlled by powerful others.
12. (C) Whether or not I get into a car accident is mostly a matter of luck.
13. (P) People like myself have very little chance of protecting our personal interests when they conflict with those of strong pressure groups.
14. (C) It's not always wise for me to plan too far ahead because many things turn out to be a matter of good or bad fortune.
15. (P) Getting what I want requires pleasing those people above me.
16. (C) Whether or not I get to be a leader depends on whether I'm lucky enough to be in the right place at the right time.
17. (P) If important people were to decide they didn't like me, I probably wouldn't make many friends.
18. (I) I can pretty much determine what will happen in my life.
19. (I) I am usually able to protect my personal interests.
20. (P) Whether or not I get into a car accident depends mostly on the other driver.
21. (I) When I get what I want, it's usually because I worked hard for it.
22. (P) In order to have my plans work, I make sure that they fit in with the desires of people who have power over me.
23. (I) My life is determined by my own actions.
24. (C) It's chiefly a matter of fate whether or not I have a few friends or many friends.

Table 22: Locus of Control questionnaire

H Instructions

The experiment was conducted in German and the original instructions were in German. Below we provide the translation in English.

Introduction

You are about to participate in a scientific study. Please read the following instructions carefully. The instructions inform you about everything you need to know to participate in the study. If you do not understand something, please raise your hand and an instructor will come to you and answer your question.
For participating in this study and arriving on time, you have already earned a show up fee of 2.50 Euro. During the study you may receive additional money by earning points. The amount of points you earn will depend on your decisions and the decisions of other participants. All points earned during the study will be converted to Euro at the end of the session. The conversion rate is:

12 Points = 1 Euro

At the end of the study you will receive the amount of money that you earned plus the 2.50 Euro show up fee.
During the study, it is strictly forbidden to communicate with each other. In addition, please use only the functions on the computer which relate directly to the study. Communication or using the computer in a way unrelated to the study will lead to exclusion from the study. If you have questions we are happy to assist you.

All participants are divided into two groups: **Participants 1 and Participants 2**. You will be randomly assigned a group and remain in this group for the whole duration of the session.

This study consists of three parts:

Part 1: Part 1 lasts for **20 rounds**. In each round a Participant 1 and a Participant 2 will be matched randomly. At no time will you or any other participant be informed of the identity of the individuals that you are matched with. At the end of the session, **one** of the 20 rounds will be randomly selected and you will be **paid** according to the points earned in **the selected round only**. Before Part 1 starts, there will be a trial round which does not count toward your earnings.

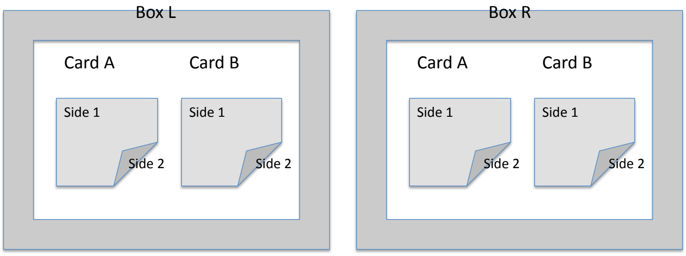
Part 2: Instructions for Part 2 will be provided once Part 1 has ended.

Part 3: Instructions for Part 3 will be provided once Part 2 has ended.

Part 1 (Treatment 1 and 2)

[In Part 1, Treatment 1 and 2 differ only in the endowment of Participant 2. Sentences that differ in the two treatments are highlighted.]

In each round each Participant 1 will be randomly matched with a Participant 2. In each round Participant 1 and Participant 2 have the task of choosing a single card and will earn points depending on the chosen card. There are 2 boxes, Box L and Box R. Each box contains 2 cards, Card A and Card B.



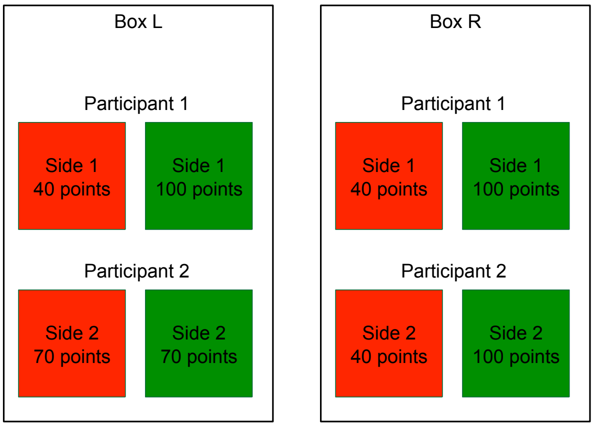
Card A and Card B each have 2 sides. One side is marked ‘Side 1’, the other ‘Side 2’. The color of Side 1 determines the points Participant 1 receives. The color of Side 2 determines the points Participant 2 receives. Each side of a card can be Red or Green.
The cards’ colors in Box L are independent from the cards’ colors in Box R. The cards’ colors are also independent across rounds.

