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Testing Alternative Explanations of Phantom Decoy Effects

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ABSTRACT

Phantom decoys are alternatives that asymmetrically dominate a targeted alternative and yet lead to increased selection of the target when the decoy is declared to be unavailable. This effect is difficult to explain within most standard theoretical accounts of decoy effects. The current experiments tested between three explanations of this effect: (1) the relative advantage model based on loss aversion, (2) similarity substitution, and (3) range weighting. In Experiment 1, participants were presented trinary choice sets, with half of the sets containing a phantom decoy in one of five possible locations within the attribute space. Phantom decoy effects were robust across all decoy locations but one, and the pattern of effects most closely corresponded to predictions of the relative advantage model. Experiment 2 used a within-subjects manipulation of the five phantom decoy locations. The overall pattern of effects most closely corresponded to predictions from the relative advantage model, as did the pattern for the group of participants who exhibited the strongest phantom decoy effects. Copyright © 2007 John Wiley & Sons, Ltd.

KEY WORDS context effects; attraction effect; decoy effects; choice; phantom decoy; loss aversion

INTRODUCTION

There is extensive evidence of the context-dependent nature of choice. Much of this work is based on the inclusion of alternatives in the choice set that are designed to alter preference relationships among the other alternatives in the set. Such contextual alternatives are called decoys, and they have been demonstrated to have robust and powerful effects on choice (e.g., Ariely & Wallsten, 1995; Choplin & Hummel, 2005; Dhar & Glazer, 1996; Huber, Payne, & Puto, 1982; Huber & Puto, 1983; Pettibone & Wedell, 2000; Simonson, 1989; Wedell, 1991; Wedell & Pettibone, 1996). For example, although a person may be indifferent between a target alternative (**T**) and its competitor (**C**) in pairwise choice, he or she may strongly prefer **T** over **C** in a trinary choice task that includes the decoy. Numerous explanations of decoy effects have emerged, although few of these can account for all of the observed decoy effects using a single mechanism.

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Particularly challenging to many of the proposed explanations is the effect of the so-called ''phantom decoy,'' which was first introduced by Pratkanis and Farquhar (1992) and refers to a highly attractive alternative included in the choice set but unavailable at the time of choice. This creates a situation similar to a ''bait and switch'' by your local retailer, in which limited quantities of a superior product at a superior price are advertised with the intent of selling other, more available and more profitable products. As such, studying the phantom decoy can provide important insights into this marketing technique, as well as insights into the contextual dependence of choice. From a marketing perspective, it is important to know how the relationship between the attributes of the unavailable and ostensibly superior product and its competitors affects choice of a targeted product. More so than other types of decoys, there are many potential ways of presenting a phantom alternative, and some may be more effective than others in influencing preference. The theoretical explanations for these effects, such as similarity to the phantom, perceived losses and gains, or perhaps the relative weighting of dimensions, make different predictions as to which phantoms will be effective. These are the key issues explored in the research presented here.

The studies presented in this article have two goals. First, we wished to explore the impact that different types of attractive but unavailable alternatives have on choice. To this end, the current study explores the effects of five different types of phantom decoys by varying the location of the phantom alternative in the attribute space. This goal has implications for the applied use of phantom decoys for influencing a variety of consumer and organizational behaviors. Second, we wished to clarify the mechanisms guiding phantom decoy effects by comparing the results of these manipulations with predictions from potential explanations of the phantom decoy effect. Although models such as similarity-substitution (Pettibone & Wedell, 2000) have been proposed specifically to explain the phantom decoy effect, they have not been tested directly until now. Thus, this research expands our theoretical understanding of the contextual sensitivity of choice, as well as our understanding as to why phantom decoys seem to operate differently from other decoys. To see why the phantom decoy effect is difficult to explain, we first present basic explanations of the standard asymmetrically dominated decoy, which is known to produce the most robust effects on choice (Huber & Puto, 1983; Huber et al., 1982). Following this, we explore models of phantom decoy effects that lead to different and testable predictions of choice behavior.

Explanations of decoy effects

Figure 1 illustrates locations of several choice alternatives in a two-dimensional space. In this representation, the value of **T** is superior to **C** on dimension 2 but not dimension 1. The dotted line represents an equi-preference contour that assumes equal weighting of both dimensions. Because **T** and **C** lie on the same contour, each is predicted to be chosen 50% of the time in pairwise choice. The shaded region represents locations in the attribute space of alternatives that are dominated by **T**. The other labeled alternatives represent possible decoys included in a trinary choice set along with **T** and **C**. First consider the standard asymmetrically dominated decoy, designated $\mathbf{AD_R}$ because it is asymmetrically dominated by **T** and extends the range downward on **T**'s poorer dimension. Although $\mathbf{AD_R}$ is rarely chosen, it typically leads to much greater choice of **T** (Huber et al., 1982).

Explanations for the asymmetric dominance effect can be broken down into three types of theories: range-weighting, value-shift, and relational-valuation. Range-weighting explanations suggest that the extension of the range on dimension 1 due to the decoy leads to less relative weighting of that dimension. Contrary to this explanation, several researchers have produced evidence for the opposite occurrence: Range extension leads to greater weighting of a dimension (Mellers & Biagini, 1994; Wedell, 1998; Wedell & Pettibone, 1996).

Value-shift models propose that $\mathbf{AD_R}$ enhances the dimensional value of the target on dimension 1 relative to the competitor through processes that produce contrast effects in dimensional judgment. Support for this explanation has come primarily from demonstrations that dimensional judgments and similarity judgments

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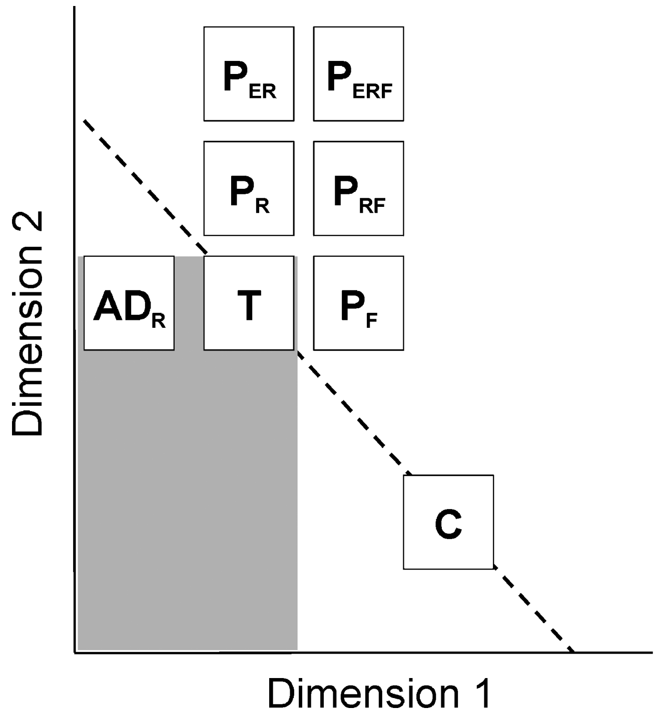

Figure 1. Placements of the standard asymmetrically dominated range decoy (**AD$_R$**), the phantom range decoy (**P$_R$**), the phantom extreme range decoy (**P$_{ER}$**), the phantom frequency decoy (**P$_F$**), the phantom range-frequency decoy (**P$_{RF}$**), and the phantom extreme range-frequency decoy (**P$_{ERF}$**). All decoys target alternative **T** over alternative **C**. The shaded region represents values dominated by **T**

reflect a contrastive shift of **T** along dimension 1 (Choplin & Hummel, 2005;[1] Dhar & Glazer, 1996; Pettibone & Wedell, 2000; Wedell & Pettibone, 1996). Despite these demonstrations, another process seems to be needed to deal with situations such as compromise decoys, in which shifts in dimensional values do not favor the target, yet still lead to reliable shifts in preference (Pettibone & Wedell, 2000).

