Prize Decoys at Work 2.0: Does Frame Equivalence Replicate Asymmetric Dominance Effects in Risky Choices on Lotteries?

By Holger Müller*, Toni Richter, and Horst Gischer

In 1992, Simonson and Tversky introduced the "prize decoy asymmetric dominance effect" by showing that preferences between two non-dominated options winnable in a competition, namely prize A (a $6 cash payoff) and prize B (an attractive pen), can be shifted toward the target prize B by introducing a prize decoy C (a less attractive pen) which is dominated by B, but not by A. In a controlled conceptual replication that keeps the initial experimental frame equivalent to the original study, it is examined whether the decoy effect remains a robust behavioral pattern when it is transferred to the domain of risky choices in terms of binary lotteries. The replication confirms a substantial decoy effect which amounts to 13 % in the aggregate of choices. Moreover, the detected effect works in a bidirectional way. By further discussing the general need for frame equivalence and the importance of parameters of experimental designs of replication studies (e.g., real choices, tradeoff conformance) the present work provides new insights further stimulating the debate on (a) failed attempts to replicate decoy effects in recent studies and (b) the robustness and the drivers (moderators, mediators) of context effects.

1. Introduction

1.1. The origin of decoy effects

Nearly 40 years ago, the asymmetric dominance effect (termed hereafter: decoy effect) was introduced to the scientific marketing community in a seminal contribution published by Huber et al. (1982). Interpreted as a clear deviation from "rational choice behavior," the decoy effect exists if preferences or choice frequencies between two non-dominated options A (i.e., the competitor) and B (termed the target) can be systematically shifted toward target B by introducing an asymmetrically dominated decoy option C (i.e., C is dominated by the target B, but not by competitor A). Hence, central assumptions in traditional economic choice theory such as the axiom of independence of irrelevant alternatives and the constant ratio rule are violated. Numerous follow-up studies in the field (e.g., Ratneshwar 1987; Wedell 1991;

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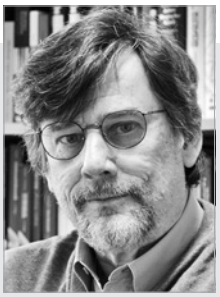

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Simonson and Tversky 1992; Lehmann and Pan 1994; Heath and Chatterjee 1995) proved the detected decoy effect and other choice characteristics subsumed under the notion of context effects to generally be robust choice patterns across various setups of decision-making (e.g., single/repeated choices, within/between-subjects designs), types of options (such as products, services, events, candidates), and procedures (e.g. real [binding]/ hypothetical choices, in-/exclusive of no-choice-options).

1.2. Conflict in research findings: The issue of failed replications

However, a few years ago, Frederick et al. (2014) and Yang and Lynn (2014) conducted a sequence of multi-category replication studies and reported severe difficulties producing the decoy effect even when using setups that were – in their point of view – identical to those successfully applied in previously published research work. As an example, Frederick et al. (2014) failed to replicate a decoy-conform choice shift in what was termed the "prize decoy experiment" as introduced by Simonson and Tversky (1992). Specifically, in this experiment, it is shown that preferences between two non-dominated options winnable in a competition, namely prize A (a $6 cash payoff) and prize B (a pen from an attractive, well-known brand) can be shifted toward the target prize B by introducing a prize decoy C (a less attractive pen) which is dominated by B, but not by A. As a consequence, according to the many failed attempts to replicate it, Frederick et al. (2014) were putting the general robustness of the decoy effect into question and supposed it to be an experimental artifact which is limited to stylized product representations (Müller et al. 2014).

Conversely, Simonson (2014) immediately re-commented this obvious conflict in research findings by addressing three important points. *First*, he argued that as a fundamental feature of the applied design framing, the original prize decoy experiment was a real choice study – Frederick et al. (2014) elicited mere hypothetical choices (i.e., fictitious prizes) instead. As recent research findings indicate that context effects may vary in occurrence and size depending on whether consumers face economic consequences or not (e.g., Müller et al. 2012a; Diels and Müller 2013), it is reasonable to assume that this difference in the setting may account for the conflict in the results. *Secondly*, Simonson (2014) further stated that Frederick et al. (2014) used a fully dominated pen as the decoy option (i.e., dominated by the target and by the competitor). As a result, (a) the positioning of prizes differed from the original study, and (b) the required tradeoff considerations between the prizes were then eventually not triggered – which, on the other hand, are prerequisites for the occurrence of decoy effects. *Thirdly*, Simonson (2014) raised doubts as to what extent the $6 cash prize used in their original study conducted nearly 25 years ago was still a meaningful prize option to subjects in 2014 (i.e., the replication date) worth spending cognitive deliberation on. In sum, Simonson (2014) concluded that these profound deviations from the original general frame and the experimental setup of the design may account for the failure to reproduce the prize decoy effect.