Each round has the following steps:

1. **Information about points:** Both participants learn the points associated with the card selection.
2. **Bidding:** [*In Treatment 1:* Both participants receive an endowment of 100 points. *In Treatment 2:* Participant 1 receives an endowment of 100 points.]. Participant 1 uses his/her endowment to bid for the right to choose the card. *Depending on the submitted bid:*
   - *either* Participant 1 receives the decision right and pays a fee
   - *or* Participant 2 receives the decision right, in which case neither participant pays any fee
3. **Information about cards:** If Participant 1 has the decision right, Box L is opened. If Participant 2 has the decision right, Box R is opened. The computer randomly determines the colors of Side 1 and Side 2 on the cards in the opened box.
   - Participant 1 learns the color of Side 1 on the cards in the opened box.
   - Participant 2 learns the color of Side 2 on the cards in the opened box.
4. **Card selection:** The participant with the decision right selects a card out of the opened box.
5. **Earnings:** The points earned by each participant in the round are recorded, but each participant learns his/her earnings only at the end of the session.

Each step is explained in more detail below:

- **Step 1 - Information about points**
  Information about points resulting from the card selection is provided in a table. The table below is an example.



In this example:

- If the card is selected from Box L:
  Participant 1 receives 40 points if Side 1 is red, 100 points if Side 1 is green.
  Participant 2 receives 70 points if Side 2 is red, 70 points if Side 2 is green.
- If the card is selected from Box R:
  Participant 1 receives 40 points if Side 1 is red, 100 points if Side 1 is green.
  Participant 2 receives 40 points if Side 2 is red, 100 points if Side 2 is green.

- **Step 2 - Bidding**
  [*In Treatment 1:* Both participants receive an endowment of 100 points. *In Treatment 2:* Participant 1 receives an endowment of 100 points.]. Using the endowment, Participant 1 bids for the right to make the card selection at the end of the round. Participant 2 cannot bid.

  - If the bid of Participant 1 is successful, Participant 1 will have the decision right. A fee will be paid by Participant 1.
  - If the bid of Participant 1 is unsuccessful, Participant 2 will have the decision right. No fee will be paid by either participant.

  Participant 1 chooses a bid between 0 and 100 points.

  $$\mathbf{0 \leq bid \leq 100}$$

  Whether the bid of Participant 1 is successful and, if so, which fee is deducted, is determined as follows. The computer randomly draws one number out of the integers between 1 and 100. Each number is equally likely to be drawn. If the drawn number is smaller than or equal to the bid, then the bid is successful and Participant 1 will pay a fee equal to the drawn number. If the drawn number is larger than the bid, then the bid is unsuccessful and neither participant pays any fee.

  Examples:

  1. Participant 1 chooses a bid equal to 15:
     If the computer draws a number between 1 and 15, for example 10, then Participant 1 has the decision right and will pay a fee equal to 10. If the number is larger than 15, then Participant 2 has the decision right and neither participant pays any fee.

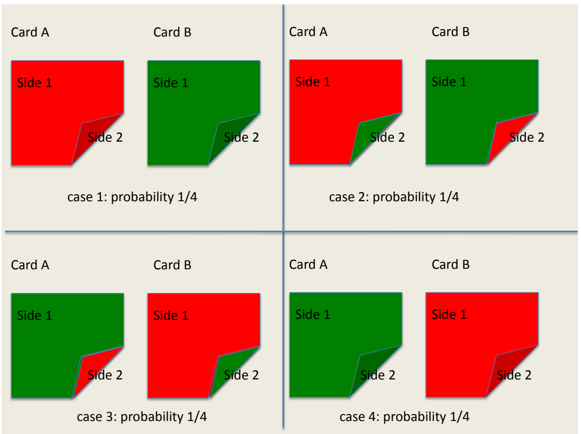
2. Participant 1 chooses a bid equal to 75:
   If the computer draws a number between 0 and 75, for example 60, then Participant 1 has the decision right and will pay a fee equal to 60. If the number is larger than 75, then Participant 2 has the decision right and neither participant pays any fee.

