THE LIMITS OF ATTRACTION

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Abstract

Consumer research has documented dozens of instances in which the introduction of an “irrelevant” third option affects preferences between the remaining two. In nearly all such cases, the unattractive dominated option enhances the attractiveness of the option it most resembles – a phenomenon known as the "attraction effect." In the studies presented here, however, we contend that this phenomenon may be restricted to stylized product representations in which every product dimension is represented by a number (e.g., a toaster oven that has a durability of 7.2 and ease of cleaning of 5.5). Such effects do not typically obtain when consumers experience the product (e.g., taste a drink) or when even one of the product attributes is represented perceptually (e.g., differently priced hotel rooms whose quality is depicted with a photo). We posit that perceptual representations of attributes do not support the sorts of comparisons that drive the effect with highly stylized examples, and we question the practical significance of the effect.

Keywords**:** Attraction effect, Context effects, Attribute representation, Consumer choice

INTRODUCTION

The "attraction effect" or “asymmetric dominance effect” (Huber, Payne, and Puto 1982; Huber and Puto 1983) refers to instances in which the addition of an inferior option to a choice set increases the choice share of the option it most closely resembles. The practical significance of such an effect seems clear, because the composition of choice sets is readily manipulated. Moreover, by violating a central axiom in models of rational choice, the effect is often upheld to illustrate the deficiency of those models and the necessity of developing psychologically richer ones.

For these reasons, the attraction effect is among the most discussed and documented phenomena in the consumer behavior literature (see Appendix A). However, the apparent robustness this summary suggests is misleading, because most demonstrations involve highly stylized stimuli in which the attribute levels of the focal goods are represented by 2 X 2 numeric indices. Such stimuli may recruit similar psychological processes whether the numbers happen to refer to quality ratings of TVs, durability of digital cameras, attractiveness of romantic partners, honesty of politicians, or capacitance of widgets.

Though such highly stylized stimuli may be sufficient to capture essential tradeoffs consumers routinely make (e.g., between price and quality), the psychological processes evoked by these stylized stimuli may differ from those evoked by more realistic stimuli. In ordinary purchase settings, it is rare that every attribute would be represented solely by a numeric index. For instance, consider consumers who enter an electronics store intent on purchasing a flat screen television. They do not choose between abstract summaries of the picture quality and price of two unspecified brands (e.g., [7.3, $390] vs. [8.8, $610]). Instead, they typically stroll

around the store, examining various models and actually experience the quality of images displayed (often brightly colored fish swimming around a coral reef).

Though researchers have been encouraged to test whether attraction effects hold in more natural contexts [see, e.g., Simonson, (1989)], we are aware of only five studies that report an attraction effect using choice stimuli that are not highly stylized: (and three others in Kivetz, Netzer, and Srinivasan 2004; Ratneshwar, Shocker, and Stewart 1987; Sen 1998; two in Simonson and Tversky 1992; Trueblood et al. 2013). Notably, we could not replicate the results of any of these studies, as we report in Appendices C1 through C5. Ratneshwar, Shocker and Stewart (1987) used "hybrid" stimuli which retain numeric indices for all attributes but supplement numeric summaries of quality with verbal descriptions. We replicated their result using those materials, but when we omitted the numeric index and used *only* the verbal description, we, again, found no attraction effect (see Appendix C6).

This paper continues to probe the boundary conditions of the attraction effect, reporting the results of studies that test for its existence using options whose relevant attributes can either be directly experienced (e.g., beverages with different flavors and concentrations) or options whose attribute levels are represented in ways *not* involving numeric indices – either because the attributes are inherently qualitative (e.g., a popcorn's brand and flavor) or because we elected to represent attribute levels perceptually rather than numerically (e.g., by depicting apartment views with photographs, rather than ratings).

Collectively, these studies reveal no evidence for an attraction effect. Against the backdrop of dozens of studies reporting attraction effects using highly stylized stimuli (see Appendix A), our failure to find them implicates attribute representation as playing a crucial role. To test this further, we present several studies which hold the stimuli constant, but manipulate

how their attributes are represented. We found attraction effects when stimuli were represented numerically, but not otherwise.

STUDIES 1a – 1s: DO ATTRACTION EFFECTS OCCUR WITH REALISTIC STIMULI?