Relational-valuation models propose that the targeted alternative gains preference strength through its relationships to other alternatives in the set, even though dimensional values and weights may remain constant. One way this may happen is through a desire to justify choices (Simonson, 1989). In support of this explanation, research using justifiability ratings has verified that participants find the target easier to justify when an asymmetrically dominated, inferior, or compromise decoy is included in the set (Pettibone & Wedell, 2000; Wedell & Pettibone, 1996). Furthermore, Simonson (1989) demonstrated that the effect of **AD$_R$** decoy on choice significantly increased when participants were told that they would have to justify their choices publicly. Thus, the goal of justifying choices may be one reason that people value relationships such as asymmetric dominance.

The relational-valuation component might also emerge as a result of the dynamics of the decision-making system. Roe, Busemeyer, and Townsend's (2001) multi-alternative decision field theory (MDFT) provides an example of how relational processing may occur as a result of inhibitory connections between alternatives in

[1]It should be noted that the model proposed by Choplin and Hummel (2004) only predicts contrast effects in specific situations, namely when actual differences are less than a comparison-suggested difference apart and people do not judge the alternatives to be approximately the same. In other cases the model actually predicts assimilation effects.

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a connectionist network. Their model, which incorporates similarity-driven local competition between alternatives resulting from inhibitory connections, is able to account for a variety of decoy effects, including asymmetrically dominated, inferior and compromise decoys. The relational processing of alternatives represented in MDFT does not depend on the goal of justification, although such a goal might reasonably increase the weight given to the inhibitory processing of similar alternatives. On the other hand, the fact that decoy effects can be found in other species, such as honeybees, humming birds and gray jays (Hurly & Oseen, 1999; Shafir, Waite, & Smith, 2002), implies that justification is not necessary for the effect to occur.

Another relational-valuation mechanism for explaining decoy effects is based on loss aversion, as described in the relative advantage model of Tversky and Simonson (1993). In this model, each alternative is compared with the other alternatives in terms of losses and gains, but losses are given greater weight than gains. This model can account for a wide variety of decoy effects with a single common mechanism. It has also served as the basis for a dynamic neural network model of multi-alternative choice that explains several decoy effects (Usher & McClelland, 2004). As we shall see, an important aspect of this model is that it makes clear predictions for the phantom decoy effect.

Explanations for the phantom decoy effect

Regardless of the specific mechanisms posited, it would seem that the basic effects of adding an asymmetrically dominated, inferior, or compromise decoy can be explained by two general processes (shifts in dimensional value and relational valuation). Most of these models, however, have difficulty explaining phantom decoy effects. The results of the phantom decoy manipulations reported in the literature have been particularly perplexing in that the most of the accounts we have described would predict effects opposite from what has been obtained (Highhouse, 1996; Pettibone & Wedell, 2000; Pratkanis & Farquhar, 1992). This is because the phantom decoys typically both asymmetrically dominate the target and extend the range upward on the target's best dimension, two factors that should lead to reduced rather than enhanced choice of the target.

The situation can be better understood by referring to Figure 1. All decoys that are shown are designed to favor the selection of **T**. Note that the phantom decoys (labeled with a **P**) are presented in the choice set but are designated as unavailable. First consider the $\mathbf{P_R}$ decoy (phantom alternative with range extension), which extends the range upward on **T**'s favored attribute and which also asymmetrically dominates **T**. Most of the models described above would predict that one or both of these features should reduce the choice of **T** rather than enhance it. After all, **T** seems a less justifiable choice when it is dominated by $\mathbf{P_R}$ and **C** is not. Similarly the local competition of **T** with $\mathbf{P_R}$ should hurt not help **T** within the connectionist framework (Roe et al., 2001). Furthermore, dimensional valuation models would typically predict lower attractiveness of the dimension 2 attribute of **T**, leading to lower overall attractiveness for **T**. However, rather than reduce the choice of **T**, the $\mathbf{P_R}$ decoy increases the choice of **T** over **C**.

Of the models successfully accounting for the asymmetric dominance effect, only the relative advantage model (Tversky & Simonson, 1993), which assumes losses are valued more than gains, can account for $\mathbf{P_R}$ favoring **T** without requiring additional assumptions. In the relative advantage model, the function relating the difference between losses and gains (designated in the model as disadvantages and advantages) is assumed to be a convex increasing function so that as the value increases, there is a corresponding increase in the difference between the loss of that value and the gain of that value. Because **T** and **C** fall on the same preference contour in Figure 1, **C**'s advantage over **T** on dimension 1 is matched by **T**'s advantage over **C** on dimension 2, and conversely, their disadvantages are matched. It is only in comparison to the third alternative, $\mathbf{P_R}$, that relative advantages differ. Note that **T** has no advantage relative to $\mathbf{P_R}$ and its disadvantage is a subset of the disadvantage shared by **C** relative to $\mathbf{P_R}$. Because we can eliminate the shared disadvantage, the remaining disadvantage of **C** to $\mathbf{P_R}$ is the difference between **T** and **C** on dimension 2, and similarly the

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advantage of **C** to $\mathbf{P_R}$ is the difference between **C** and **T** on dimension 1. Given the structure of alternatives **T** and **C**, this disadvantage will outweigh the advantage so that **C** suffers by comparison.

Figure 2 illustrates the relative valuation process for the $\mathbf{P_R}$ decoy condition. The amount of losses for **T** and **C** relative to $\mathbf{P_R}$ are shown by black double-headed arrows. Because losses are valued more than gains, the perceived loss is extended, as represented by the gray-line extensions to the actual losses generated by multiplying losses by a factor of 1.5. No such extension is applied to the gains. The right panel of Figure 2 then illustrates how combining the extended losses with gains can lead to the target being valued higher relative to the competitor.

Another alternative explanation of phantom decoy effects can be derived from the relationship between attribute weighting and attribute range. Weighting explanations of the effects of the $\mathbf{AD_R}$ have proven to be problematic because of evidence that extending the range increases rather than decreases the weight of the dimension (Mellers & Biagini, 1994; Wedell & Pettibone, 1996). The phantom decoys used in past research have all extended the range on the targeted alternative's favored dimension. If range extension leads to increased weight of that dimension, then the target should be more likely to be chosen when the phantom decoy is unavailable.

One interesting aspect of this hypothesis is that it can account for the lack of an effect of phantom decoys on overall ratings of attractiveness reported by Pettibone and Wedell (2000). This is because the greater weight given to **T**'s favored dimension would be offset by the reduced attractiveness value of **T** on that dimension as predicted by range-frequency theory and verified empirically (Parducci, 1995). The range-weighting hypothesis, however, would need some modification to explain why phantom decoy effects occur in choice but not judgment. One such modification derives from the well-documented finding that choice is more lexicographic than judgment (Tversky, Sattath, & Slovic, 1988; Wedell & Senter, 1997). Thus, while range extension may result in only a moderate increase in the corresponding weight of that dimension in judgment, it might lead to a much greater increase in weight for choice, as participants tend to weight attributes less evenly in choice.

