Decoy Effects in Financial Service E-Sales Systems

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ABSTRACT

Users of E-Sales platforms typically face the problem of choosing the most suitable product or service from large and potentially complex assortments. Whereas the problem of finding and presenting suitable items fulfilling the user's requirements can be tackled by providing additional support in the form of recommender- and configuration systems, the control of psychological side effects resulting from irrationalities of human decision making has been widely ignored so far. Decoy effects are one family of biases which have been shown to be relevant in this context. The asymmetric dominance effect and the compromise effect have been shown to be among the most stable decoy effects and therefore also carry big potential for biasing online decision taking. This paper presents two user studies investigating the impacts of the asymmetric dominance and compromise effect in the financial services domain. While the first study uses synthesized items for triggering a decoy effect, the second study uses real products found on konsument.at, which is an Austrian consumer advisory site. Whereas the results of the first study prove the potential influence of decoy effects on online decision making in the financial services domain, the results of the second study provide clear evidence of the practical relevance for real online decision support- and E-sales systems.

Categories and Subject Descriptors

H.5.2 [**INFORMATION INTERFACES AND PRESENTATION**]: User Interfaces—*Graphical user interfaces (GUI)*

General Terms

Human Factors, Experimentation, Theory

Keywords

Decision Phenomena, Decoy Effects, Consumer Decision Making, E-Sales Platforms.

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1. INTRODUCTION

It is often hard for customers of E-sales platforms to find suitable products or services (denoted as items for the remainder of this paper) which match their requirements. This challenge is triggered by the size and complexity of the underlying item assortment. Recommender applications facilitate the item identification process by proactively supporting the customer/user in different types of decision scenarios [7]. These systems have been a very active research field for many years which resulted in different solutions for many item domains [10][13][15][19]. What has been widely ignored by the E-sales and recommender community is that once sets of items are presented on some sort of result page, decision phenomena occur which can have significant impacts on customer decision making [30].

One family of effects which have been shown to be relevant in this context are decoy effects [30]. The decoy effect induces an increased attraction of target items with respect to competitor items due to the existence of so-called decoy items. In other words, the target items are those which (should) profit more from the existence of the decoys than the competitors. Two prominent types of decoy effects are the *asymmetric dominance effect* (ADE) [11] and the *compromise effect* (CE) [31]. These two decoy effects differ in terms of the relative positions (described by the corresponding attribute dimensions – in our example: *optical zoom* and *resolution*) of the decoy items in the item landscape (see Figure 1). Compared to the target item, an asymmetrically dominated decoy item (see {d1, d2, d3} in Figure 1) is worse in every dimension (d1) or worse in at least one dimension and equal in the other dimensions (d2 and d3). Compared to the competitor, the asymmetrically dominated decoy item is - though worse in some dimensions - also better in some dimensions. In other words, there are dimensions where the decoy item defeats the competitor, but the decoy defeats the target in none of the given dimensions.

Table 1 shows a simplified example of the ADE (d1) with two attribute dimensions and two items in the domain of digital cameras: The target item is better than the competitor in the dimension resolution (8 mpix) whereas the competitor is better in the dimension optical zoom (6x). In theory, the addition of an asymmetrically dominated decoy the attractiveness of the target increases.

The asymmetry induced by the decoy is most easily shown by the corresponding domination graph which outlines the superiority/inferiority relations between all items in every dimension. Figure 2 is showing the corresponding domination graphs for the example in Table 1.

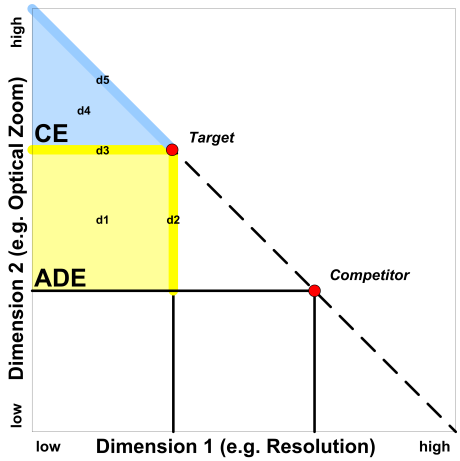

Figure 1: Asymmetrically dominated decoy items (area ADE) and decoy items triggering a compromise effect (area CE) for the benefit of the target.