Method

We conducted 19 studies of the attraction effect using "natural" stimuli in which one or more of the product attributes can be experienced, directly perceived, or somehow communicated without the use of numbers (see Appendix B for the stimuli used in these studies). Aside from this difference, our studies preserved the fundamental structure of other studies on the attraction effect: respondents were randomly assigned to choose either between two core options or among options in an expanded set that included a third "decoy" option which was similar, but inferior to, one of the core options. In some cases, these were small stand-alone studies; elsewhere, these stimuli were part of larger surveys involving other topics. Participants were drawn from various sources, including universities in the U.S. and Asia and picnickers at a 4th of July celebration. Respondents were randomly assigned to condition, and the total sample sizes for each study ranged from 68 to 681. The stimuli and results are summarized in Tables 1 and 2.

Results and Discussion

As shown in Table 2, we found no evidence for an attraction effect in any of these studies: the decoy did not increase the choice share for the option it most closely resembled (the "target"). Indeed, it was just as common for the decoy to *reduce* the choice share of that option –

something we term a “repulsion effect.” For example, in one study, respondents sampled normal strength cherry *Kool-Aid*, normal strength grape *Kool-Aid*, and dilute grape *Kool-Aid* (mixed to ½ the recommended concentration). The addition of a dilute grape option *reduced* the choice share of regular grape (from 53% to 39%; $\chi^2 = 3.45$; $p = .06$).[1]

Insert Tables 1 and 2 about here

We will revisit repulsion effects in the general discussion, but we emphasize here the most notable result from these studies: the conspicuous absence of an attraction effect. We next discuss two possible accounts for the lack of an effect.

EXPLAINING THE ABSENCE OF AN ATTRACTION EFFECT WHEN ATTRIBUTE VALUES ARE NON-NUMERIC

Comparing Tradeoff Rates Requires Numeric Specification

As one possible account of the attraction effect, Simonson and Tversky (1992) discuss the notion of "tradeoff contrast." To illustrate this account, consider three cars that vary in fuel efficiency and price: A= (25 mpg; $25K), B= (35 mpg; $35K), and C= (36 mpg; $42K). Fuel efficiency is cheaper moving from A to B ($1,000 per unit) than from B to C ($7000 per unit), and this comparison may favor B. Of course, computing tradeoff rates requires that both dimensions are numeric, which might help explain why we did not observe attraction effects in Studies 1a – 1s.

Range and Number of Levels Effects

In some cases, a decoy increases the considered range for the attribute on which the target is inferior, "shrinking" the perceived significance of that difference (see Parducci 1974) and thereby enhancing its attractiveness relative to the other core option.[2] Depending on its location in attribute space, the decoy may also more finely partition the dimension on which the target is superior, which usually increases the weight this dimension receives (Currim, Weinberg, and Wittink 1981). Such effects are less applicable when attribute values are not represented by numbers; when the decoy is inferior to the target in a qualitative rather than quantitative sense. For example, it is not clear how adding dilute grape *Kool-aid* to the choice set (regular cherry, regular grape) either shrinks the perceived significance of grape's lack of cherry flavor or serves to partition the distance, in n-dimensional space, between grape and cherry.

In light of the aforementioned theoretical reasons and the (non) results from studies 1a-1s, we propose that attraction effects could be attenuated, eliminated, or possibly even reversed if product attributes were represented as percepts that could be directly experienced rather than as concepts (in the form of numeric indices of attribute levels). We test this next.

STUDIES 2a – 2c: NUMERIC VS. PERCEPTUAL REPRESENTATIONS OF PROBABILITY IN CHOICES AMONG GAMBLES

Our stimuli in these studies were gambles varying in the probability of winning and the winning amount. Based on prior research involving gambles (Huber, Payne, and Puto 1982; Wedell 1991), we expected to find an attraction effect when the probability of winning is represented numerically. However, based on the results of the aforementioned studies, we conjectured that if probability was presented visually (in the form of the shaded area of a

probability wheel), these effects would be attenuated or eliminated. We conducted three studies using similar methods.