1.3. Requirements to replication studies: Frame equivalence

The (presumably) most fundamental suggestion for any type of replication studies is inherently positioned in Simonson's (2014) re-comment and will be termed hereafter "frame equivalence." Specifically, regardless of whether it is a (a) direct replication in terms of an exact replication addressing the statistical conclusion validity (i.e., alpha error) of findings, (b) a replication with extension attempting to provide evidence for the generalizability of findings, or (c) a conceptual replication where potential background factors (e.g., moderators/mediators), sample characteristics, and design settings are systematically varied for the purpose of extending the original research findings, it is nonetheless essential to keep the main setting of the experimental design (i.e., the frame) as close as possible (i.e., equivalent) to the design used in the original study. As a logical and necessary consequence, profound pretesting effort is required in terms of preliminary group discussions and/or quantitative pre-studies to ensure that the original experimental setup resembles the present choice setup from the perspective of the sample selected for the actual replication.

In line with Simonson's (2014) important suggestion, Müller et al. (2014) reran the original prize decoy experiment under strict frame equivalence to finally resolve the abovementioned conflict in research findings. Specifically, while presenting the subjects with cash and pen prizes completely different from those used by Simonson and Tversky (1992) in the original prize decoy effect study, the general experimental frame was equivalent to the one applied in the original study. As a logical consequence, Müller et al. (2014) confirmed in their replication with extension a significant prize decoy effect sized 16 % which further remained robust across several demographic sample subgroups. Therefore, their findings indicate that Frederick et al.'s (2014) failures to replicate the decoy effect in most of their replication studies might have been induced by (rather unconsciously made) variations in the choice setting, thereby violating frame equivalence.

1.4. Contribution of the present study

Consequently, the main contribution of the present work is based on Simonson's (2014) important premise. In particular, in a profound conceptual replication that keeps the initial experimental frame largely equivalent, it is examined whether the prize decoy effect remains a robust behavioral pattern when it is transferred to a different but from the authors' point of view quite promising domain: risky choices in terms of lotteries.

For reason of simplicity, the present experimental study elicits choices between binary lotteries each of which

providing two possible outcomes. That is, in a given binary lottery a subject can (a) win a certain amount of money (X€) with probability (p) or (b) win nothing (0 €) with probability (1-p).

While the domain of lotteries has already been an issue in previous context effect research (e.g., Huber et al. 1982; Herne 1999), the overwhelming part of options included in the choice sets were mostly any kind of categories, products, services, brands, travel destinations, or even elaborated fractional attribute combinations of those objects. From the authors' perspective, this imbalance is surprising since lotteries provide a very distinct and valuable feature: In contrast to the often multifaceted and complex attribute profiles that consumers usually consider and which they base their choice on when making decisions between product offerings (e.g., Müller et al. 2012a), lotteries allow to describe any option under consideration in the experimental setup in an unambiguous, unequivocal way by means of only two specific dimensions: the probability of winning, and the payoff in case of winning. As a consequence, by engaging in adequate pretest effort, this enables the researcher in a rather simple way to systematically control *ex ante* for (a) the required tradeoff conformance between offered winning probabilities and payoff levels (i.e., choosing options with higher winning probabilities requires to accept lower payoffs et vice versa), (b) the correct positioning of options in the perceptual space of lotteries (i.e., competitor and target are non-dominated options whilst the decoy is asymmetrically dominated only by the target), and (c) to identify meaningful real lottery choice options with an adequate payoff level which induce a sufficient degree of cognitive deliberation when making choices between them. Consequently, the research question of the present work is as follows:

RQ: Can the prize decoy effect introduced by Simonson and Tversky (1992) conceptually be replicated in risky choices on binary lotteries under frame equivalence of the experimental design?