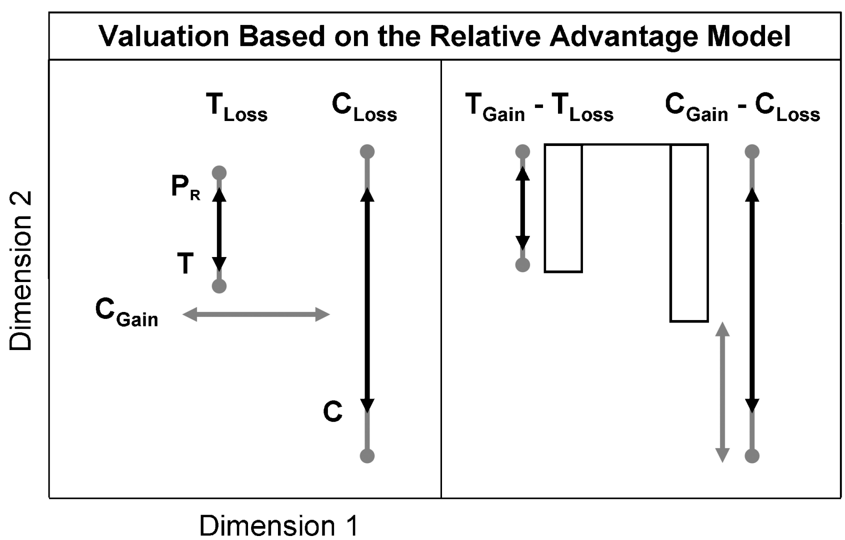

Figure 2. Demonstration of valuation under the relative advantage model. The left panel shows locations for the target (**T**), competitor (**C**), and range phantom ($\mathbf{P_R}$). The black double-arrowed lines indicate losses for **C** and **T** relative to $\mathbf{P_R}$. The gray extension lines on these indicate the magnification of loss under loss aversion (by a factor of 1.5). The gray double-arrowed lines indicate the gain for **C** relative to $\mathbf{P_R}$. The right panel shows how these gains and losses are combined to result in the overall value of **T** being less negative than that of **C**

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A third hypothesis, called similarity-substitution, was proposed by Pettibone and Wedell (2000) in order to deal with the presence of a phantom decoy effect in choice, but no effect of the phantom on attractiveness or justifiability ratings. This pattern of findings led to the speculation that the selection of **T** in the presence of $\mathbf{P_R}$ may be due to substituting the most similar alternative for the preferred but unavailable alternative, referred to as the similarity-substitution hypothesis. There are three attractive features of this hypothesis. First, it is consistent with the effect occurring in choice (where a substitution may be made) but not in judgment (where substitution is not a factor). Second, substituting the most similar alternative makes sense from a resource-conservation perspective, as one need not re-compute preferences, but rather one simply chooses the alternative most similar to the one that is preferred. Third, it has the testable implication that phantom decoy effects should decrease with decrease in similarity between the target and the decoy, assuming similarity is graded and falls off rapidly.

Testing between explanations of phantom decoy effects

Thus far we have discussed three explanations of the phantom decoy effect. The first is based on the loss-aversion principle used in the relative advantage model (Tversky & Simonson, 1993). The second is based on the principle that the extension of the range of a dimension leads to greater weighting of that dimension (Mellers & Biagini, 1994). The third is based on using similarity to the phantom decoy to guide choice (Pettibone & Wedell, 2000). Differences in the proposed mechanisms provide a means to test among them by varying the location of the phantom decoy in the attribute space.

In addition to the $\mathbf{P_R}$ decoy, we used four other phantom decoy locations to examine how the effect varied as a function of range extension and similarity to the target. Figure 1 schematically represents different phantom decoys we used in our studies. The $\mathbf{P_{ER}}$ decoy is the extreme range decoy that extends the range on dimension 2 beyond the extension made by the $\mathbf{P_R}$ decoy while maintaining the same value on dimension 1. The $\mathbf{P_F}$ decoy manipulates the frequency ranking along dimension 1, making the target the third best option instead of the second best option on this dimension, but has the same value as **T** on dimension 2. Thus, the $\mathbf{P_F}$ decoy does not extend the range on either dimension. The $\mathbf{P_{RF}}$ decoy maintains the same range extension as $\mathbf{P_R}$, but also manipulates the frequency ranking of alternatives on dimension 1. Finally, the $\mathbf{P_{ERF}}$ combines the extreme range manipulation of the $\mathbf{P_{ER}}$ decoy with the frequency ranking manipulation of the $\mathbf{P_F}$ decoy. This may be considered the phantom decoy with the least similarity to **T** as it shares no common dimensional value and it is farthest away in the attribute space.

The three explanations predict different patterns of effects across the decoy locations shown in Figure 1. First, the similarity-substitution explanation predicts that the effects of the phantom decoy should decrease as similarity to the target decreases. Thus, effects should be largest for the $\mathbf{P_R}$, $\mathbf{P_F}$, and $\mathbf{P_{RF}}$, which are closest to **T**, and smallest for $\mathbf{P_{ER}}$ and $\mathbf{P_{ERF}}$ decoys, which are farthest. The range-weighting explanation predicts a much different pattern. First, it predicts no significant effect for the $\mathbf{P_F}$ decoy, as range was not extended on either dimension, and so weights should be unaffected. Second, the greater range extension for the $\mathbf{P_{ER}}$ and $\mathbf{P_{ERF}}$ decoys should lead to potentially greater effects rather than the diminished effects predicted by the similarity-substitution explanation. Finally, the loss-aversion principle of the relative advantage model (Tversky & Simonson, 1993) predicts a difference in the magnitude of effects for the $\mathbf{P_R}$ and $\mathbf{P_{ER}}$ decoys relative to the $\mathbf{P_F}$, $\mathbf{P_{RF}}$, and $\mathbf{P_{ERF}}$ decoys. The basic prediction is that effects for the first group should be greater than the effects for the second group, because the second group increases the disadvantages of the target without increasing the disadvantages of the competitor.

Generating specific predictions

In this section we build on the qualitative pattern of predictions described above by developing more specific quantitative predictions. To do this, we used a simple logistic model of choice that included valuation

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parameters from the different decoy models described above. We substituted in values that mimicked the choice sets described in Figure 1, thus generating specific predictions from the three models concerning relative preference for the target. Below we clarify our assumptions about (1) the nature of loss aversion, (2) the determination of similarity, and (3) how range extension affects weighting, and also provide quantitative results for each.

For all examples, the assumed coordinates in the two-dimensional space for the different alternatives are as follows: $\mathbf{T} = \{3, 5\}$, $\mathbf{C} = \{5, 3\}$, $\mathbf{P_R} = \{3, 6\}$, $\mathbf{P_{ER}} = \{3, 7\}$, $\mathbf{P_F} = \{4, 5\}$, $\mathbf{P_{RF}} = \{4, 6\}$, and $\mathbf{P_{ERF}} = \{4, 7\}$ (and complementary locations for the decoys favoring **C**). In all cases we assume equal weighting of dimensions 1 and 2 in pairwise choice and in trinary choice, except as specified for the range-weighting hypothesis. To generate choice proportions, we assume a simple logistic function for all models of the form:

$$\Pr(\mathbf{T}) = \frac{1}{1 + \exp(-c(V_{\mathbf{T}} - V_{\mathbf{C}}))} \tag{1}$$

where $V_{\mathbf{T}}$ and $V_{\mathbf{C}}$ are the valuations based on the specified models and c is a scaling factor. Pr(**T**) represents the proportion of total trials in which the function predicts the selection of the targeted alternative. Value functions were specified for each model so only one parameter (c) was estimated in order to equate the effect for the $\mathbf{P_R}$ decoy across all models (we equated these at a choice difference of 0.10, a fairly commonly obtained difference). In the following sections, we describe how this logistic choice function needs to be altered to fit the assumptions of each of the three models.