Study 2a

In our first study, a total of 507 participants (276 picnickers in a large northeastern city and 231 participants from an online survey site) chose between two (or three) gambles. The two samples did not differ in their choice patterns and thus we combined them in our data analysis. The core set included a "safe" gamble (73% of chance of winning $197) and a "risky" gamble (28% chance of winning $516). The three-option choice set included those and a third, "decoy" gamble (23% chance of winning $507) that was dominated by the risky gamble. Using a 2 x 2 design, we manipulated the presence or absence of the decoy gamble and the mode by which winning probability was represented: either numerically (as it typically is) or perceptually (as the shaded region of a probability wheel, as shown in Figure 1).

Insert Figure 1 about here

Results and Discussion

When probability was represented numerically, we found a significant attraction effect, as the decoy increased the choice share of the target risky gamble from 14% to 28% ($\chi^2 = 7.22$; $p < .01$). However, when probability was represented as the shaded region of a probability wheel, the decoy had no effect on the choice share of the target gamble (24% vs. 26%) as noted in Table 3.

Insert Table 3 about here

Study 2b

Our follow-up study involved 791 respondents recruited from a private northeastern university and a national online panel, using a different set of gambles (see below). Participants chose between two gambles (a 73% chance to win $12 vs. 28% chance to win $33) or three (those two plus a third "decoy" option: a 28% chance to win $30). As before, the winning probabilities were represented either numerically or pictorially, as shown in figure 2.

Insert Figure 2 about here

Results and Discussion

As before, we found a significant attraction effect when probability was represented numerically, as the presence of the decoy nearly doubled the choice share of the risky gamble (21% to 37%; $\chi^2 = 11.55$, $p < .001$). However, when probability was represented as the shaded area of a probability wheel, the decoy had no effect (34% vs. 35%), as shown in Table 4.[3]

Insert Table 4 about here

Study 2c

Our third study involving gambles was completed by 511 picnickers in Boston, and used stimuli nearly identical to those shown in figure 2.[4] Probability was represented visually for all participants, but half of the participants provided numerical estimates of the probability represented before making their choice. The remainder did so after choosing (which presumably did not affect their choices). We conjectured that an attraction effect might obtain if ratings preceded choices, since the visual representation would then be supplemented with a numeric representation – albeit one the participants themselves provided.

Results and Discussion

We found no evidence for an attraction effect in either condition as shown in Table 5. Although participants had access to essentially the same set of numbers as those in the numeric conditions of studies 2a and 2b, the mere presence of a visual representation was apparently sufficient to inhibit the effect.[5]

Insert Table 5 about here

The studies discussed next are analogous to the gamble studies, though the focal goods are television sets, and we manipulated the manner in which image quality is represented.

STUDIES 3a – 3c: NUMERIC VS. PERCEPTUAL REPRESENTATIONS OF IMAGE QUALITY IN CHOICES AMONG TELEVISION SETS

Study 3a

A total of 240 respondents from universities in the U.S. and Asia chose between televisions that varied in price and picture quality. Using a 2 x 2 between-subjects design, we manipulated whether the choice set contained a decoy option and the mode by which image quality was represented (with a numeric rating or a photo).

To represent image quality visually, we created a high-, a medium-, and a low-quality image by using graphics software to manipulate color, sharpness, contrast, and resolution, as shown in Figure 3.

Insert Figure 3 about here

To create a corresponding numeric condition, we used the average ratings of a separate group of eighty respondents, who rated the picture quality of each of these three images on a 10-point scale ranging from 1 (low quality) to 10 (high quality). This led to the corresponding set of numeric stimuli, with the second number representing average ratings of image quality [($503, 8.0), ($350, 5.5), ($339, 3.5)]. Note that the medium quality TV ($350, 5.5) almost dominates the low-quality TV ($339, 3.5), as it has a much higher quality rating for only eleven dollars more.

Results and Discussion

As shown in Table 6, when image quality was represented numerically, adding the low-quality decoy TV caused a significant attraction effect, increasing the choice share of the target TV from 33% to 57% ($\chi^2 = 6.60$, $p < .05$). However, when picture quality was represented with an image, the decoy *decreased* the choice share of the target from 53% to 35% ($\chi^2 = 3.37$, $p = .07$). A logistic regression with dummy variables for decoy presence and mode of quality representation yielded the expected significant interaction term ($\beta = -1.71$, $p < .01$).