	Competitor	Target	Decoy
Resolution	8 mpix	5 mpix	6 mpix
Optical Zoom	3x	6x	2x

Table 1: Example of the ADE in the domain of digital cameras. The additional presentation of the decoy shifts the attraction towards the target.

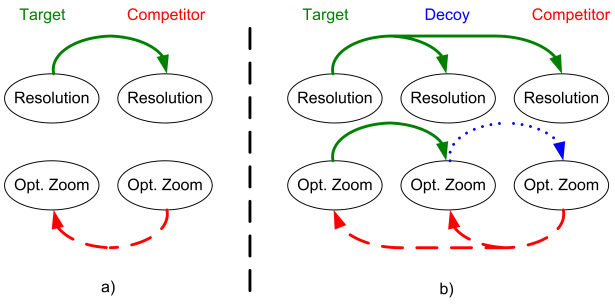

Figure 2: Domination graph: Without decoy (a) the target as well as the competitor dominate each other in one dimension. After inclusion of the decoy (b) the equality seems to change as the target dominates the decoy in both dimensions whereas the competitor dominates the decoy in only one dimension and is even dominated by the decoy in one dimension (blue/spotted arrow).

	Competitor	Target	Decoy
Resolution	10 mpix	7 mpix	3 mpix
Optical Zoom	3x	6x	7x

Table 2: Example of the CE in the domain of digital camera. The additional presentation of the decoy makes the target a good compromise.

In a set without decoy (a), the target and the competitor items are dominating each other in the same number of attributes (i.e. in our case in on attribute dimension each). Due to the inclusion of a decoy item the situation changes (b). Now the target dominates the rest of the set more than the competitor (i.e. three arrows vs. two arrows). As a direct consequence of asymmetrical dominance, d1, d2, and d3 are inferior items such that the overall utility calculated with some objective utility function (e.g. multi attribute utility theory [32]) is lower compared to the target.

Another important decoy effect is the compromise effect [24][31] (see d4 and d5 in Figure 1). The key reason for the existence of this effect is the fact that consumers rather prefer items with medium values in all dimensions than items with extreme values ("good" compromise items). This aspect of human choice behavior is denoted extremeness aversion [28]. Table 2 shows a very simple example.

Again, by the addition of the compromise decoy (d4) the attractivity of the target item is increased compared to the attractivity of the competitor item. The distinction between d4 and d5 is based on an objective utility function [23]. Having such a utility function, all items positioned on the diagonal in Figure 1 are pareto optimal. As a consequence, a d5-decoy has the same overall utility as the target, i.e. does not constitute an inferior item. In this case the only mechanism causing the compromise effect is extremeness aversion. As a d4-decoy also constitutes an extreme item, it triggers extremeness aversion. Additionally it constitutes an inferior item such that the occurring tradeoff contrasts support positive influences for the target. Tradeoff contrasts exist when the advantages of one item outweigh the advantages of another item. In the example of Table 2, the target is much better in the dimension *resolution* than it is defeated by the decoy in the dimension of *optical zoom*. As discussed above, the extreme case of a tradeoff contrast leads to dominance.

The major contributions of this paper are the following: We provide an in-depth analysis of the existence of decoy effects in the financial services domain. In this context we show the existence of decoy effects for result sets with more than three items and also show the effects on the basis of commercial product assortments. The investigations concentrate on the two most important effects, namely the asymmetric dominance effect and the compromise effect. All presented studies have been carried out online and unsupervised and thus preserved a maximum of real world conditions. The results of the presented empirical studies clearly show the impact of decoy effects on item selection behavior of users. Consequently, although not taken into account up to now, these effects play a major role for the construction of recommender and esales applications.