Similarity-substitution predictions

The typical approach to calculating distance within a two-dimensional space is to use a Minkowski metric. As the two dimensions being combined are often separable, a city-block metric (representing an exponent of 1.0) was considered more appropriate here. Assuming equal weighting of dimensions, the distance between alternatives in the two-dimensional space is given by:

$$d_{ij} = 0.5\left|X_{i1} - X_{j1}\right| + 0.5\left|X_{i2} - X_{j2}\right| \tag{2}$$

where X denotes the coordinate location of the given alternative (i or j) on the given dimension (1 or 2). Shepard (1987) has examined the relationship between similarity and distance in a large number of studies and concluded it typically follows the form of an exponential decay function, whereby similarity drops off rapidly with distance. We adopt the exponential decay function so that

$$S_{ij} = \exp(-d_{ij}) \tag{3}$$

where S_{ij} represents the similarity between alternatives i and j. Assuming that the phantom alternative is the favored one, then the relative value of the alternatives is determined by the relative similarity to the phantom. Based on this idea, we substitute the similarity between the phantom decoy and **T** for $V_{\mathbf{T}}$ and the similarity between the phantom decoy and **C** for $V_{\mathbf{C}}$. The value of c for this model was 0.38. The predicted difference in the proportion choosing **T** when **T** is favored versus when **C** is favored across the five decoys is presented in the column labeled "SS" in Table 1. This pattern demonstrates that extension of the range leads to reduced effects of the phantom decoy, with effects weakest for the $\mathbf{P_{ERF}}$ decoy.

Range-weighting predictions

According to the range-weighting hypothesis, a dimension is given greater weight with extension of the range. A simple way to do this is to equate the range with the values presented and let the weight given to

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Table 1. Model predictions of phantom decoy effects as a function of decoy type

Decoy	SS	RW1	RW2	RA1	RA2
P_R	0.10	0.10	0.10	0.10	0.10
P_{ER}	0.06	0.17	0.10	0.10	0.08
P_F	0.07	0.00	0.00	0.05	0.05
P_{RF}	0.04	0.10	0.10	0.05	0.04
P_{ERF}	0.03	0.17	0.10	0.05	0.03

Note: Values given for phantom decoy effects represent the predicted increase in choice percentage for the targeted alternative due to context. P_R = phantom range decoy; P_{ER} = phantom extended range decoy; P_{ERF} = phantom extended range-frequency decoy; P_{RF} = phantom range-frequency decoy; P_F = phantom frequency decoy; SS = similarity substitution; RW1 = range-weighting model 1 based on Equation (4); RW2 = range-weighting model 2 based on Equation (A5); RA1 = relative advantage model 1 based on Equation (6); RA2 = relative advantage model 2 based on Equation (7).

dimension 1 be proportional to its range relative to both ranges:

$$w_1 = \frac{\text{Range}_1}{\text{Range}_1 + \text{Range}_2} \tag{4}$$

where Range_1 and Range_2 represent the range of variation of attractiveness values on dimensions 1 and 2, respectively, and w_1 is the weight accorded values on dimension 1. The weighting of dimension 2 is then given by $w_2 = 1 - w_1$, as weights sum to 1.0. Values for alternatives ($V_{\mathbf{T}}$ and $V_{\mathbf{C}}$) were generated by multiplying the obtained dimensional weights from Equation (4) by the dimensional values of **T** and **C**, and these values were substituted into Equation (1) to generate predictions (with $c = 0.50$). The model predicts greater phantom decoy effects with greater range extension and no decoy effect for the frequency phantom decoy, as shown in the column labeled "RW1" in Table 1.

Because Mellers and Biagini (1994) typically modeled range weighting as a step function, we present a second set of predictions based on a single step. Here we kept $c = 0.5$ and assumed the weight of dimension 1 was increased by a constant whenever its range was greater than the range for dimension 2:

$$w_1 = 0.50 + a \tag{5}$$

where a is the constant by which w_1 is incremented and $w_2 = 1 - w_1$. The predictions from this model are straight forward, with the phantom effect equal for all decoys except $\mathbf{P_F}$, for which no phantom effect is predicted (shown in the column labeled "RW2" in Table 1).

Relative advantage predictions

According to the relative advantage model (Tversky & Simonson, 1993), phantom decoy effects occur because the decoy serves as the referent point and the value function for losses is steeper than that for gains. A simple way to calculate values based on loss aversion is as follows:

$$V_i = \text{Gains}_i - 2(\text{Losses}_i) \tag{6}$$

where Gains_i represents the sum of advantages of alternative i over the decoy and Losses_i represents the sum of losses of alternative i relative to the decoy. Losses are multiplied by 2 to represent the greater weight accorded to losses than gains. The predictions generated from Equation (6) using $c = 0.10$ are shown in the column labeled "RA1" in Table 1. The distinctive pattern is that loss aversion produces strong and equal effects for the $\mathbf{P_R}$ and $\mathbf{P_{ER}}$ decoys and weak (but equivalent) effects for the other three decoys.

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Because loss aversion is often incorporated into a value function with risk aversion in the domains of gains and risk seeking in the domain of losses, we examined a second loss-aversion model that incorporated this relationship (Kahneman & Tversky, 1979). Basically, the risk relationship is captured in the curvature of the functions. We used a simple power exponent to capture this difference in curvature using the following equation:

$$V_i = \text{Gains}_i^{0.50} - 2(\text{Losses}_i^{0.50}) \tag{7}$$

where 0.50 is the power exponent. The predictions are shown in the column labeled "RA2" in Table 1. Like similarity substitution, the concavity on gains and convexity on losses leads to some diminishing effects of the decoy as its location is extended further from the target. However, the general pattern of greater effects for the $\mathbf{P_R}$ and $\mathbf{P_{ER}}$ set still holds.

EXPERIMENT 1

The predicted patterns of effects shown in Table 1 imply that varying the locations of the phantom decoy in the attribute space may be helpful in distinguishing what mechanism determines these effects. As shown, the range-weighting hypothesis makes predictions that are most clearly distinct from the other two hypotheses. It is the only hypothesis that leads to the prediction of no decoy effects for the phantom decoy based on a frequency manipulation ($\mathbf{P_F}$). Furthermore, it is the only hypothesis to predict a possible increase in the effect with extension of range. The similarity-substitution and relative advantage explanations differ in more subtle aspects from one another. For example, loss aversion predicts that the three decoys that include a frequency manipulation each result in a weaker effect than the standard decoy effect. Similarity substitution instead predicts that the key determinant of effects will be distance from the target, with $\mathbf{P_{ERF}}$ having the weakest effect.

In Experiment 1, we had participants make trinary choices for 20 consumer choice sets, with the key between-subjects variable being decoy location ($\mathbf{P_R}$, $\mathbf{P_{ER}}$, $\mathbf{P_F}$, $\mathbf{P_{RF}}$, or $\mathbf{P_{ERF}}$) and the key within-subject variable being the favored alternative (**T** and **C**). An additional between-subjects blocking variable controlled for which alternative was favored in which choice set. This approach to testing decoy effects is similar to that used in previous studies (Pettibone & Wedell, 2000; Wedell & Pettibone, 1996), and has the advantage of increasing power for detecting the decoy effect over a purely between-subjects comparison of a two-item and a three-item condition. Given that the phantom effect is somewhat small, we felt that maximizing power needed to be an important feature of the design. A wide variety of consumer products was used to construct the choice sets, such as computers based on memory and processing speed, video cameras based on weight and number of features, etc. Our aim was to use the pattern of results to distinguish between different hypothesized explanations of phantom decoy effects.