Insert Table 6 about here

Though our prior results – and, more to the point, our repeated non-results – led us to predict no attraction effect when quality was represented visually, we were curious whether the marginally significant *repulsion* effect obtained above would replicate, so we re-ran the study using Google Surveys, which enabled us to quickly obtain very large samples.[6]

Study 3b

A total of 4033 web browsers answered our question, yielding roughly 1000 respondents for each of the four conditions just described. In this study, we used a nearly identical design, although options were displayed vertically when quality was represented as a number, and horizontally when quality was represented visually (as small thumbprints which expanded when the cursor was dragged over them as shown in Figure 4). Also, we didn't ask respondents to assume they were purchasing a *second* TV, and we specified that the TVs in question were 42 inch LED flat screens. The order of option presentation was randomized in all conditions.

Insert Figure 4 about here

Results and Discussion

The raw results are shown in table 7.

Insert Table 7 about here

Unlike the prior paper and pencil study, the decoy option was chosen frequently in this context. Though not unexpected given the source of the data, this complicates interpretation of the results. If we assume that those who chose the decoy were simply answering randomly, that similar numbers must have randomly selected the other presented options, and that the incidence of random responding does not depend on the number of options considered, we can adjust the data as shown in table 8.

Insert Table 8 about here

The adjusted data replicate one aspect of the prior study: we found significant attraction effects when quality was represented numerically ($\chi^2 = 33.6$; $p < .0001$) but no effect when

quality was represented visually (χ^2 = .2; p =.64). We did not find further evidence of a repulsion effect.

Study 3c

Mirroring study 2c, we conducted a follow-up study in which all respondents could view images, but in which they also provided ratings of image quality either *after* choosing (which should mimic the visual conditions from the prior studies) or *before* choosing (which creates the hybrid "visual + numeric" condition of interest).[7] A total of 1945 respondents participated: 1581 workers on Amazon's mTurk and 364 participants from two northeastern universities. Image quality was represented as in Study 2a (though this time prices were listed *above* the photos that displayed image quality).

Results and Discussion

The results are shown in Table 9. As predicted, the decoy had no significant effect when ratings followed choices, though this time we did find a small, but significant attraction effect in the "hybrid" condition, as the presence of the decoy increased the choice share of the target from 34% to 41% (χ^2= 4.47; p =.03).[8]

Insert Table 9 about here

GENERAL DISCUSSION

The attraction effect (aka, asymmetric dominance effect or decoy effect) is among the most studied and celebrated phenomena in the behavioral marketing literature and widely asserted to be large, robust, and important:

> *[We conclude] that the attraction effect is robust, has a wide scope, is quite sizeable and is of practical significance.*
>
> (Doyle, O'Connor, Reynolds, and Bottomley, 1999, p. 225)
>
> *Decoy effects …occur in product classes ranging from restaurants to light bulbs and occur regardless of whether choice sets are manipulated between subjects or within subjects. [They] are important for both theory and practice*.
>
> (Heath and Chatterjee, 1995, p. 268)
>
> *[T]he attraction effect is a real-world phenomenon, not just an experimental artifact.*
>
> (Mishra, Umesh and Stem, 1993, p.331)
>
> *Asymmetric dominance and advantage (decoy) effects can exert a powerful force on choice because they provide a compelling justification for the purchase of one option over another.*
>
> (Kivetz, Netzer, & Srinivasan, 2004, p. 265)
>
> *[The attraction effect is] a general feature of human choice behavior because [it is] a fundamental part of decision-making processes.*
>
> (Trueblood, Brown, Heathcote, & Busemeyer, 2013, p. 906)

This message has been consumed and promulgated by the popular literature as well. The opening chapter of the best seller *Predictably Irrational* (Ariely, 2008) focuses almost exclusively on the attraction effect as one of the irrational tendencies to which we are predictably vulnerable. Amid discussions of missing internal value meters that necessitate a focus on relative advantages, claims that attraction effects should be potent and ubiquitous seem believable enough. As proof of concept, Ariely cites a result from his MBA class suggesting that the addition of a decoy option increases the choice share of the target option from 32% to 84%![9]

Our research suggests a different conclusion. Outside of the most abstract contexts, we find no evidence for this effect, and we failed to replicate several of the results most frequently cited as evidence – including the (otherwise) stunning result noted above.