The remainder of this paper is organized as follows. In Section 2 we provide an overview of related work. In Section 3 we discuss the results of a user study based on a synthesized set of financial services. In the following (Sec-

tion 4) we present the results of the second decoy study which is based on a real-world dataset (bankbooks from konsument.at). The impact of decoy effects on the construction of recommender applications is summarized in Section 5. With Section 6 we conclude the paper and provide an outlook of future work.

2. RELATED WORK

The main reason why decoy effects occur in human decision making is that humans often do not act fully rational. Fully rational agents apply some sort of value maximization model like the multi attribute utility theory, multiple regression, or Bayesian statistics in order to find an optimal solution [23][25][32]. All these approaches are computationally very expensive, but human decision taking is normally bounded by time restrictions, limited cognitive capacities, and limited willingness to accept cognitive effort. This is the reason why humans apply in many circumstances heuristic approaches (i.e. rules of thumb).

In contrast to rationality, this concept is called *bounded rationality* or *procedural rationality* [12][22][26][27]. Gerd Gigarenzer has shown in multiple experiments, that heuristic, bounded rational approaches can be as accurate as some fully rational concept like multiple regression [8][9]. Unfortunately, there are cases where bounded rationality acts as a door opener for systematic misjudgements which builds the grounding for decision phenomena/effects. Based on misjudgements due to bounded rationality, these decision effects bear the danger of suboptimal decision making [30].

Decoy effects [1][11][17][20][21][31] are one family of such effects which have the potential of severely impacting on the perceived value of goods and services. Basically, there exist three types of decoy effects: the attraction effect [21], the asymmetric dominance effect [11], and the compromise effect [24][31]. In existing literature, the expressions decoy effect, asymmetric dominance effect and attraction effect are often used synonymously, as the asymmetric dominance effect is the most prominent and stable decoy effect, and the attraction effect could be seen as the more general effect sharing the principle of tradeoff contrasts [28]. A clear distinction between the different effects, the corresponding decoy items, and the different mechanisms working behind the different decoy effects can be found in [29]. Since the 1980's a lot of research has been done in order to investigate decoy effects.

While the existence of such biases has been shown in quite a number of publications there has not been done much research in investigating the impacts of such decision biases in real world sales platforms with realistic environments and on the basis of real market data. This is out of two reasons: First, the investigation of some decision effect under clean room conditions makes it possible to eliminate a maximum of disturbing influences and therefore also maximizes and purifies the measured effect. Second, it is not easy to get good market data as companies are usually very reserved concerning the proliferation of business intelligence. Although the investigation of cognitive biases without real market conditions are indeed relevant from the basic research point of view, the practical relevance for real world applications cannot be assessed because a particular bias can be too small in relation to other overlaying (uncontrolled) effects such that the practical relevance for real world applications is possibly not given.

Closing this gap, this paper is in the line of research investigating decoy effects in realistic settings, as all studies are carried out unsupervised using a recommender like online system. The second study presented in this paper uses real market data (i.e. real capital savings books) taken from an independent consumer information site (www.konsument.at). Moreover, financial services constitutes a high-involvement decision domain, such that decoy effects should be less likely than in low-involvement domains where the user does not put too much energy into the decision process.

3. EXPERIMENT WITH SYNTHESIZED SETS OF FINANCIAL SERVICES

In order to investigate the influence of the Asymmetric Dominance- and Compromise Effects (ADE and CE) on product selection tasks in the financial services domain, a corresponding online user study was carried out. The experiment was two folded: Subjects (Students of the Alpen-Adria Universitaet Klagenfurt) had to accomplish one decision task for each effect (Asymmetric Dominance- and Compromise Effect). Altogether there were 535 valid sessions whereby 358 were from female persons. The subject's age ranged from 18 to 76 years (mean = 25.8, std = 7.2).