Method

Participants and design

Participants were undergraduates from the University of Alabama at Huntsville and Southern Illinois University Edwardsville. Both universities are of similar size and focus. The $\mathbf{P_R}$, $\mathbf{P_{ERF}}$, and $\mathbf{P_{ER}}$ conditions included only SIUE students, while the other two conditions contained participants from both institutions. All participants received course credit for volunteering for this study. There were 90 participants in the $\mathbf{P_R}$ condition, 102 in the $\mathbf{P_{ER}}$ condition, 81 in the $\mathbf{P_F}$ condition, 89 in the $\mathbf{P_{RF}}$ condition, and 77 in the $\mathbf{P_{ERF}}$ condition. Within-subject variables included context (decoy favoring **T** and **C**), choice domain (20 choice sets), and alternative (**T** and **C**). For a given participant, half of the choice sets contained phantom decoys and

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the other half contained three equally attractive alternatives. We did this so that participants could not simply assume that only two of the alternatives on a given trial would be available. To control for differences in choice sets due to both this and the within-subjects manipulation of context, an additional between-subjects blocking variable was added. This variable, Set, had four different combinations indicating which items favored **T** and which favored **C**. Products were arbitrarily assigned to each choice set so that interactions with this variable are not of particular interest. Participants were randomly assigned to the between-subjects conditions, and presentation order of choice sets was randomized for each participant in each session.

Materials and apparatus

Stimuli were based on the 20 choice sets adapted from those described by Pettibone and Wedell (2000). Each set contained alternatives from a single type of consumer product (e.g., computers, microwaves, etc.) or consumer service (e.g., choosing a restaurant, hiring a mechanic, etc.), and each was made up of two alternatives (**T** and **C**) and another alternative described on two dimensions (e.g., price, ride quality, etc.). Results from choice sets containing the three equally attractive alternatives were not analyzed.

The $\mathbf{P_R}$ decoy was created by substituting the value of the target on its worse dimension and by increasing the value of the target's better dimension by , the difference between **T** and **C**. The $\mathbf{P_{ER}}$ decoy was created by substituting the value of the target on its worse dimension and by increasing the value of the target's better dimension, the full difference between **T** and **C**. The $\mathbf{P_F}$ decoy was created by substituting the value of the target on its better dimension and by increasing the value of the target's worse dimension by , the difference between **T** and **C**. The $\mathbf{P_{RF}}$ decoy was created by substituting the value of the $\mathbf{P_R}$ decoy on the target's better dimension and substituting the value of the $\mathbf{P_F}$ decoy on the target's worse dimension. The $\mathbf{P_{ERF}}$ decoy was created by substituting the value of the $\mathbf{P_{ER}}$ decoy on the target's better dimension and substituting the value of the $\mathbf{P_F}$ decoy on the target's worse dimension. All materials and instructions were presented via microcomputers.

Procedure

Participants were told that they would encounter many sets composed of three alternatives and should choose the alternative they found most attractive. Each choice set was represented as a 3×2 matrix, with rows corresponding to alternatives and columns to dimensions. On each trial, the arrangement of the alternatives and dimensions on the screen was randomized. Choice sets were presented on the screen 3 seconds prior to presentation of the choice prompt. When participants received a choice set containing a phantom decoy, they were told that one of the alternatives was unavailable due to unforeseen circumstances after the 3-second presentation delay. The label for the unavailable alternative was made to blink on screen. They were then told to select from the two available alternatives and were unable to select the phantom decoy.

Results

Table 2 presents an index of the phantom decoy effect for each decoy along with confidence intervals. The index is simply the proportion choosing **T** when **T** was favored minus the proportion choosing **T** when **C** was favored. As indicated by significance tests in Table 2, all but the $\mathbf{P_F}$ decoy produced significant phantom decoy effects (at the $p < 0.05$ level). This basic result is most consistent with the range-weighting model, as this was the only model to predict a lack of an effect for the $\mathbf{P_F}$ decoy. However, other aspects of the data are also consistent with the relative advantage model. In particular, the model of Equation (6) predicted similar and smaller effects for the $\mathbf{P_F}$ and $\mathbf{P_{RF}}$ and $\mathbf{P_{ERF}}$ decoys than for the decoys involving range extension only ($\mathbf{P_R}$ and $\mathbf{P_{ER}}$). This pattern was generally obtained.

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Table 2. Summary of results for choice proportions of the target across the different types of phantom decoys (Experiment 1)

Decoy	n	Pr(T) when T is targeted	Pr(T) when C is targeted	Difference	95% Confidence interval
P_R	90	0.58	0.38	0.20*	0.12–0.26
P_{ER}	102	0.52	0.38	0.14*	0.08–0.20
P_F	81	0.47	0.43	0.04	−0.03–0.13
P_{RF}	89	0.50	0.41	0.09*	0.03–0.16
P_{ERF}	77	0.54	0.44	0.10*	0.03–0.17

Note: P_R = phantom range decoy; P_{ER} = phantom extended range decoy; P_F = phantom frequency decoy; P_{RF} = phantom range-frequency decoy; P_{ERF} = phantom extended range-frequency decoy.
*Significant at $p < 0.05$ by a t-test.

An Analysis of Variance (ANOVA) was performed on the difference in choice proportions indexed in Table 2. The main effect of decoy location was significant, $F(4, 434) = 2.56$, $p < 0.05$, indicating that the phantom decoy effects differed across the five decoys. The models were compared to the data using single degree of freedom contrasts designed to capture key aspects of the model. For the relative advantage model, the contrast compared the combined effects for the $\mathbf{P_F}$, $\mathbf{P_{RF}}$, and $\mathbf{P_{ERF}}$ decoys to the combined effects for $\mathbf{P_R}$ and $\mathbf{P_{ER}}$ decoys. This contrast was significant, $F(1, 434) = 8.24$, $p < 0.01$, and accounted for 80% of the systematic variance in decoy effects. For the similarity-substitution model, the contrast compared the combined effects for the most similar alternatives to **T** (the $\mathbf{P_R}$, $\mathbf{P_F}$, and $\mathbf{P_{RF}}$ decoys) to the combined effects for the most dissimilar (the $\mathbf{P_{ER}}$ and $\mathbf{P_{ERF}}$ decoys). This contrast was not significant, $F(1, 434) = 0.05$, $p > 0.05$. For the range-weighting model, the contrast compared the combined effects for the only decoy which did not extend the range, $\mathbf{P_F}$, with the combined results of the other four range extending decoys, the $\mathbf{P_R}$, $\mathbf{P_{ER}}$, $\mathbf{P_{RF}}$, and $\mathbf{P_{ERF}}$ decoys. This contrast was significant, $F(1, 434) = 4.39$, $p < 0.05$, and accounted for 43% of the systematic variance in decoy effects.

Discussion

Several important observations about the effects of phantom decoys can be made from the pattern of results presented here. First, the effects of an asymmetrically dominating phantom alternative appear robust, with four of the five locations producing significant decoy effects. Only the $\mathbf{P_F}$ decoy did not produce a significant effect. This suggests that in most cases, taking an attractive alternative and making it unavailable will influence choice, and that the effect is not dependent on the particular relationship between the decoy and the choice set used in previous research (Highhouse, 1996; Pettibone & Wedell, 2000; Pratkanis & Farquhar, 1992).

Second, the pattern of effects observed was not supportive of the similarity-substitution hypothesis. Decoy effects did not generally decrease with decreased similarity to the target, which was contrary to the predictions of the similarity-substitution model. In particular, the lack of a significant effect for the $\mathbf{P_F}$ decoy seems problematic for this model, as similarity to **T** is quite high so a strong decoy effect would be predicted. Note that other explanations of the phantom decoy effect based on similarity will have difficulty with this finding. For example, the MDFT explanation (Roe et al., 2001) of the phantom effect would seem to require that because of its unavailability, the phantom decoy is negatively evaluated so that similarity to the target helps rather than hurts the target. If this is the case, there should be a reduction in the effect as the phantom decoy becomes more dissimilar to the target.