2. Pretest procedures

In a first step, to identify an adequate set of significant prizes in terms of binary lotteries, preliminary group discussions among the target population of the study (small-sized samples of students of two major German universities) were executed. The group members' comprehension of binary lotteries, the general interest in winning a prize in a lottery, the importance of really playing such a lottery out, and the correct tradeoff consideration (higher payoffs/winning probabilities are preferred over lower payoffs/winning probabilities) were confirmed. Further, subjects were presented with specified sets of binary lotteries covering different payoff prize levels (e.g., sets ranging from 2 € to 4 €, from 50 € to 70 €, etc.). As a result, it turned out that payoff levels ranging from 4 € to 10 € were perceived as significant in value by the group members so that they would be motivated to spend cognitive deliberation on the respective choices. Further, potential choice sets of corresponding target and competitor lotteries (e.g., {80 % chance of winning 5 €}, {50 % chance of winning 8 €}) were identified and preselected. Finally, the perceived attribute importance (i.e., decision focus: € or % or both) was checked which was generally balanced with a slight focus on winning probabilities.

In a second step, the qualitative insights gathered in the group discussions were validated by running a comprehensive follow-up quantitative pretest. Specifically, a short (mean working time: 296.69 sec) standardized online study among 45 undergraduates of the same two major German universities was executed. Indicators reflecting the induced degree of cognitive deliberation in choices on preselected binary lotteries {80 % chance of winning 5 €} and {50 % chance of winning 8 €} were assessed on five-point rating scales ranging from 1 = "not at all" to 5 = "very much." The results indicated sufficient levels of lottery comprehension (M = 4.51, SD = .97), perceived attractiveness (M = 3.56, SD = .94), subjective importance of making choices on lotteries providing real payoffs (M = 3.24, SD = 1.26), and the motivation to choose between the lotteries carefully (M = 3.60, SD = 1.14). Further, the required tradeoff conformance was established since participants agreed to strictly prefer both higher winning probabilities as well as higher payoffs over lower ones. Further, the differentiated positions of the preselected lotteries were checked and affirmed. Specifically, 35 participants (78 %) simultaneously considered the lottery {80 % chance of winning 5 €} as providing a high chance to win a rather low payoff and the lottery {50 % chance of winning 8 €} as a lottery providing a medium chance to win a relatively high payoff. Thus, the differentiated positioning of the non-dominated competitor/target options in the perceptual lottery space was confirmed as intended. Finally, the analysis of stated attribute importance revealed that 58 % of the subjects balanced their focus on both dimensions (€ and p), whereas 27 % (15 %) stated to set the focus in choices between binary lotteries primarily on the winning probability p (payoff size €).

3. Main study

The insights gathered in the pretest procedure effectively facilitated the development of an equivalent experimental frame for the prize decoy replication study.

3.1. Test stimuli (Lotteries)

Generally, a systematic multiple-choice approach was used in that test participants had to make a total of ten decisions either between two lotteries (i.e., pairs, each of which consisting of a competitor and a target) or between three lottery options (i.e., triplets, each of which consisting of a competitor, target, and a decoy). The efficacy of decoys was systematically tested in two directions: Five

	Choice Set	Competitor		Target		Decoy near the target	
		Probability	Payoff	Probability	Payoff	Probability	Payoff
Lotteries favoring the high payoff option (chance of winning 8 €)	L1	80%	5 €	20%	8 €		
	L2	80%	5 €	30%	8 €		
	L3	80%	5 €	40%	8 €		
	L4	80%	5 €	50%	8 €		
	L5	80%	5 €	60%	8 €		
	L11	80%	5 €	20%	8 €	15%	7 €
	L12	80%	5 €	30%	8 €	25%	7 €
	L13	80%	5 €	40%	8 €	35%	7 €
	L14	80%	5 €	50%	8 €	45%	7 €
	L15	80%	5 €	60%	8 €	55%	7 €
Lotteries favoring the low payoff option (chance of winning 5 €)	L6	50%	8 €	60%	5 €		
	L7	50%	8 €	70%	5 €		
	L8	50%	8 €	80%	5 €		
	L9	50%	8 €	90%	5 €		
	L10	50%	8 €	100%	5 €		
	L16	50%	8 €	60%	5 €	55%	4 €
	L17	50%	8 €	70%	5 €	65%	4 €
	L18	50%	8 €	80%	5 €	75%	4 €
	L19	50%	8 €	90%	5 €	85%	4 €
	L20	50%	8 €	100%	5 €	95%	4 €