3.1 Compromise Effect

Design

The first decision task the subjects had to accomplish was to decide which type of financial service they would choose if they had 5000 Euros. Depending on the products the subjects had to choose from, three groups were differentiated: The *control* group with the product types *public_bonds*, *gold*, *mixed_funds*, group *Decoy_A* with the product types *bankbook* (=decoy), *public_bonds*, *gold*, *mixed_funds*, and group *Decoy_B* containing the product types *public_bonds*, *gold*, *mixed_funds*, *shares* (=decoy) (see Figure 3).

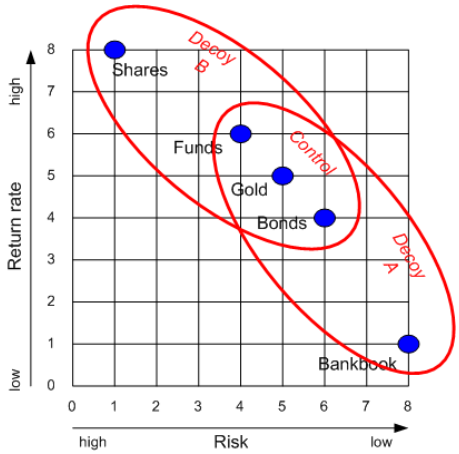

Figure 3: Product landscape of CE-task: three alternative items (funds, gold, bonds) with the corresponding decoy items (shares and bankbook, respectively).

The utility of each product was described in terms of risk and return rate (see Figure 3 and Table 3), whereby low risk and a high return rate was interpreted as good (i.e. high utility value).

As exact preference models were not given equal weighted

Product type	Return Rate	Risk
Bankbook	1	8
Public bonds	4	6
Gold	5	5
Mixed funds	6	4
Shares	8	1

Table 3: Product utilities in CE-task.

Multi attribute utility Theory (MAUT [32]) was used for designing suitable options. Although exact knowledge about user preferences (e.g. attribute weights) would be preferred also a linear equal weight model does the job as all hypotheses are tested on behalf of corresponding control groups revealing the actual preferences. The product types bonds, gold, and funds have the same overall utility (= 10) and therefore no tradeoff contrasts (TC) occur (see Table 3). The extreme options bankbook and shares have a little lower overall utility (= 9). Adding such options leads to TCs and therefore can cause compromise effects.

There were two hypotheses postulated:

- H1: Choice of Bonds is increased by the presence of Bankbook.
- H2: Choice of Funds is increased by the presence of Shares.

Results

Generally, users preferred low risk items over high return items. Comparing the choice distribution of the control group with group Decoy_A [H1], it can be said that more people chose bonds in the decoy group than in the control group (see Figure 4). In fact, the presence of bankbook made bonds the strongest option whereas in the control group gold was the most often chosen product type. The corresponding statistical analysis of bonds choices in the two groups showed a strong tendency (Fisher's Exact Test, one-sided: p <.079). Comparing the choice distribution of the control group and group Decoy_B [H2] the effect is even clearer. The increase of funds choices in presence of shares was highly significant (Fisher's Exact Test, one-sided: p <.001). It is notable that in all three groups the compromise options (i.e. the product groups in the middle) scored better than the extreme options.

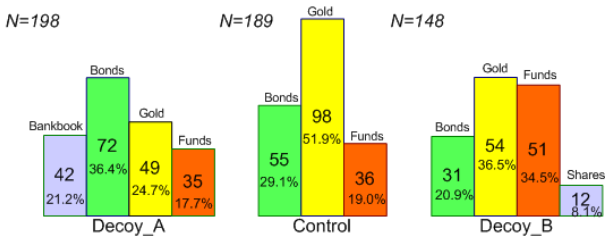

Figure 4: Choice distribution for the CE-task.