Third, the pattern of results provides some support for the range-weighting model in that this model predicts no significant effects for the $\mathbf{P_F}$ decoy. On the other hand, the range-weighting model does not predict

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the generally reduced decoy effects for $\mathbf{P_F}$, $\mathbf{P_{RF}}$, and $\mathbf{P_{ERF}}$ compared to $\mathbf{P_R}$ and $\mathbf{P_{ER}}$, which was found to be significant and accounting for most of the variance associated with decoy location. Overall, the results support the relative advantage model explanation based on loss aversion, but these results were not definitive, as the lack of decoy effect for the $\mathbf{P_F}$ decoy is somewhat problematic for this model.

EXPERIMENT 2

Experiment 1 established robust phantom effects for several decoy locations. However, there were two major problems associated with the between-subjects manipulation of decoy location used in the design of Experiment 1. The first revolves around power. Because the effects associated with the phantom decoy are relatively weak in a between-subjects design (η^2 was just 0.023 in Experiment 1), it may take an inordinate number of participants in each condition to determine whether the effects differ significantly, as predicted by different theories. The second problem with the between-subjects approach is that one may end up combining results from participants who are engaged in very different decision processes, so that the overall pattern of effects is not representative of the decision processes being used by any of the participants.

For example, consider that there may be a subset of participants who use the phantom decoy as a standard of comparison. If these comparisons are in line with range-frequency theory applications to this problem (Pettibone & Wedell, 2000; Wedell & Pettibone, 1996), then the effects of the phantom on the targeted alternative will be negative, and more so for the extreme range conditions. Presumably, such a group of judges, if it existed, would be in a minority, as the overall effects of the phantom decoy are positive on target choice proportions rather than negative. However, when one combines data from this group with data from a larger group of participants who may have engaged in the simple relative advantage choice process, the resulting combined data set would show a pattern described by similarity-based models, with extreme range decoys producing small phantom effects. Thus, in a between-subjects design, there is no way to know if the pattern emerged from the use of a similarity process or from the mixture of judges using different processes.

The best way to avoid these problems then is to manipulate type of decoy within-subjects and examine patterns of decoy effects for different groups of participants. Ideally, one could group participants based on another predictor variable. To this end we included the need for cognition measure (Cacioppo, Petty, & Kao, 1984) which has been demonstrated to moderate contrast effects in some experimental paradigms (Martin, Seta, & Crelia, 1990). We also examined judgment time as a possible individual difference variable, as prior research has shown it to moderate the nature of contrast effects in impression formation (Wedell, 1994). However, even if no useful predictor variable is available, one can also segregate the data into groups who exhibit different levels of the effect in order to determine what pattern best characterizes the data for each group. This was the strategy used in Experiment 2.

Rather than use a large set of different products defined on different dimensions, we used a more homogenous set of products defined on the dimensions of price and quality. In this way, participants could make a large number of choices so that stable decoy effects could be obtained. The products we chose were those commonly encountered in a grocery shopping trip, such as milk, frozen peas, paper towels, etc. These products covered a fairly restricted price range. To reduce idiosyncratic variability, participants were told they were shopping for a household so that even if they did not like a particular product, others in the household would use it and so they should still consider choosing the best value for the best price. In addition to price, a second dimension of quality was provided using quality ratings on a 100-point scale. For each participant, there were six products assigned to each of the five decoy types and each **T**-**C** pairing occurred twice, once with the phantom favoring **T** and once with the Phantom favoring **C**. As in Experiment 1, after the products appeared for a short time, the phantom product would be marked as unavailable so that the participants would choose from the remaining two products (**T** or **C**).

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Method

Participants and design

Participants were 175 undergraduates from the University of South Carolina and 87 undergraduates from Southern Illinois University Edwardsville for a total of 262 participants. All participants received course credit for volunteering for this study. The completely within-subjects design consisted of the factorial combination of decoy type ($\mathbf{P_R}$, $\mathbf{P_{ER}}$, $\mathbf{P_F}$, $\mathbf{P_{RF}}$, and $\mathbf{P_{ERF}}$), context (decoy favoring **T** and **C**), replication (six choice sets for each), and alternative (**T** and **C**). All 60 choice sets contained phantom decoys that were presented in random order for each participant. As in Experiment 1, decoy effects were examined through a within-subjects comparison of each choice set with a decoy that favored either **T** or **C** from Figure 1. Again, this was done to maximize the power to find a small effect.

Materials and apparatus

Stimuli were based on common grocery store items. Each set contained alternatives from a consumer product (e.g., frozen peas, paper towels, frozen pizza, mayonnaise, etc.). Each item was described by a price and a quality rating described on a 0–100 scale. Prices of items ranged from \$0.39 to \$4.19 and averaged \$2.31. Quality ratings ranged from 34 to 100 and averaged 61.33. Decoys were created using the same rules described for Experiment 1. All materials and instructions were presented via microcomputers.

Procedure

Participants were told to imagine that they were on a series of shopping trips, and that they lived in an apartment with three roommates who took turns shopping for a common list of items. They were told to shop for good value, so that they got good quality at a good price. On a given trial, the product label first appeared on the screen, for example, "Margarine (16 oz)." After 1.5 seconds, the set of three products to choose from appeared in separate boxes described by price and quality. Participants were informed that the quality scale ranged from 0 to 100, with 100 indicating highest possible quality. They were also informed that not all of the products were available. After products were on the screen for 3.5 seconds, the phantom decoy was crossed over with a big red "X" and marked "Unavailable." At this point, the participant could move the mouse cursor to the product he or she preferred and click on it to choose it. This procedure was repeated for a total of 60 trials. After completing the shopping trials, participants filled out the 18-item need for cognition inventory (Cacioppo et al., 1984) using a 9-point scale anchored by "1" = "not at all like me" and "9" = "very much like me."

Results

Table 3 presents the choice proportions for **T** when **T** was favored versus when **C** was favored, with the difference representing an index of the phantom decoy effect. As shown in Table 3, two of the decoys, $\mathbf{P_R}$ and $\mathbf{P_{ER}}$, resulted in significant effects in the predicted direction, whereas the effects for the other three decoys were not statistically significant. This pattern was in line with the predictions of the relative advantage model and fairly consistent with the results from Experiment 1, except that overall the effects of the decoy manipulation were smaller in size.

In order to explore individual differences in the phantom decoy effect, the frequency of choices of alternative **T** was tabulated for each of the 10 Decoy Type $\times$ Decoy Favors conditions, with possible scores ranging from 0 to 6. Additionally, phantom effect scores for each decoy were calculated by subtracting choice frequencies when **C** was favored from those when **T** was favored. Scores could range from -6, meaning one always chose the alternative that was not favored, to 6, meaning one always chose the targeted alternative. A total phantom effect score was then tabulated by summing phantom effect scores for each decoy.

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Table 3. Summary of results for choice proportions of the target across for the different types of phantom decoys (Experiment 2)

Decoy	*n*	Pr(T) when T is targeted	Pr(T) when C is targeted	Difference	95% Confidence interval
P_R	262	0.42	0.32	0.10*	0.07–0.13
P_{ER}	262	0.41	0.36	0.05*	0.02–0.08
P_F	262	0.48	0.47	0.01	−0.02–0.03
P_{RF}	262	0.41	0.39	0.02	−0.01–0.04
P_{ERF}	262	0.47	0.45	0.02	−0.01–0.05

Note: P_R = phantom range decoy; P_{ER} = phantom extended range decoy; P_F = phantom frequency decoy; P_{RF} = phantom range-frequency decoy; P_{ERF} = phantom extended range-frequency decoy.
*Significant at $p < 0.05$ by a *t*-test.