Tab. 1: Set of lotteries

of the ten choices contained a setup favoring a high payoff lottery (8 €) as the target. Specifically, the pairs contained a high chance/low payoff competitor lottery fixed throughout all five choices at 80 % chance of winning 5 € and a high payoff target lottery offering an 8 € at five varying chances from 20 % to 60 %. In the respective triplet, a decoy lottery targeting the high payoff target was added as the third option offering a slightly lower payoff than the target (7 €) along with five correspondingly varying but slightly smaller winning chances than the target ranging from 15 % to 55 %. In addition, five choices contained a setup favoring a low payoff lottery (8 €) as the target. Specifically, the pairs contained a medium chance/high payoff competitor fixed throughout all five choices at 50 % chance of winning 8 € and a low payoff lottery offering 5 € at five varying chances from 60 % to 100 %. In the triplet, a decoy lottery targeting the low payoff lottery was added as a third option offering a slightly lower payoff than the target (4 €) along with five correspondingly varying but slightly smaller winning chances than the target ranging from 55 % to 95 %. In sum, the following choice sets were created (*Tab. 1*).

It has to be noted that the systematic multiple choice scenario approach as described above has to be considered as a promising setup for effectively examining context-dependent shifts in subjects' preferences in general. Specifically, the systematic increase in the winning chance of the respective target lottery (high or low payoff lottery) facilitates the identification of each subject's tipping points at which a switch in choice from the competitor to the target becomes likely. Logically, decoys of any kind can only then take an effect on choice if individual tipping points exist at all. Further, it has to be emphasized that the chance of winning instead of the payoff size was systematically varied since the pretest studies revealed that this dimension was (at least slightly) more important to the subjects on average.

3.2. Procedure

Before entering the computer labs in which the study was administered, the participants were welcomed and informed inter alia that they were participating in a study on decision-making, that there were no correct or wrong answers, and that they were allowed to complete the online survey at their own pace. In the first part of the study, the test participants entered the lab and were instructed by the experimenter that the show up payment (10 €) would be handed out outside of the lab after they finished the survey. Further, they were told that 10 % of them determined as a winner in a random draw would additionally get a second payment as a prize whereby the

exact value of the prize would depend on the outcome of a chosen lottery which later would really be played out for each of the 10 % winners. In detail, the instructions (read aloud by the experimenter in front of the lab) were as follows:

Hello everybody! Thank you very much for participating in our study. At the beginning, please let me briefly introduce myself. (...) Your show-up payment of 10 € will be paid to you immediately after you have finished the survey and left the computer lab. Outside of the lab, a cashier will hand out the money at a separate desk to each participant.

By participating in our survey, you can additionally get a second payment as a prize. As you will learn later, the value of this prize (that is, the amount of €) depends on the choices you make today between what is termed "Binary Lotteries." After the survey is finished, every tenth participant (10 %) will be determined as a winner in a random draw. Each winner will be a) informed by email in calendar week (XX) and b) asked to come to the computer lab again to play out the lottery chosen in exactly one choice (likewise randomly determined) of his/her lottery choices made in the survey.

After that, subjects were asked to read a double-sided written instruction (positioned physically at their workstations) regarding the principle of binary lotteries and the way in which they would be played out, i.e., by drawing one ball out of twenty numbered balls from an urn with the winning probabilities predetermined by ranges of numbers.

Now, I would like to ask you to read the following instructions carefully! In the following part of the survey, you can make choices between what is termed "Binary Lotteries." Each binary lottery has two possible outcomes: you win a certain amount of money (€), or you win nothing (0 €). Both outcomes have a certain probability (P) to occur. In the choices you are presented with, each lottery is described for ease of use by the winning probability and the payoff in case of winning. To this end, the following table depicts an example on a typical choice setting:

	Lottery X	Lottery Y
Probability of winning (P)	80%	50%
Payoff in case of winning (€)	5 €	8 €

Regarding Lottery X, the following is true: You have an 80 % chance to win 5 €, but with a 20 % chance you win nothing! Regarding Lottery Y, the following is true: You have a 50 % chance to win 8 €, but with a 50 % chance you win nothing! Your task in the following section is to indicate the lottery that you prefer in each of ten presented choice sets of lottery options.