Given these rules, it is in the interest of Participant 1 to choose a bid which represents how much he/she values the decision right.

- **Step 3 - Information about cards**

<table>
<tr><th>Box L</th><th>Box R</th></tr>
<tr><td>

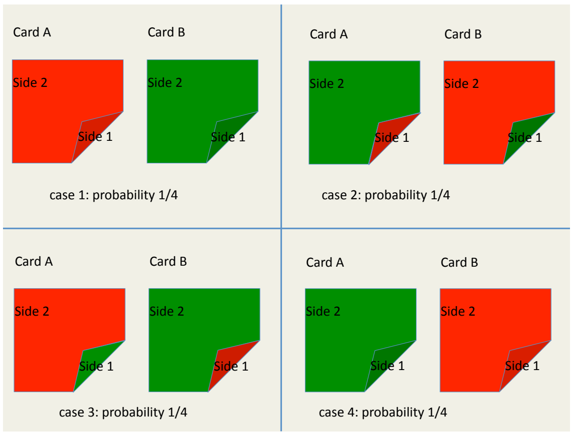
If Participant 1 has the decision right, Box L is used. The computer randomly determines the colors of Side 1 and Side 2 on the cards in Box L, by picking one of the four cases shown below.



Then Box L is opened.
Participant 1 observes Side 1 of Card A and Card B, but not Side 2. Participant 2 observes Side 2 of Card A and Card B, but not Side 1.

</td><td>

If Participant 2 has the decision right, Box R is used. The computer randomly determines the colors of Side 1 and Side 2 on the cards in Box R, by picking one of the four cases shown below.



Then Box R is opened.
Participant 1 observes Side 1 of Card A and Card B, but not Side 2. Participant 2 observes Side 2 of Card A and Card B, but not Side 1.

</td></tr>
</table>

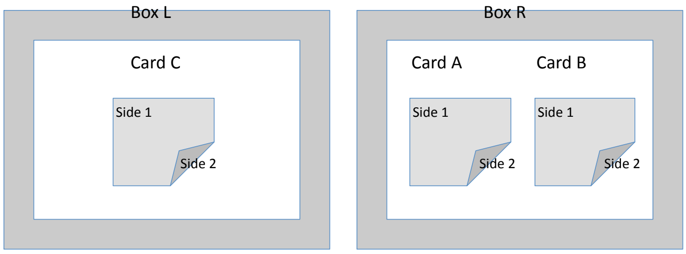
- **Step 4 - Card selection**
  The participant with the decision right selects Card A or Card B.
  - If Participant 1 has the decision right, he/she selects a card out of Box L.
  - If Participant 2 has the decision right, he/she selects a card out of Box R.
- **Step 5 - Earnings**
  The points earned in the round depend on the selected card. The color of Side 1 determines the points Participant 1 receives. The color of Side 2 determines the points Participant 2 receives.

  Participant 1's earnings are: **Endowment - Fee + Points from card selection**

  Participant 2's earnings are: [*In Treatment 1:* **Endowment + Points from card selection**] [*In Treatment 2:* **Points from card selection**]

Part 1 (Treatment 3)

In each round each Participant 1 will be randomly matched with a Participant 2. In each round Participant 1 and Participant 2 have the task of choosing a single card and will



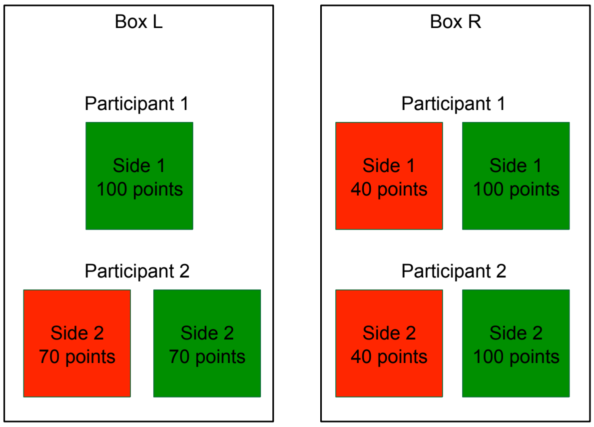
earn points depending on the chosen card. There are 2 boxes, Box L and Box R. Box L contains one card, Card C. Box R contains two cards, Card A and Card B.
Card A, B and C each have 2 sides. One side is marked 'Side 1', the other 'Side 2'. The color of Side 1 determines the points Participant 1 receives. The color of Side 2 determines the points Participant 2 receives. Each side of a card can be Red or Green.
The cards' colors in Box L are independent from the cards' colors in Box R. The cards' colors are also independent across rounds.