The mean of phantom effect scores was small ($M = 1.17$, $SD = 3.88$), but significantly greater than zero, $t(261) = 4.89$, $p < 0.001$. This corresponds to about a 4-point difference in choice percentages, which is about 1/3 the size of the overall decoy effect in the between-subjects design. Figure 3 shows the distribution of these scores. Participants varied widely in terms of the degree to which they showed the predicted phantom effect. As described earlier, two possible predictors of these individual differences in phantom effect scores were considered, need for cognition scores and choice latencies. However, neither of these predictors correlated significantly with phantom effect scores. Lacking an independent predictor of phantom effect scores, the scores themselves were used to create three groups of participants, with the aim being to discover if the relative pattern of effects across decoy location differed between groups as well as examine which models best explained these patterns. Cutoffs for the three groups are shown in Figure 3. The positive group consisted of those participants with scores greater than 2, the negative group consisted of those with scores less than −2, and the low group consisted of those participants with scores of −2, −1, 0, 1, or 2. Our primary focus was on the positive group ($n = 79$), as these participants showed the clearest evidence of the consistent phantom decoy effects. The negative group consists of participants who showed an overall tendency of an opposite effect of the phantom decoy. The low group consisted of participants who may show a mixture of these tendencies.

A mixed ANOVA was conducted on the phantom effect scores, with decoy ($\mathbf{P_R}$, $\mathbf{P_{ER}}$, $\mathbf{P_F}$, $\mathbf{P_{RF}}$, $\mathbf{P_{ERF}}$) as a within-subjects variable and group (Positive, Low, or Negative) as a between-subjects variable. The main effect of decoy was significant, $F(4,1036) = 4.32$, $p < 0.01$, indicating that decoy effects differed with decoy

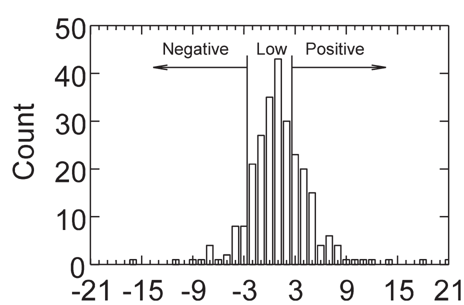

Figure 3. Distribution of phantom effect scores in Experiment 2. Three groups were further analyzed: The positive group with scores greater than 2, the negative group with scores less than −2, and the low group with scores between these values

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location. However, the critical test was of the Decoy × Group interaction, which was also significant, $F(8, 1036) = 2.47$, $p < 0.05$, indicating that the pattern of decoy effects differed significantly across groups.[2] Simple effects analyses were conducted for each group to understand how the patterns differed across groups.

The top panel of Figure 4 shows the pattern of decoy effects for the Positive group. An ANOVA conducted on this group revealed a significant effect of decoy, reflecting the differences in the magnitude of effects across the five decoys. As shown, effects were significant and positive for all five decoys. More importantly,

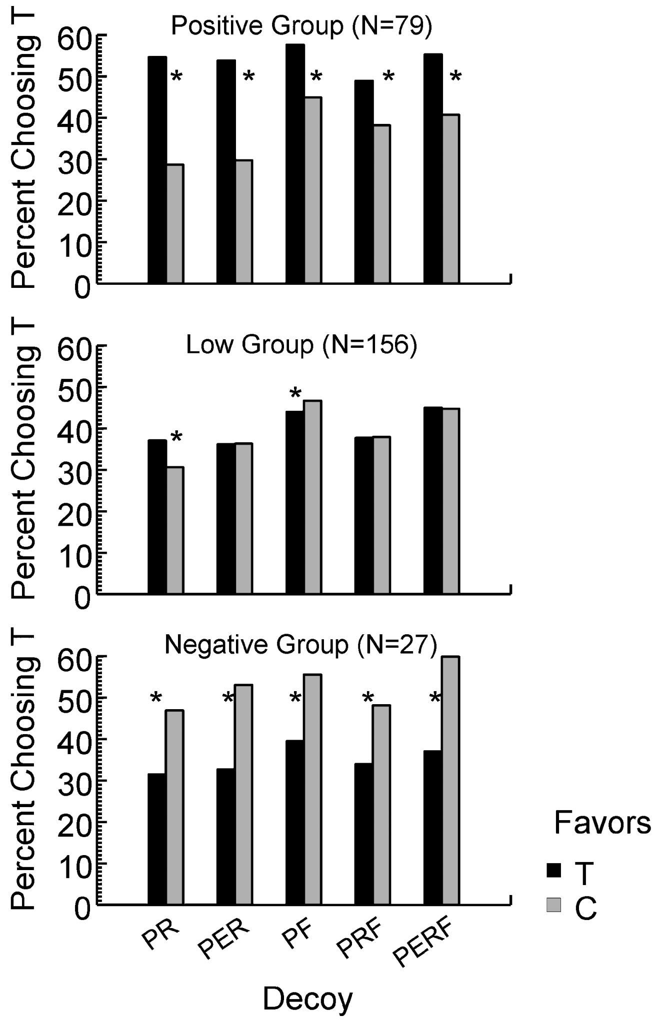

Figure 4. Decoy effects as a function of group (Positive, Negative, and Low) and type of decoy (**PR** = Phantom range, **PER** = Phantom extreme range, **PF** = phantom frequency, **PRF** = phantom range frequency, and **PERF** = Phantom extreme range frequency). Asterisks mark significant decoy effects. The pattern for the positive group closely corresponds to the predictions of the relative advantage loss-aversion model

[2]Because the group variable was determined by the relative size of demonstrated decoy effects, this effect may not be surprising. However, the analysis is still useful in pointing out differences between the groups.

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the pattern of effects appears to be very consistent with the pattern predicted by the relative advantage model with simple loss aversion (Equation (6)). A contrast based on the relative advantage model was constructed comparing the combined effects for $\mathbf{P_R}$ and $\mathbf{P_{ER}}$ to the combined effects for $\mathbf{P_F}$, $\mathbf{P_{RF}}$, and $\mathbf{P_{ERF}}$. This contrast was significant, $F(1, 78) = 19.40$, $p < 0.001$ and accounted for 80% of the variance due to the decoy manipulation. To test whether significant residual variance remained, a 3 *df* contrast was constructed out of the remaining orthogonal contrasts; this test was not significant, $F(3, 76) = 0.53$, $p > 0.05$, indicating that the data pattern was supportive of the relative advantage model. A contrast to test the predictions of the range-weighting model was constructed comparing the $\mathbf{P_F}$ decoy to the other four. This contrast was significant, $F(1,76) = 4.33$, $p < 0.05$. However, the test of the residual variance for this model was also significant, $F(3, 76) = 6.57$, $p < 0.001$, indicating that the range-weighting model does not provide an adequate description of the data. Finally, a test of the similarity-substitution model was devised using a contrast that compared the two extended range decoys to the other three. This contrast was not significant, $F(1, 76) = 1.96$, $p > 0.05$, providing no support for a similarity-substitution interpretation of these data.

The middle panel of Figure 4 shows the pattern of decoy effects for the low group. An ANOVA conducted on this group revealed a significant effect of decoy, $F(4, 620) = 5.20$, $p < 0.001$, reflecting the differences in the magnitude of effects across the five decoys. As shown, only two decoys produced significant effects. The $\mathbf{P_R}$ decoy produced a significant positive effect whereas the $\mathbf{P_F}$ decoy produced a significant negative effect. Consistent with similarity-driven models, the more distant decoys ($\mathbf{P_{ER}}$ and $\mathbf{P_{ERF}}$) produced no significant effects. However, inconsistent with similarity-substitution and the similarity-based explanation of MDFT, the effects were of opposite sign for $\mathbf{P_R}$ and $\mathbf{P_F}$ decoys. None of the models discussed provide a good account of the pattern of these effects.