If you become one of the 10 % winners, exactly one of the choices that you will make today is then randomly chosen and will be played out as follows: We take a look at the probability of winning (P) of the lottery you have selected in that choice. Then, we put 20 balls numbered from 1 to 20 in an urn. Then you have to take a ball out of that urn. As an example, assume that you had chosen Lottery X (p = 80 %, 5 €). You would win 5 €, given that you would have drawn any of the balls numbered from 1 to 16 (this corresponds to an 80 % chance of winning, since 16 divided by 20 equals 80 %). However, if you draw a ball numbered 17, 18, 19, or 20, you win nothing. If in contrast, you would have chosen Lottery Y (p = 50 %, 8 €) then you would win 8 €, given that you would have drawn any of the balls numbered from 1 to 10 (this corresponds to a 50 % chance of winning, as 10 divided by 20 equals 50 %). Otherwise, you win nothing.

To support your choices, we provide a list of probabilities regarding this drawing procedure. You may inspect them at any time during the today's survey.

Winning probability	You win, if you draw one of the following numbered balls out of the twenty numbered balls in the urn
15%	1,2,3
20%	1,2,3,4
25%	1,2,3,4,5
30%	1,2,3,4,5,6
35%	1,2,3,4,5,6,7
40%	1,2,3,4,5,6,7,8
45%	1,2,3,4,5,6,7,8,9
50%	1,2,3,4,5,6,7,8,9,10
55%	1,2,3,4,5,6,7,8,9,10,11
60%	1,2,3,4,5,6,7,8,9,10,11,12
65%	1,2,3,4,5,6,7,8,9,10,11,12,13
70%	1,2,3,4,5,6,7,8,9,10,11,12,13,14
75%	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15
80%	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16
85%	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17
90%	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18
95%	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19

After finishing the inspection of the instruction, subjects pushed a button on the PC to proceed to the second part of the survey. In a common between-subjects design, the survey software assigned the participants at random to the two experimental groups. That is, participants were either exposed to pairs of lotteries each of which including only a target and a competitor (i.e., competitor-target group, choice sets L1-L10 in *Tab. 1*) or triplets consisting of a target, a competitor, and a decoy (i.e., competitor-target-decoy group, choice sets L11-L20 in *Tab. 1*). In each condition, subjects were presented with a total of ten choice scenarios as described above. A repetition of the choice scenario that was presented first in this section was additionally included after the tenth choice to check the participants' choice consistency. Regarding the screen displays, the choice sets of lottery prizes were presented in a common alternative-by-attribute matrix format in which the respective lotteries were represented in columns with the rows depicting the winning probabil-

Competitor-target group:

Please make your choice between the following lotteries!

Lottery	L	M
Winning probability	80%	50%
Payoff in case of winning	5€	8€
Your choice		

Competitor-target-decoy group:

Please make your choice between the following lotteries!

Lottery	L	D	M
Winning probability	80%	45%	50%
Payoff in case of winning	5€	7€	8€
Your choice			

Fig. 1: Visualization of choices

ity and the payoff in case of winning. Participants indicated their prize choice simply by checking a box below the respective column. To avoid empirically proven starting point biases (Chang and Liu 2008; Mitchell and Carson 1989), the order of the ten choices was randomized. To summarize, the respective screens visualizing the choices on pairs/triplets were designed as follows (*Fig. 1*):

In the third part of the survey, subjects went through a short part addressing manipulation checks. Specifically, the subjects' focus on the outcome of lotteries ("How much have you been focused on the outcome when making decisions?") and the decision involvement ("How involved have you been when making your choices?") were assessed on a seven-point rating scale ranging from 1 (= not at all) to 7 (= very much).

Finally, subjects provided demographic data. After finishing the survey, every tenth participant was manually selected to go through a short debriefing interview outside of the laboratory.

One week after the study took place, the 10 % winners were drawn and invited to play out the lottery that was only then determined by the experimenters as their prize in a random drawing. For reason of control, all winners were afterwards asked to indicate (a) the degree of satisfaction with their choice in that lottery on a seven-point rating scale ranging from 1 (= not at all) to 7 (= very much), and (b) whether or not they would make the same choice again (yes/no answer).

3.3. Sample

In the main experiment, a total of 131 undergraduates of two major German universities participated in a between-subjects online survey conducted in computer laboratories. 64 participants made decisions among all pairs of competitor-target options, and 67 made decisions among all triplets of competitor-target-decoy options.

3.4. Structural homogeneity

The analysis of the debriefing interviews confirms that the selected participants (a) did comprehend the principle of binary lotteries, and (b) were largely unaware of any applied prize choice set manipulation.