In total, we conducted thirty-eight studies: the nineteen summarized as Studies 1a-1s, the six presented in Studies 2a-c and 3a-c, the six replication attempts outlined in Appendices C1-

C6, a conceptual replication in C6, and six related studies summarized in Appendix D. In five instances (one pair of conditions in studies 2a, 2b, 3a, and 3b, and D1), our stimuli were highly abstract: consisting of two dimensional matrices of numbers that specified attribute levels. We found significant attraction effects in four of those five cases. In five other instances (one pair of conditions from studies 2c, 3c, the first study reported in Appendix C6, and conditions 3 and 5 from Appendix D) all relevant attributes were numerically specified but as least one was accompanied by a perceptual representation or verbal description. We found a significant attraction effect in two of these five cases (study 3c and the first study in Appendix C6). The remaining 27 studies (studies 1a through 1s; Appendices C1 through C5, and D2, D4, and D6) involved choice stimuli in which at least one of the attributes could be directly experienced (e.g., beverages and jellybeans that were actually consumed, facial tissues that were actually touched; apartment views depicted by photographs, and so on). We found no instances of a significant attraction effect (and one instance of a significant repulsion effect).

We believe these results warrant three conclusions: (1) Consumer researchers should reconsider the status of the attraction effect as a stylized fact. (2) Perceptual representations often elicit markedly different effects than numeric representations. (3) Outside the domain of highly abstract stimuli that have dominated research on this topic, repulsion effects may be more common than attraction effects. Curiously, there has been essentially no experimental work on repulsion effects. The experiment closest to those we conducted was a thought experiment in David Kreps' (1990) microeconomics textbook in which he proposes (pg. 28) that the consideration of mediocre French food might diminish the attractiveness of excellent French food.[10] This neglect of the repulsion effect is surprising, considering: (1) that this intuition has been formalized as the *law of similarity*, whereby the bad properties of one object are transferred

to other objects in that category (Rozin, Haidt, and McCauley 2000; Rozin, Millman, and Nemeroff 1986; Rozin and Nemeroff 2002); (2) that there is widespread evidence for both contrast and assimilation effects within the large literature on context effects in psychology (Bless and Schwarz 1998; Mussweiler, Rüter, and Epstude 2004); and (3) that it is broadly consistent with unsuccessful brand extensions, in which unattractive products such as *Bic* pantyhose and *Heinz* pet food taint more successful products sharing the same brand name (Hertwig et al. 2004; Kotler and Keller 2005).

Concluding Remarks

As part of a curriculum in consumer behavior, the attraction effect fascinates. Students are understandably spellbound to learn about a simple trick that promises to nearly triple the number of customers choosing a firm's most profitable product (see Ariely, 2008, p. 6.). However, we now believe that the truth is much less good than this story. The boundary conditions for the effect appear so restrictive that one should question its practical validity. We doubt the academics who read this will amend their courses by removing slides that reliably elicit oohs and aahs, but we hope our article gives pause to those citing the effect and stimulates more discussion about the aspects of ecological validity that must be preserved to draw valid inferences from consumer research.