Each round has the following steps:

1. **Information about points:** Both participants learn the points associated with the card selection.
2. **Bidding:** Participant 1 receives an endowment of 100 points. Participant 1 uses his/her endowment to bid for Box L to be used instead of Box R. *Depending on the submitted bid:*
   - *either* Box L is used and Participant 1 pays a fee
   - *or* Box R is used, in which case neither participant pays any fee
3. **Information about cards:** If Participant 1's bid is successful, Box L is opened. Otherwise, Box R is opened. The computer randomly determines the colors of Side 1 and Side 2 on the card(s) in the opened box. Side 1 of Card C is always Green.
   - Participant 1 learns the color of Side 1 on the card(s) in the opened box.
   - Participant 2 learns the color of Side 2 on the card(s) in the opened box.
4. **Card selection:** If Box L is opened, Card C is selected automatically. If Box R is opened, Participant 2 selects a card out of Box R.
5. **Earnings:** The points earned by each participant in the round are recorded, but each participant learns his/her earnings only at the end of the session.

Each step is explained in more detail below:

- **Step 1 - Information about points**
  Information about points resulting from the card selection is provided in a table. The table below is an example.



In this example:

- If Card C is selected from Box L:
  Participant 1 receives 100 Points, since Side 1 is green.
  Participant 2 receives 70 Points if Side 2 is red, 70 Points if Side 2 is green.
- If the card is selected from Box R:
  Participant 1 receives 40 Points if Side 1 is red, 100 Points if Side 1 is green.
  Participant 2 receives 40 Points if Side 2 is red, 100 Points if Side 2 is green.

- **Step 2 - Bidding**
  Participant 1 receives an endowment of 100 points. Using the endowment, Participant 1 bids for Box L to be used instead of Box R. Participant 2 cannot bid.

  - If the bid of Participant 1 is successful, Box L is used. A fee will be paid by Participant 1.
  - If the bid of Participant 1 is unsuccessful, Box R is used. No fee will be paid by either participant.

  Participant 1 chooses a bid between 0 and 100 points.

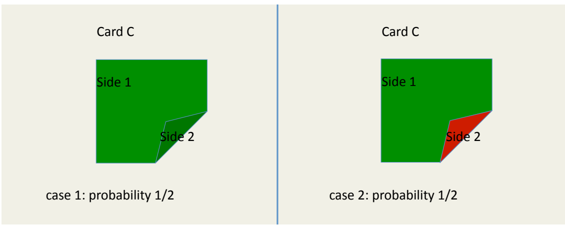
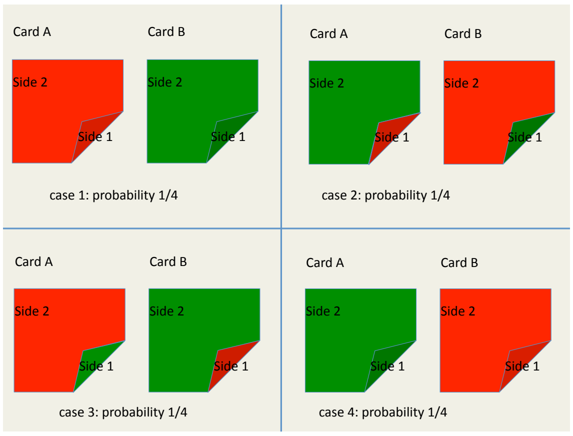
  $$\mathbf{0 \leq bid \leq 100}$$

  Whether the bid of Participant 1 is successful and, if so, which fee is deducted, is determined as follows. The computer randomly draws one number out of the integers between 1 and 100. Each number is equally likely to be drawn. If the drawn number is smaller than or equal to the bid, then the bid is successful and Participant 1 will pay a fee equal to the drawn number. If the drawn number is larger than the bid, then the bid is unsuccessful and neither participant pays any fee.
  Examples:

  1. Participant 1 chooses a bid equal to 15:
     If the computer draws a number between 1 and 15, for example 10, then Box L is used and Participant 1 will pay a fee equal to 10. If the number is larger than 15, then Box R is used and neither participant pays any fee.
  2. Participant 1 chooses a bid equal to 75:
     If the computer draws a number between 0 and 75, for example 60, then Box L is used and Participant 1 will pay a fee equal to 60. If the number is larger than 75, then Box R is used and neither participant pays any fee.