Further, Chi-square-based contingency analyses confirm the required structural homogeneity of the two experimental splits. Specifically, the random assignment of participants to the experimental groups was successful as they turn out to be homogeneous with respect to each of the gathered demographical data such as gender, age group, faculty, country region, household size, marital state, left/right-handedness, etc. For instance, the competitor-target group contained 39 male and 25 female persons. In the competitor-target-decoy group, there were 35 male and 32 female persons ($\chi^2_{(1)} = 1.008$, $p = .315$).

3.5. Validity checks

Moreover, general validity checks reveal a sufficient degree of decision involvement ($M = 5.49$, $SD = 1.19$), outcome focusing ($M = 5.80$, $SD = 1.26$), and working time ($M = 122.59$ sec, $SD = 49.71$: see *Fig. 1*). However, regarding the working time, differences between the experimental groups become apparent in that it took 22 seconds longer to go through the choices on triplets of lotteries than on pairs [1]. Further, 99 % of the participants repeated the decision they made in the first choice set when they were exposed to the last of all presented repetition choice. Therefore, it is reasonable to assume that the subjects (a) willingly engaged in cognitive deliberation when making the choices on lotteries, (b) really noticed the decoy by taking it into consideration in the triplets, and (c) did not choose merely at random but based on subjective preferences [2].

3.6. Main analysis of lottery choices

The observed choice shares are depicted in *Tab. 2*.

As for the main analysis, results in a first step are checked on an overall level in which decisions are aggregated across all the choice sets. Specifically, the totality of 1310 choices (i.e., 131 test participants × 10 choices per person) is considered at this level. As a result, it turns out that in the competitor-target group, target was chosen in 41 % of the cases (choices), whereas in the competitor-target-decoy group, the target was chosen in 54 % of the cases. Put differently, the target gained 13 %, what commonly is denoted as the attraction effect of a decoy ($\chi^2_{(1)} = 22.27$, $p < .01$).

Further, when considering the low payoff-favoring vs. high payoff-favoring choice sets separately, the attraction effect of the lottery decoy remains stable and works in a

