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Coping with complexity – Experimental evidence for narrow bracketing in multi-stage contests☆

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ABSTRACT

This paper investigates whether decision makers bracket their choices narrowly to facilitate complex decision problems. Evidence from a framing variation of rewards in experimental two-stage pairwise elimination contests indicates that decision makers neglect the option value of participation in future stages of the contest if the reward frame facilitates the separate consideration of stages, but not if the reward frame induces forward-looking behavior. Decision makers account for the option value of participation in future stages of the contest independently of the reward frame, however, when complex strategic interactions in future stages of the contest are replaced by simple lotteries that facilitate the determination of the option value. The results present novel evidence for the prevalence and the determinants of choice bracketing as a means to cope with complexity.

1. Introduction

It has been hypothesized repeatedly that decision makers break down complex decision problems into smaller components, which they then consider in isolation to reach a decision. While from the perspective of standard economic models of decision making, such behavior might appear biased, the intuitively appealing idea of "narrow choice bracketing" is likely to be relevant in many complex decision environments. To investigate its relevance, much of the existing literature has focused on the failure of decision makers to integrate outcomes of independent lotteries. The separate consideration of *independent* lotteries only affects behavior in specific cases – for instance, when decision makers are loss averse and naive about their loss aversion.[1] Conceptually, there is no obvious link between prospect-theoretic preferences and the inclination of decision makers to employ narrow bracketing as a means to reduce complexity, which itself constitutes a form of behavioral bias.

This paper investigates whether decision makers employ narrow bracketing as a means to cope with complexity in multi-period decision problems. In particular, we analyze whether decision makers omit future consequences of current actions to

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[1] See Benartzi and Thaler (1995), Gneezy and Potters (1997), Langer and Weber (2001), Rabin and Weizsäcker (2009), Hilgers and Wibral (2014), and the references cited therein.

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simplify investment choices in a complex dynamic decision environment with *interdependent* choices. Specifically, we analyze investment decisions in a two-stage pairwise elimination contest. Decision makers first choose their stage-1 investment and conditional on succeeding in stage 1, subsequently choose their stage-2 investment. Agents who have already won stage 1 trade-off the costs of the investment and the benefit of increasing their chances to receive the prize Δ_2 when choosing stage-2 investment, and the optimal solution to this trade-off depends on expected stage-2 investment by the opponent.

Of more interest for the purpose of the present paper is the stage-1 investment decision, however. This decision is considerably more complex than the stage-2 investment choice. In particular, decision makers in stage 1 of the contest compete for a prize Δ_1 awarded to the stage-1 winner *and* for the right to participate in stage 2 of the contest where they have a chance to win the additional reward Δ_2. Due to strategic interaction in stage 2 of the contest, the option value of participation in stage 2 is determined by the decision maker's own future stage-2 investment and by expected stage-2 investment of the future opponent. In addition to this option value, the investment decision is influenced by the interaction in stage 1. This implies that stage-1 investment decisions are influenced by several factors relating to stage 1 *and* the option value of stage 2. Omitting future consequences of current actions by ignoring the option value of participation in stage 2 when choosing stage-1 investment is thus suboptimal from the perspective of the standard decision model. However, the omission has the benefit that it substantially simplifies the stage-1 investment decision. Decision makers who bracket narrowly only take account of the expected stage-1 investment by the opponent, but omit future consequences of current actions. This is cognitively much less demanding as it reduces the mental computing power required to make the (optimal) stage-1 investment decision by also incorporating the option value into the decision. Narrow bracketing can thus be seen as a means to avoid the complexity inherent in the determination of the option value of participation in future strategic interactions. In contrast, broadly bracketing decision makers must take expected stage-1 investment by the opponent, expected stage-2 investment by the future opponent, and own future stage-2 investment into account when choosing their optimal stage-1 investment.

We analyze the prevalence and potential determinants of narrow bracketing in laboratory experiments by exploiting controlled variation in a two-by-two design that varies the salience of the second stage interaction and the complexity of the stage-1 investment decision. To manipulate the salience of the second stage, we implement different reward frames that involve identical stakes but either facilitate or complicate the separate consideration of interdependent choices. In particular, decision makers in the "separate reward" (SR) frame receive the reward Δ_1 for winning stage 1 before they compete for the second reward Δ_2 in stage 2. Rewards in the "integrated reward" (IR) frame are received only after decision makers have chosen both their stage-1 and their stage-2 investments. The stage-2 loser only then receives the reward Δ_1 for winning stage 1, while the stage-2 winner receives a large prize $\Delta_1 + \Delta_2$ that integrates the rewards for winning stage 1 and winning stage 2, respectively.

To manipulate the complexity of the stage-1 investment decision while maintaining the reward frames, we eliminate the strategic interaction in stage 2. In particular, in the control treatments SRc and IRc we replace the second stage of the contest by a lottery, such that the option value of participation in stage 2 is independent of the decision maker's own future stage-2 investment and of the expected stage-2 investment by the future opponent. Hence, the two-by-two design delivers two baseline treatments SR and IR where subjects choose both their stage-1 and stage-2 investment, and two control treatments SRc and IRc where stage 2 is replaced by a lottery such that subjects only choose their stage-1 investment.

The payoffs as well as the associated realization probabilities are identical in all reward frames as long as decision makers bracket broadly and act according to the textbook predictions, which thereby provides a natural null hypothesis of behavioral equivalence across the treatments. However, the different reward frames might affect stage-1 investment choices of decision makers who employ narrow bracketing as a means to cope with complexity. While the "integrated reward" frame forces decision makers to take account of the option value of participation in stage 2 – there is no immediate reward for winning stage 1 – decision makers in the "separate reward" frame might focus exclusively on the immediate stage-1 reward and omit the option value of participation in stage 2 when choosing their stage-1 investment. This would imply that average stage-1 investment differs across baseline treatments and is lower in SR than in IR. In addition, the comparison of stage-1 investment choices across control treatments SRc and IRc allows us to test whether the prevalence of narrow bracketing is related to the complexity of the decision environment. In particular, if the complexity associated with the stage-1 investment decision is the reason for narrow bracketing in SR, stage-1 investment choices should not be affected by the reward frame in the control treatments, or if anything to a lesser extent.

The major advantage of the setting considered in this paper in comparison to most existing studies that analyze narrow bracketing is that the impact of narrow bracketing on behavior is independent of how the utility function is shaped, which allows us to study the prevalence and potential determinants of narrow bracketing independent of myopia regarding loss aversion. Moreover, the strategic environment introduces an element of complexity that occurs frequently and naturally in many real life situations as well as in many lab studies.

The data reveal that stage-1 investments are significantly lower in SR than in IR, while the investment choices of subjects in stage 2 are almost identical across the two baseline treatments. In addition, we find that stage-1 investment choices are almost identical across the two control treatments with reduced complexity. These findings are consistent with the hypothesis that decision makers apply narrow bracketing as a means to cope with complexity. Additional analyses of the data at the individual level provide further support for the hypothesis. In particular, we find that cognitive capacity – approximated by self-reported math grades – is systematically related to the treatment effect in the baseline treatments: subjects with lower cognitive capacity invest less in stage 1 of the SR treatment than in stage 1 of the IR treatment, while stage-1