Given these rules, it is in the interest of Participant 1 to choose a bid which represents how much he/she values the use of Box L instead of Box R.

- **Step 3 - Information about cards**

<table>
<tr><th>Box L</th><th>Box R</th></tr>
<tr><td>If the bid of Participant 1 is successful, Box L is used. The computer randomly determines the color of Side 2 of Card C in Box L, by picking one of the two cases shown below.</td><td>If the bid of Participant 1 is unsuccessful, Box R is used. The computer randomly determines the colors of Side 1 and Side 2 on the cards in Box R, by picking one of the four cases shown below.</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Then Box L is opened.
Participant 1 observes Side 1 of Card C, but not Side 2. Participant 2 observes Side 2 of Card C, but not Side 1.</td><td>Then Box R is opened.
Participant 1 observes Side 1 of Card A and Card B, but not Side 2. Participant 2 observes Side 2 of Card A and Card B, but not Side 1.</td></tr>
</table>

- **Step 4 - Card selection**
  - If Box L is used, Card C is selected automatically.
  - If Box R is used, Participant 2 selects a card out of Box R.

- **Step 5 - Earnings**
  The points earned in the round depend on the selected card. The color of Side 1 determines the points Participant 1 receives. The color of Side 2 determines the points Participant 2 receives.

  Participant 1's earnings are: **Endowment - Fee + Points from card selection**

  Participant 2's earnings are: **Points from card selection**

Part 1: Comprehension questions

For each of the following statements, please select 'correct' or 'incorrect':

- If participant 1 has the decision right, box R is opened. (correct: Not True)
- It is in the best interest of participant 1, to bid equal to his/her true valuation for the decision right. (correct: True)
- The participants receive payments for each round of part 1. (correct: Not True)
- If the bid of participant 1 is higher than the randomly determined number, participant 1 has to pay a fee equal to the amount of the bid. (Correct: Not True)

Part 2: Lottery-choice questionnaire

In Part 2 you are presented with a series of decisions. Each decision is a paired choice between two options, Option A and Option B. Option A gives you a specific amount of points with certainty. Option B gives you either a high amount of points or a low amount of points, with equal probability. At the end of Part 2 one decision will be randomly selected and you will receive the points that have resulted from your own choice in that decision only.

Part 3: Locus of Control questionnaire

In Part 3 you are presented with a series of statements and you are asked to indicate the extent to which you agree or disagree to each of them, using a scale that ranges from 'strongly disagree' to 'strongly agree'. For each statement, please select the answer that best reflects your own opinion. Your answers will be always treated anonymously.