APPENDIX A: LIST OF STIMULI AND ATTRIBUTES USED IN ARTICLES ON THE ATTRACTION EFFECT

Paper	*Stimuli*	*Attributes*	*Attribute Representation*
Ariely and Wallsten 1995	Microwaves	Price, capacity (ft.), wattage (W)	Numeric
	Running shoes	Comfort, durability, price	Numeric
	Computers	Speed (Hz), memory (MB), price	Numeric
	TVs	Screen size (in), price, wattage (W)	Numeric
	Bicycles	Price, weight (LB), wheel base (in)	Numeric
Bargava, Kim and Srivastava 2000	Cars	Quality of ride, fuel	Numeric
	Flights	Price, penalty	Numeric
Branstrom 1998	Apartments	Monthly rent, distance from campus (min)	Numeric
Burton and Zinkhan 1987	Beer	Price, taste quality	Numeric
	Restaurants	Food quality, driving time	Numeric
Choplin and Hummel 2002	Airplane ticket	Cost, layover (min)	Numeric
	Studio apartment	Rent, commute (min)	Numeric
Colman, Pulford, and Bolger 2007	Game strategies	Payout	Numeric
Dhar and Glazer 1996	Automobile	Comfort rating, gas mileage	Numeric
	Stereo	Sound rating, reliability	Numeric
	Apartment	Distance (miles), condition rating	Numeric
	Manager	Technical rating, human skill rating	Numeric
	MBA	GMAT, GPA	Numeric
	Beer	Quality, price/6-pack	Numeric
	Battery	Life (# hours), price/pair	Numeric
	Restaurant	Food quality, driving time (min)	Numeric
	VCR	Picture rating, reliability rating	Numeric
Doyle et. al. 1999	Audiocassette tapes	Price, quality	Numeric
	Batteries	Price, quality	Numeric
	Orange juice	Price, quality	Numeric
Ha, Park and Ahn 2009	Vacation tour s	Vacation site, Hotel Service Quality, Hotel Location	Numeric
	Laptop computers	Brand, Weight, Memory Capacity	Numeric
	Camera phone	Phone Type, Screen Size, Resolution	Numeric
Heath and Chatterjee 1991, 1995	Beer	Price, quality rating	Numeric
	Cars	Car mileage, ride quality	Numeric
Hedgcock, Rao, and Chen 2009	Beer	Price, quality	Numeric
	Health plans	Max coverage, copay, % donor participation	Numeric
	Cruises	Price, incidence of disease	Numeric
	Housing	Crime rate, number of bedrooms	Numeric
	Automobiles	Safety, lease terms	Numeric
	Presidential candidates	Economic policy, international policy	Numeric
Highhouse 1996	Job candidates	Interview rating, promotability rating	Numeric
Huber, Payne, and Puto 1982; Huber and Puto 1983	Beer	Price/six pack, quality	Numeric
	Cars	Ride quality, gas mileage (mpg)	Numeric
	Restaurants	Driving time (min), food quality	Numeric
	Lotteries	Chance of winning, amount of win	Numeric
	Film	Developing time (min), color fidelity	Numeric
	TV sets	Percent distortion, reliability	Numeric
	Calculator batteries	Estimated life (# hours), price/pair	Numeric
Kim and Hasher 2005	Grocery discounts	Discount offered (%), minimum purchase required ($)	Numeric
	Extra credit	Extra credit offered (points), min amount of time (min)	Numeric
Kivetz, Netzer, Srinivasan 2004	Subscriptions	Cost, type	Qualitative
Mishra, Umesh and Stem 1993	Beer	Price/six pack, quality	Numeric
	Cars	Ride quality, gas mileage	Numeric
	TV sets	Percent distortion, reliability	Numeric
Moran and Meyer 2006	Vacation deals	Price, hotel quality	Numeric
		Duration, hotel quality	Numeric
Olsen and Burton 2000	Cars	Gas mileage, reliability rating	Numeric
Pan and Lehmann 1993	TV sets	Resolution (lines), durability (months)	Numeric
	Apartments	Size (sq. feet), closeness to campus (secs to walk)	Numeric
	Batteries	Expected life (hours), price	Numeric
	Compact sedan	Fuel efficiency (mpg), acceleration	Numeric
	Light bulb	Expected life (hours), light output (output)	Numeric