3.2 Asymmetric Dominance Effect

Design

In the second decision task the subjects also had to imagine they had 5000 Euros for investment. In this case they only could choose among various bankbooks. Depending on the products the subjects had to choose from, four groups were differentiated: The *control* group contained the products *bankbook1*, *bankbook2*, *bankbook3*. Group *Decoy_1* contained *bankbook1*, *bankbook2*, *bankbook3*, *decoy1*. Group *Decoy_2* contained *bankbook1*, *bankbook2*, *bankbook3*, *decoy2*, and group *Decoy_3* contained *bankbook1*, *bankbook2*, *bankbook3*, *decoy3* (see Figure 5). *decoyX* denotes an asymmetrically dominated decoy for *bankbookX*. When presenting the items to the user, the decoy items (decoy1, decoy2, decoy3) were called *bankbook4* (in order to avoid experimental side effects triggered by the item name).

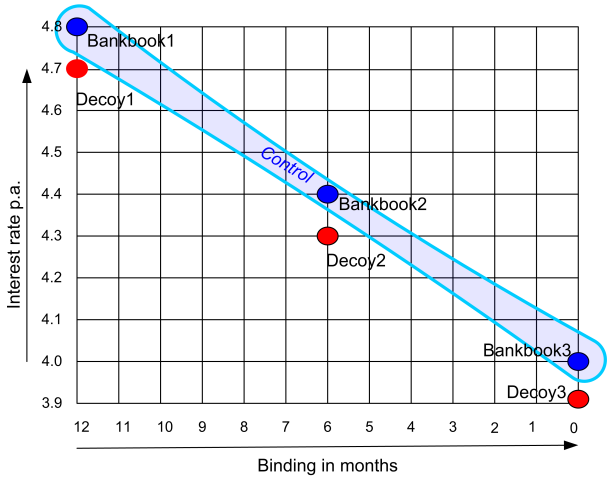

Figure 5: Product landscape of ADE-task: three alternative bankbooks with the corresponding decoy items.

The utility of each product was described in terms of interest rate per year (p.a.) and binding in months (i.e. the time within it is not possible to withdraw the money), whereby low binding and high interest rate was interpreted as good (i.e. high utility value). Figure 5 and Table 4 summarize the settings.

Product	Interest rate p.a.	Binding in months
Bankbook1	4.8	12
Bankbook2	4.4	6
Bankbook3	4.0	0
Decoy1	4.7	12
Decoy2	4.3	6
Decoy3	3.9	0

Table 4: Product attributes in ADE-task.

In the control group no tradeoff contrasts (TCs) where existent as the product with the highest interest rate had also the longest binding and vice versa. The decoy products (decoy1, decoy2, decoy3) constitute asymmetrically dominated alternatives (e.g. decoy1 is only dominated by bankbook1, etc). Additionally to the ADE-constellation there can also be found further TCs between the decoy and the non dominating bankbooks (i.e. compromise effects).

There were three hypotheses postulated:

- H3: Choice of Bankbook1 is increased by the presence of Decoy1.
- H4: Choice of Bankbook2 is increased by the presence of Decoy2.

- H5: Choice of Bankbook3 is increased by the presence of Decoy3.

Results

In this case users preferred high return rates over binding in years. Comparing the number of subjects choosing bankbook1 in the control group and in the group Decoy_1 one can remark a non-significant increase by 1.5% (Fisher's Exact Test, one-sided: p <.448, see Figure 6) [H3]. Comparing the choice distribution of the control group and group Decoy_2 the effect was significant. The increase of bankbook2 choices in presence of decoy2 made up 12.1% (Fisher's Exact Test, one-sided: p <.001) [H4]. The decoy3 in the group Decoy_3 increased the bankbook3 choices by 6.8% compared to the control group (Fisher's Exact Test, one-sided: p <.127) [H5].