The bottom panel of Figure 4 shows the pattern of decoy effects for the negative group. An ANOVA conducted on this group revealed no significant effect of decoy, reflecting a lack of differences in the magnitude of effects across the five decoys. As shown, all five decoys produced significant negative effects of decoy. This type of general negative effect is consistent with dominance valuing in which being asymmetrically dominated by an alternative in the set adds an overall negative evaluation to the alternative. It is also consistent with general models of contrast effects (Wedell & Pettibone, 1996). As the effects are consistently negative, this pattern is not supportive of the basic models of phantom decoys we have discussed. Furthermore, as these data were from only a small set of participants (27 out of 262, or 10% of all participants), this negative processing of the phantom decoys does not appear to be very widespread.

Discussion

The effect of the decoy manipulation was much smaller in this strictly within-subjects design (about 4 points) than was found in the strictly between-subjects design (about 11 points). This may be due to a variety of factors that include the greater number of choice sets, the use of the exact same pair of **T** and **C** alternatives in sets that favored **T** as in sets that favored **C**, or perhaps the familiarity of the task. Although the effect was reduced, the within-subjects manipulation of type of decoy allowed us to examine more clearly the applicability of different models.

Ideally, we would have had an independent measure that correlated with the degree of decoy effects by which to segregate participants into different groups. Lacking such a measure, we were most interested in examining the pattern of effects for the positive group who most clearly showed phantom decoy effects. The pattern of results for this group was clear cut, and followed closely the pattern predicted by the relative advantage model (with losses weighted more heavily than gains by a constant factor). As predicted by this model, effects of the $\mathbf{P_R}$ and $\mathbf{P_{ER}}$ decoys were significantly greater than those for corresponding $\mathbf{P_F}$, $\mathbf{P_{RF}}$, and $\mathbf{P_{ERF}}$ decoys. This is because the shifts in locations add only to the losses for **T** relative to the phantom and not for **C** relative to the phantom.

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The low group was by far the largest and showed a mixed pattern of effects. A significant positive effect of the $\mathbf{P_R}$ decoy was accompanied by a significant negative effect of the $\mathbf{P_F}$ decoy, with the other decoys showing no significant effect. This pattern is not predicted by any of the three models we have discussed and would seem to involve competing processes. One set of processes uses the phantom to advantage the target, by either similarity-related, weighting-related or loss–gain-related evaluations. The other set of processes uses the phantom to disadvantage the target, perhaps by dimensional contrast or by noting the asymmetrical dominance relation.

The negative group was quite small and showed consistent negative effects of the phantom decoy across all phantom decoy locations. This is clearly not the dominant response among judges, but it may reflect a competing response that moderates positive effects of the phantom decoy. An important focus of future research would be to determine what conditions might lead to the phantom being turned around to adversely affect the target, a boomerang effect. Although the majority response to a phantom decoy was in line with prior research, further research should be done to explore the reasons why some individuals respond in different ways to phantom decoys.

GENERAL DISCUSSION

Experiments 1 and 2 provided tests of the generality of phantom decoy effects to different locations in the attribute space. Importantly, it was demonstrated that all types of phantom decoys produced an increase in preference for the target save for the $\mathbf{P_F}$. This implies at least three things. The first is that phantom decoys are a robust phenomenon for most people (although some do show opposite effects). Simply offering a product that is more attractive than at least one other product and is unavailable will generally increase preference for the product that is closest to it in the attribute space. Second, the lack of a phantom decoy effect with $\mathbf{P_F}$ clearly rules out similarity-based models, such as the similarity-substitution model (Pettibone & Wedell, 2000), that imply that effects should diminish as similarity between the target and the phantom decoy diminishes.

Third, the pattern of effects in Experiment 1 was best characterized by the relative advantage model, in which a comparison of losses and gains in the attribute space can be used to predict the magnitude of the effect. Relative to the $\mathbf{P_R}$ and $\mathbf{P_{ER}}$ decoys, the $\mathbf{P_F}$, $\mathbf{P_{RF}}$, and $\mathbf{P_{ERF}}$ decoys all add to the disadvantages of **T** without concomitant disadvantages to **C**, and therefore the phantom effect is predicted to be diminished. Although the lack of a significant effect of the $\mathbf{P_F}$ decoy was consistent with the range-weighting model, the overall pattern was closer to that predicted by the relative advantage model.

Results from Experiment 2 can be used to bolster this conclusion. The overall pattern of effects was consistent with the relative advantage model predictions. Furthermore, when examining only those participants who showed the most clear cut phantom decoy effects (the positive group), the pattern adhered quite closely to predictions of the relative advantage model (Tversky & Simonson, 1993) in which losses are weighted more heavily than gains. Indeed, the residual variance from this model was not significant. There was no hint of diminishing sensitivity with greater dissimilarity, and so the similarity-substitution explanation of phantom decoy effects for this group was not supported. Although the range-weighting model predicted some of the variance in decoy effects for this group, the residuals from this model were significant and the significant effect for the $\mathbf{P_F}$ decoy was inconsistent with the model. Thus, for those participants showing the largest phantom effects, the loss-aversion based relative advantage model clearly provided the best account of the data. This finding provides a simple rule in applied settings for when one should expect an unavailable alternative to effectively bolster the choice of a targeted alternative. This rule is simply the relative advantage rule whereby one adds up gains and losses for the target and the competitor and weights losses more (as shown in Figure 2).

However, the differing patterns of results for the remaining participants suggest that there may be more than one process operating in using the phantom decoy to alter evaluations of the target. The fact that the

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majority group (the low group consisting of 156 of 262 participants) produced a significant negative effect of the $\mathbf{P_F}$ decoy constitutes the strongest evidence that phantom decoys do not always produce effects that are favorable to the closest and dominated alternative. A two-process account would include a dimensional contrast or dominance valuing process that would hurt **T** relative **C** combined with processes favorable to **T**, such as the three tested here. What would then be required is a formulation that produced weaker positive effects for $\mathbf{P_F}$ (such as range weighting) or that produced stronger negative effects for $\mathbf{P_F}$. Alternative explanations might posit a single process guiding choice, but include a parameter tied to location in the attribute space. For example, Choplin and Hummel's (2005) comparison-induced distortion account proposes that the direction of the effect (positive or negative) depends on whether the obtained difference in attributes is greater than or less than the expected difference. Alternatively, MDFT (Roe et al., 2001) could use a single process based on similarity-driven inhibition to account for the data if a meditating process that alters the favorability of the phantom decoy is included.

The combined data from the two experiments provided strong support for a loss-aversion mechanism, as utilized in the relative advantage model (Tversky & Simonson, 1993) and in the leaky accumulator model (Usher & McClelland, 2004), to explain choice effects produced by the phantom decoy. An added benefit of this mechanism is that it is able to provide an account of various decoys, including the phantom decoy, with a single mechanism. Although the loss-aversion based explanation was supported, the overall pattern of data in the two experiments leaves room for considering other mechanisms that might operate with phantom decoys, including those that predict negative effects on the target. Future research might include within-subject manipulation of various decoy locations to examine the degree to which different decoy effects correlate with one another, signaling a common mechanism as opposed to multiple mechanisms.

From a broader perspective, these results demonstrate conditions under which unavailable yet superior alternatives may be most likely to bolster a targeted alternative. Similarity does not appear to be the key issue. Rather, the structure of the alternatives must be such that the loss for the target is markedly less than the loss for the competitor. As noted earlier, the ''Bait and Switch'' tactic may be regularly applied in retail situations. This research indicates situations when it is most likely to work well as reflected in the different phantom locations. As demonstrated in Experiment 2, the use of a phantom decoy can backfire for a subset of the population who might focus on dimensional valuation and show a contrast effect. Furthermore, the fact that the frequency phantom location $\mathbf{P_F}$ was most likely to prompt negative evaluations across all participants indicates the relative ineffectiveness of this particular phantom location. Overall, our research reinforces the powerful effects of perceived losses on valuation in choice and how these may operate even when the decoy is an unavailable alternative.

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