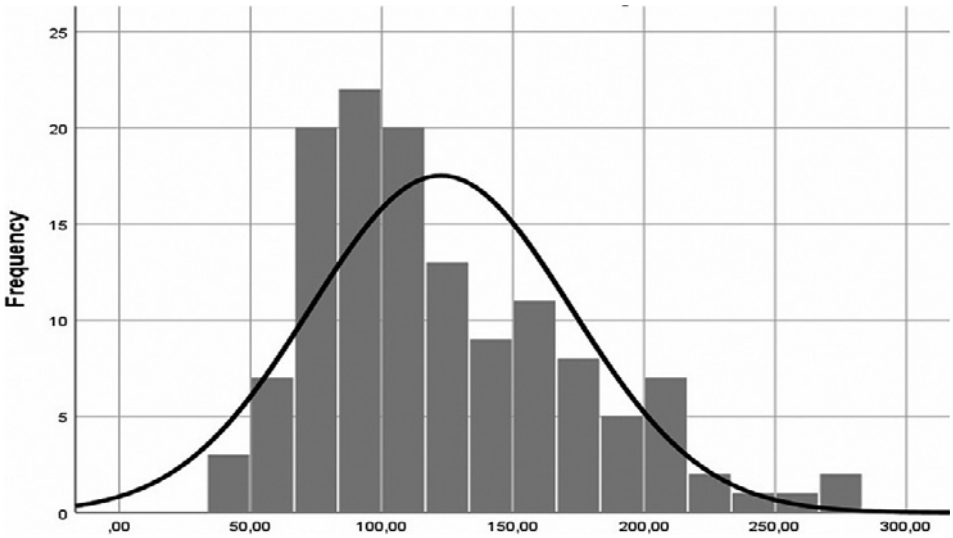

Fig. 1: Time required for choices on lotteries in seconds

	Choice Set	Competitor		Target		Decoy		Choice share (absolute)		
		Prob-ability	Payoff	Prob-ability	Payoff	Prob-ability	Payoff	Compe-titor	Target	Decoy
Lotteries favoring the high payoff option {8 €}	L1	80%	5 €	20%	8 €	-	-	63	1	-
	L2	80%	5 €	30%	8 €	-	-	59	5	-
	L3	80%	5 €	40%	8 €	-	-	58	6	-
	L4	80%	5 €	50%	8 €	-	-	43	21	-
	L5	80%	5 €	60%	8 €	-	-	23	41	-
	L11	80%	5 €	20%	8 €	15%	7 €	61	6	0
	L12	80%	5 €	30%	8 €	25%	7 €	53	14	0
	L13	80%	5 €	40%	8 €	35%	7 €	48	18	1
	L14	80%	5 €	50%	8 €	45%	7 €	33	34	0
	L15	80%	5 €	60%	8 €	55%	7 €	13	54	0
Lotteries favoring the low payoff option {5 €}	L6	50%	8 €	60%	5 €	-	-	59	5	-
	L7	50%	8 €	70%	5 €	-	-	39	25	-
	L8	50%	8 €	80%	5 €	-	-	20	44	-
	L9	50%	8 €	90%	5 €	-	-	10	54	-
	L10	50%	8 €	100%	5 €	-	-	5	59	-
										-
	L16	50%	8 €	60%	5 €	55%	4 €	56	11	0
	L17	50%	8 €	70%	5 €	65%	4 €	28	39	0
	L18	50%	8 €	80%	5 €	75%	4 €	13	54	0
	L19	50%	8 €	90%	5 €	85%	4 €	2	65	0
	L20	50%	8 €	100%	5 €	95%	4 €	2	65	0
Sum L1-L10								379 (59%)	261 (41%)	-
Sum L11-L20								309 (46%)	360 (54%)	1 (-)
Sum L1-L5								246 (77%)	74 (23%)	-
Sum L11-L15								208 (62%)	126 (38%)	1 (-)
Sum L6-L10								133 (42%)	187 (58%)	-
Sum L16-L20								101 (30%)	234 (70%)	-

Tab. 2: Choice shares of the options

bidirectional way. Specifically, given the high payoff lottery is deemed to be the target, the competitor was chosen in 77 % and the target in 23 % of the cases in the competitor-target-group. In the respective triplets including the decoy, the competitor was chosen in 62 % and the target in 38 % of the choices. Thus, under the presence of the decoy, the target gained 15 % thereby rising by a significant 1.63 rate of increase ($\chi^2_{(1)}$=16.41, $p < .01$). On the other hand, when the low payoff lottery is the defined target option, only 187 choices of targets were observed in the competitor-target group which is contrasted by the 234 target choices in the presence of the decoy. Again, the target gained 12 % in that an 1.20 rate of increase in its share is observed which again turns out to be significant ($\chi^2_{(1)} = 9.28$, $p < .01$).

4. Discussion

The main objective of the present work was to examine whether the well-established prize decoy effect remains a robust behavioral choice pattern when it is conceptually replicated under experimental frame equivalence in the domain of risky choices.

As a *first* finding on the overall level, the conceptual replication confirms the original results as published by Simonson and Tversky (1992) in that the decoy effect can be produced in the domain of risky choices presented in binary lotteries. Specifically, as compared to choice sets containing pairs (a competitor and a target), the inclusion of a decoy option in the triplets (competitor-target-decoy group) increases the choice share of the respective target lottery by no less than 13 %. Further, it turns out that in the present setup, the prize decoy effect holds even in a bidirectional manner. That is, the prize decoy is substantially at work regardless of whether the decoy option favors the high payoff lottery as the target or the low payoff lottery as the target.

Second, the present study consequently followed Simonson's (2014) suggestion of ensuring frame equivalence. That is, the general experimental setup (i.e., the frame) of the conducted replication was kept equivalent with respect to the design of the original study to validly assess the effects of the potential extension or conceptual replication under test. Specifically, a sequence of preceding pretests was run in that qualitative group discussions were followed by a comprehensive quantitative survey (i.e., online pre-study). Further, by including/checking additional process measures in the main study it was ensured that the original experimental setup resembles the present setup from the perspective of the subjects selected for the replication. Accordingly, tradeoff-conformance and a proper positioning of options were ensured. Regarding the positioning, as was the case in the original study, the replication evidently included in pairs choices between a non-dominated competitor prize (Simonson and Tversky: $ cash; present study: low/high payoff lottery) and a non-dominated target prize (Simonson and Tversky: attractive pen; present study: low/high payoff lottery). In the triplets, the respective target was then accompanied by a basically similar but not fully inferior option dominated only by the target (Simonson and Tversky: less attractive, second pen; present study: a less attractive lottery slightly lower in the winning chance/payoff than the target but not dominated by the competitor at the same time). Finally, the replication elicited real choices (Simonson and Tversky: selected prizes in terms of cash/pens were delivered to the drawn winners; present study: a lottery choice of drawn winners was really played out).