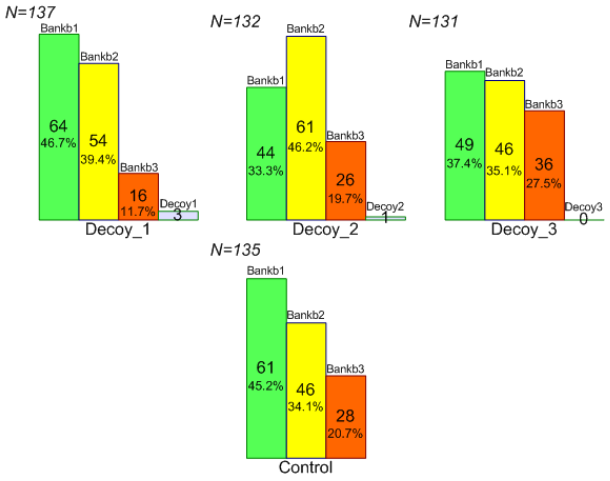

Figure 6: Choice distribution for the ADE-task.

4. EXPERIMENT WITH A REAL-WORLD SET OF FINANCIAL SERVICES

Design

The first step in order to come up with a realistic set of items was to find a suitable product domain. The domain of capital savings books was found to be perfect for our purposes because of the following reasons:

- Savings books can be well described by two dimensions, which is binding (i.e. the period in which it is not possible to withdraw the money) and interest rate (p.a.). This offers the possibility to stick to the simple two-dimensional item landscape.
- There is lots of comparable market data available.

The experimental items for the different choice sets were chosen on the basis of a products list given by Konsument.at, a well-known independent consumer information site.[1]. Konsument.at listed capital savings books having a binding period between one and five years. The products of the two- and four year categories having the highest interest rates of that category were chosen as competing items A and B.

[1]Please note that the experiment was already carried out in 2009, such that the market data was up to date at this time.

Additionally, two asymmetrical dominated decoy items dA (decoy for A) and dB (decoy for B) were defined by choosing the items with the second best interest rates of the two and four year categories. The extreme products with a binding period of one and five years showing the highest interest rates in the respective categories were constituting the corresponding compromise decoys cA (decoy for A) and cB (decoy for B). Table 5 and Figure 7 are showing the resulting product landscape of the experimental items. It has to be noted that the design is not completely symmetric as the dominated items (dA and dB) are always inferior in the binding dimension, such that dA constitutes a d3-decoy (see Figure 1) whereas dB constitutes a d2-decoy.

Item	A	B	dA	dB	cA	cB
Interest rate p.a. (%)	3,00	3,77	2,75	3,60	2,25	4,00
Binding (years)	2	4	2	4	1	5
Bank	Deniz	Auto	Erste	Direkt	Direkt	Direkt

Table 5: Attribute values of the experimental items used in the different experimental groups.

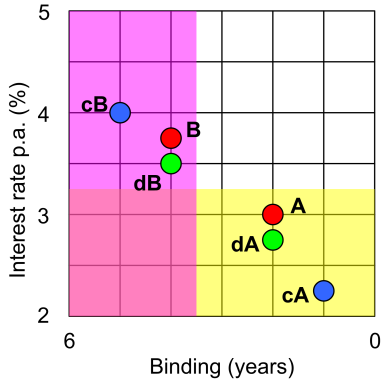

Figure 7: Product landscape: two alternative items with the corresponding decoy items.

Grounding on the experimental super set in Table 5 and Figure 7, experimental sets were defined and categorised according to the decoy added to the core setting (i.e. only the competing items A and B). The control (Control) set is consisting of only the competing items A and B. In the decoy sets one out of four possible decoys (dA, dB, cA, cB) was added, which should evoke the asymmetric dominance- or compromise effect (ADE or CE) for the benefit of A or B, respectively.

SetId	Item 1	Item 2	Item 3	Decoy Type
0	A	B		Control
1	A	B	dA	ADE - pro A
2	A	B	dB	ADE - pro B
3	A	B	cA	CE - pro A
4	A	B	cB	CE - pro B

Table 6: Experimental item sets and type of decoy.

The experiment was designed to be carried out online and unsupervised. Subjects (students of University of Klagenfurt) were invited by email containing a link to the online

experiment to take part in the experiment. Figure 8 is showing a screenshot of one experimental situation. Subjects were asked to imagine to have 10000 Euros for investment and to choose their favorite option out of a set of proposed items (i.e. the capital savings books). The subjects were assigned randomly to one of the defined settings. Furthermore, the position of the presented items was random.