I Screen Shots

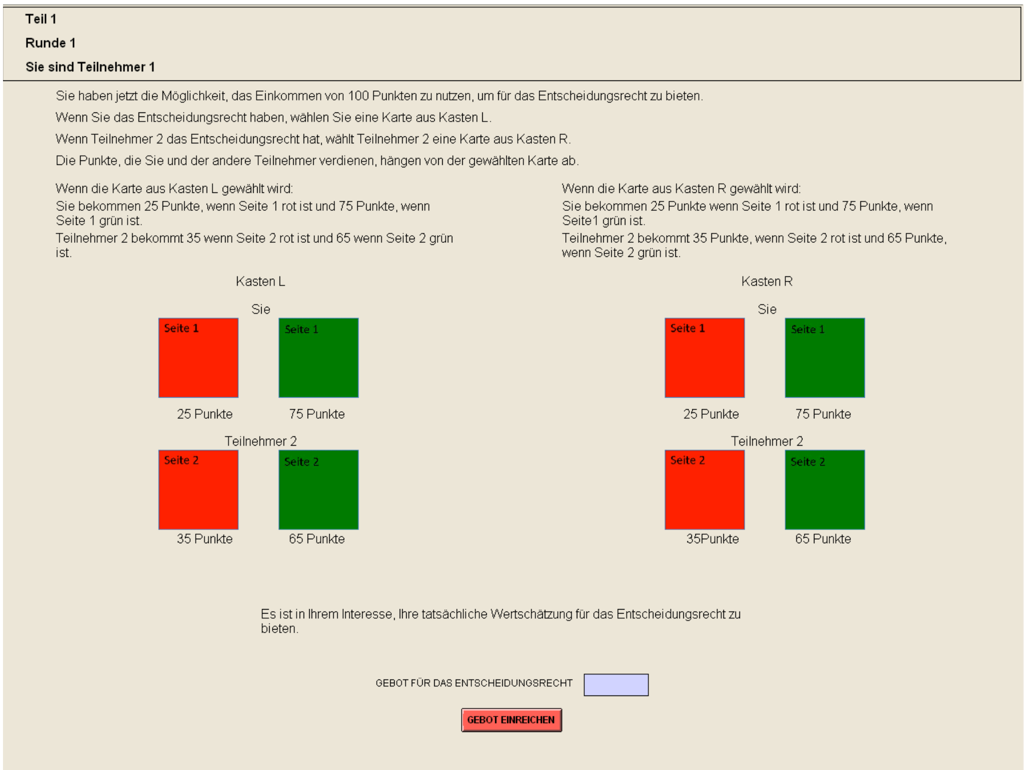


Figure 5: Example: Participant 1 will bid for the decision right, after observing the high and low payoffs for each participant for each box. From Box L, Participant 1 can earn 75 points (high payoff) or 25 points (low payoff), and Participant 2 can earn 65 points (high payoff) or 35 points (low payoff). From Box R, Participant 1 can earn 75 points (high payoff) or 25 points (low payoff), and Participant 2 can earn 65 points (high payoff) or 35 points (low payoff).

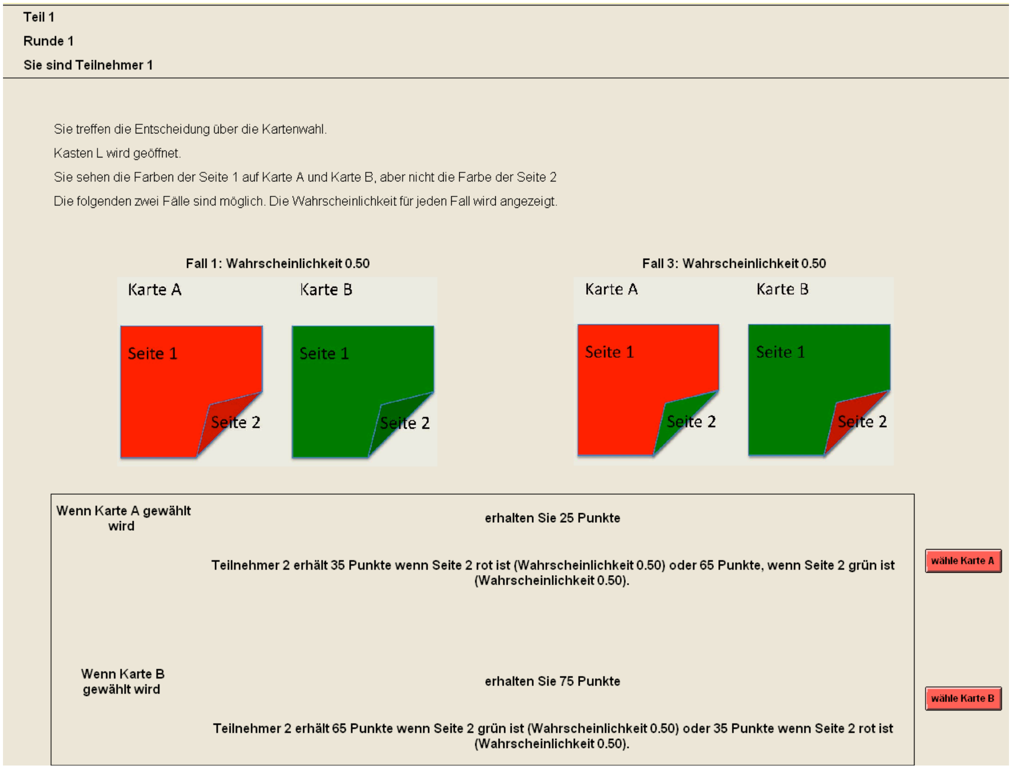


Figure 6: Example (cont.): Participant 1 has the decision right and will select a card from Box L, after observing that Card B gives him the high payoff (75 points) while Card A gives him the low payoff (25 points). Participant 1 does not observe which card gives the high payoff to Participant 2. If Card A is selected, Participant 2 is equally likely to receive the high payoff (65 points) or the low payoff (35 points). Analogously, if Card B is selected, Participant 2 is equally likely to receive the high payoff (65 points) or the low payoff (35 points).