Third, as for the one and only essential variation in the experimental frame, the applied systematic multiple choice scenario approach as described above has proven to be a proper setup for effectively detecting and analyzing context-dependent shifts in preferences. As a major advantage it facilitates the identification of each subject's heterogeneous tipping points at which a switch in choice from the competitor to the target occurs. While this is far beyond the scope of the present study and therefore, left to further research, it is reasonable to assume that decoys can take an effect on the position of the subjective tipping points of respondents. Precisely, decoys may shift the level of indifference or the preference, respectively, between the target and the competitor toward the target which in turn leads to increased choice shares of the latter. By covering a broader range of slopes of tradeoff-lines between target and competitor (which was realized in the present study by means of a systematic variation in the winning chance of the respective target lottery whilst keeping the position of the respective competitor lottery fixed) the likelihood of detecting switches in preferences logically increases. In contrast, given that a "one-shot-design" observing only one choice based on a particular fixed set of positions of options is applied, conclusions as to what extend context effects are at work can only be drawn for that particular fixed set – but not the frame/domain in general.

However, it has to be noted that whenever multi-stage choice setups are used in studies on decision-making potential biasing influences must be considered such as cognitive overload and reduced motivation, violations of choice independence, potential memory effects or a starting point bias. In this vein, the random payoff mechanism by Grether and Plott (1979) as applied in the present experimental frame meets the researcher's need for both gathering extensive choice data per subject as well as applying real consequences to a subject's choices (for reason of inducing cognitive deliberation). Specifically, while exactly one of the choices made in the experiment will afterwards be determined (e.g., in a draw) as the binding choice that will really be played out, it still affirms incentive compatibility (Braga et al 2009). Thus, it provides a substantial motivation for subjects to truthfully state their preferences between options in every single choice of the multi-stage decision procedure. Moreover, it induces independence of each decision of a subject

thus, avoiding what is termed "portfolio effects" (Grether and Plott 1979; Müller et.al. 2012b).

Finally, behavioral researchers are invited to take the domain of risky choices more frequently into consideration in studies on context effects. As described above, in contrast to the often very multifaceted profiles of products, risky choice options can adequately be designed and assessed in an unambiguous, unequivocal way by means of only a few specific dimensions – which in the case of binary lotteries are the probability of winning and the payoff in case of winning. This way, on the basis of profound pretesting efforts, the required tradeoff conformance between the two attributes as well as the effective positioning of options can be controlled ex ante by the experimenter. As a consequence, this domain largely facilitates examinations to elicit further insights to stimulate the still ongoing debate on the general robustness and the true drivers (moderators, mediators) of context effects [3].

Notes

[1] Two-sided *t*-tests (Welch, unequal group variances assumed) reveal no deviations under the experimental groups in participants' focusing on choices (M_{pair} = 5.83, SD_{pair} = 1.40; $M_{triplet}$ = 5.78, $SD_{triplet}$ = 1.13; $t_{(120)}$ = .23, p = .82) and choice involvement (M_{pair} = 5.42, SD_{pair} = 1.38; $M_{triplet}$ = 5.55, $SD_{triplet}$ = .97; $t_{(113)}$ = -.62, p = .54). However, regarding the total time taken to make all the choices on lotteries, a significant difference is detected (Welch, equal group variances assumed) between the experimental groups (M_{pair} = 111.14 sec, SD_{pair} = 49.53; $M_{triplet}$ = 133.52 sec, $SD_{triplet}$ = 47.71; $t_{(129)}$ = -2.63, p < .01).

[2] In sum, the pre-checks as described in the Chapters 3.4 and 3.5 suggest that participants (a) were equally distributed to the experimental groups, (b) did comprehend the principle and carefully made their choices on binary lotteries in line with their true preferences in both experimental groups, and (c) did not dismiss the decoy option in the experimental group exposed to the triplets (competitor-target-decoy) but rather notice/pay attention to the decoy because they spent 22 seconds more (roughly two seconds more per choice) to make their choices than those subjects who were exposed only to the competitor-target choice sets. Consequently, it is reasonable to conclude that potential differences in choice shares are rooted *ceteris paribus* in the systematic variation of the choice set (pair vs. triplet).

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Keywords

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