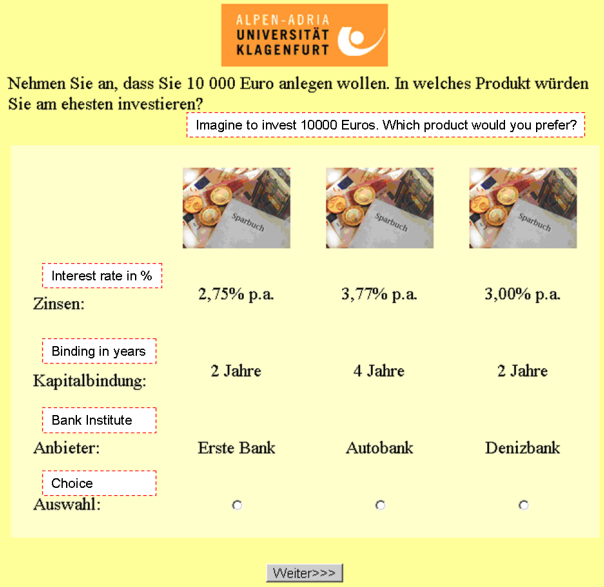

Figure 8: Screenshot of the online experiment. The translations have been added post hoc.

Following the current theory, the control set should offer the most objective view on the competing items A and B as there are no decoy effects, and thus should build the baseline. With respect to this baseline, the following hypotheses were formulated:

- H1: In setting 1, the asymmetric dominated decoy shifts attraction for the benefit of A (damages B).
- H2: In setting 2, the asymmetric dominated decoy shifts attraction for the benefit of B (damages A).
- H3: In setting 3, the compromise decoy shifts attraction for the benefit of A (damages B).
- H4: In setting 4, the compromise decoy shifts attraction for the benefit of B (damages A).

Results

Table 7 shows the experimental outcome for all five settings. It becomes obvious that only in group 2 the decoy was able to lift the number of target choices. In the other groups it seems that the choices of decoys were too many such that the absolute number of choices of both, A and B, were decreased. For the groups 3 and 4, this is not surprising, as non-dominated decoys (like a CE decoy) do not represent inferior options. The reason why the decoy in group 1 was chosen unexpectedly often must be the bank name. Whereas all other decoys were products from 'Denizbank', the decoy in group 1 was a product of 'Erste Bank', which obviously is a bank with better reputation.

In order to carve out the asymmetric influence of the decoy on A and B, Table 8 lists only the choices of A or B, neglecting the decoy choices. Now it is revealed that except in group 3, where the relation between A and B kept almost the same (i.e. H3 is not supported), the decoy pulled away more choices from the competitor than from the target, i.e. damaged the attraction of the target less than the attraction of the competitor (i.e. H1, H2, H4 are supported). Hence, the decoys rather caused an asymmetric detraction rather than an asymmetric attraction. The reason, why there could not be revealed a compromise effect in group 3, is most probably the distance between the decoy and the target (see Figure 7). The distance (i.e. cumulated attribute differences) plays a significant role for the strength of the decoy, such that the bigger difference is the less is the asymmetric influence of an intended decoy.

Although the absolute choices of a target product are not imperatively raised by a decoy item, there are nevertheless two possibilities how bank institutes could benefit from decoy effects. First, it is possible to shift the attraction within a bank's product assortments, as the bank's reputation (i.e. name) cannot have any influence (i.e. it is the same for all products). For example, it would be possible to decrease the attraction of products which show low marginal return (i.e. competitor) or to increase the attraction of products which show high marginal return. In this case, because of the possibly many decoy choices, it would be crucial that the decoy also shows a high marginal return rate in order to improve the overall result.

The second possibility for exploitation addresses the possibility for a bank itself being the target. In this case it is more convenient to think about products as parts of the bank's product portfolio. When considering portfolios, the introduction of a decoy product could significantly take away choices of the competitor banks portfolio for the sake of the target bank's portfolio. Thereby it does not matter which of the products in the portfolio benefits.

SetId	Decoy Type	A	B	Decoy	Total
0	Control	31	16		47
		66.0%	34.0%		100.0%
1	ADE - pro A	31	9	9	49
		63.3%	18.4%	18.4%	100.0%
2	ADE - pro B	24	24	2	50
		48.0%	48.0%	4.0%	100.0%
3	CE - pro A	25	13	9	47
		53.2%	27.7%	19.1%	100.0%
4	CE - pro B	20	16	18	54
		37.0%	29.6%	33.3%	100.0%

Table 7: Results of the experiment.

5. RELEVANCE FOR E-SALES SYSTEMS

In principle, decoy effects occur in any system where competing choice options are presented concurrently. Obviously, this is the case for many e-sales systems like shop applications, recommender- and configurations systems, or many other online decision support systems. Although, depending on the application, there are various situations during the user sessions where cognitive biases like decoy effects can play an important role, the most important phase for decoy effects constitutes the product presentation phase. During this phase purchase offers (in shopping systems) or recom-

SetId	Decoy Type	A	B	Total
0	Control	31	16	47
		66.0%	**34.0**%	100.0%
1	ADE - pro A	31	9	40
		77.5%	**22.5**%	100.0%
2	ADE - pro B	24	24	48
		50.0%	**50.0**%	100.0%
3	CE - pro A	25	13	38
		65.8%	**34.2**%	100.0%
4	CE - pro B	20	16	36
		55.6%	**44.4**%	100.0%

Table 8: Results of the experiment, leaving out decoy choices.

mended items (in recommender systems) are typically presented concurrently and the user (consumer) finds himself in some sort of decision dilemma. Here, decoy effects can manifest in suboptimal decision making as decoy effects bias the perceived utility of the concurring options. This may further result in product purchases which are not optimal for the consumer, the vendor, or both.

In the case of dialog-based systems (i.e. systems which gather user information by posing questions and proposing possible answers) decoy effects can also influence the answers given by the users during the dialog. This can influence the accuracy and furthermore the time-efficiency of such systems. For case case-based systems like tweaking-critiquing recommenders with multiple items to be criticized concurrently [5] this is obvious as any cycle basically constitutes a new product presentation phase.

Another aspect which is somewhat orthogonal to the biasing of decisions is the fact, that decoy effects can have a positive effect on the decision confidence [30]. This means that decoys manage to seemingly alleviate a decision situation such that users feel more confident about their decisions. Altogether, the above mentioned aspects offer a big potential for e-sales systems for optimizing the decision making process and also the quality of the taken decisions.

6. CONCLUSIONS AND FUTURE WORK

In this paper we have presented the results of a series of empirical studies that clearly show the impact of different types of decoy effects on the item selection behavior of a user in the context of financial services decision making. The existence of decoy effects has been shown for non-classical scenarios with more than three items in the result set in order to show the existence of decoy effects for real world scenarios. Therefore, we analyzed the existence of decoy effects on the basis of the bankbook dataset provided by the Austrian consumer advisory platform *konsument.at*. The results of our studies have a significant impact on the design of future e-sales systems since it is obvious that item selection behavior is not based on a complete analysis of the set of offered or recommended items. Item selection is often subject to the application of a set of simple heuristics which is the reason for the observed decoy effects. Taking into account these heuristics, and thus better understanding human decision taking, can have positive effects in terms of a higher confidence in the set of presented items. Moreover, controlling such effects also offers the possibility of increasing the probability of selection of certain items.

Apart from the ongoing investigation of diverse decision biases in the context of e-sales systems, a main focus of our future work is the implementation of a framework which allows to identify and control decision biases. In particular, we are working on a decoy filter for recommender systems which is able to identify biased item sets and calculates a set of items to be removed or added in order to objectify the decisions. Specifically in the context of recommender systems this could lead to a big improvement in terms of recommendation accuracy and user trust.

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