Pan, O'Curry and Pitts 1995	Political candidates	Education, crime control, tax policy	Numeric
Prelec, Wernerfelt and Zettelmeyer 1997	Air conditioners	Operating noise rating, price	Numeric
	Binoculars	Magnifying power, price	Numeric
	Auto-focus cameras	Number of features, price	Numeric
	Coffeemakers	Quality rating, price	Numeric
	Rain boots	Durability rating, price	Numeric
	Running shoes	Cushioning ability rating, price	Numeric
	Vacuum cleaners	Suction power rating, price	Numeric
	VCRs	Durability rating, price	Numeric
Ratneshwar, Shocker and Stewart 1987	TV sets	Percent distortion, reliability (years)	Numeric*
	Orange juice	Price/64oz, quality rating	Numeric*
	Beer	Price/six pack, quality rating	Numeric*
	Cars	City mileage (mpg), ride quality	Numeric
	Light bulbs	Light output (lumens), expected life hours	Numeric
	Gas barbeque grills	Cooking area (sq. ins) fuel tank capacity (hours)	Numeric
Scarpi 2008	MP3 players	Price, data capacity	Numeric
Schwartz and Chapman 1999	Medication	Treatment effectiveness, probability of side effects	Numeric
Sedikides, Ariely and Olsen 1999	Partner attributes	Attractiveness, honesty, sense of humor, dependability, intelligence	Numeric
Sen 1998	Restaurants	Food, atmosphere	Qualitative
Simonson 1989	Beer	Price of a six-pack, quality	Numeric
	Cars	Ride quality/gas mileage	Numeric
	Color TV	Price, picture quality	Numeric
	Apartment	Distance, general condition	Numeric
	Calculator	No of functions, Probability of repair in first 2 years	Numeric
	Mouthwash	Fresh breath effectiveness, germ killing effectiveness	Numeric
	Calculator battery	Expected life (hours), probability of corrosion	Numeric
Simonson and Tversky 1992	Microwave ovens	Capacity, price, discount	Numeric
	Paper Products	Quality (of paper towels vs. facial tissues)	Perceptual
	Cash vs. pens	Quality (of pens)	Perceptual
	Gasoline	Quality (amount of octane), price/gallon	Numeric
	Personal Computers	Memory (K), price	Numeric
Tentori, et. al. 2001	Supermarket discounts	Discount offered (%), minimum purchase required ($)	Numeric
Trueblood et. al. 2013	Rectangles	Length, Width	Perceptual
Wedell 1991	Gambles	Probability to win, amount to win	Numeric
	Automobiles	Ride quality, gas mileage (mpg)	Numeric
	Restaurants	Quality rating, driving time (min)	Numeric
	TV sets	Percent distortion, reliability	Numeric
Wedell and Pettibone 1996; Pettibone and Wedell 2000	Computers	Processing speed (MH), size of hard drive (MB)	Numeric
	Restaurants	Price of meal for two, wait to be served (minutes)	Numeric
	Plane tickets	Cost of ticket ($), Length of layover (minutes)	Numeric
	Mechanics	Warranty length (days), experience (years)	Numeric
	CD players	Price, number of disks	Numeric
	Apartments	Rent, distance (minutes)	Numeric
	Cars	Miles per gallon, number of safety features	Numeric
	Boats	Number of passengers, speed (knots per hour)	Numeric
	Job offers	Number of days of sick leave, number of paid holidays	Numeric
	Houses	Price (thousands of $), square footage	Numeric
	Electric keyboards	Tone quality (1-100), number of features	Numeric
	Mini-LCD TVs	Price, percent distortion	Numeric
	Preschools	Children per classroom, teacher's experience (years)	Numeric
	Microwaves	Warranty (months), cooking power (watts)	Numeric
	Parking spaces	Price per month, distance from work (blocks)	Numeric
	Video cameras	Weight (pounds), number of features	Numeric
	Beer (24 packs)	Price, Quality (1-100)	Numeric
	Cars	Ride quality (1-100), miles per gallon	Numeric
	Restaurants	Distance from home (minutes), quality (1-5 stars)	Numeric
	TV sets	Percent distortion, average life span (years)	Numeric
Zhou, Kim and Laroche 1996	Cars	City mileage (mpg), ride quality rating	Numeric
	Orange juice	Price, quality rating	Numeric
	Calculators	Number of functions, probability of repair in first 2 years	Numeric

* The numeric ratings were supplemented with verbal descriptions.

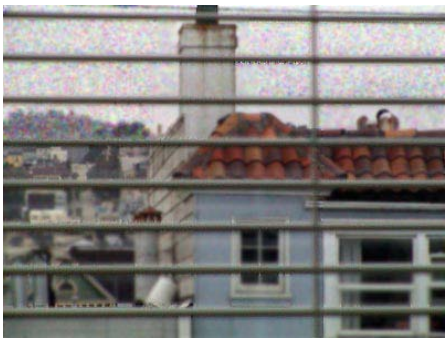
APPENDIX B – STIMULI USED IN STUDIES 1A-1S (EXCLUDING GUSTATORY STIMULI)

Apartments

Suppose you are renting an apartment. The following diagrams depict the window views and floor spaces of 3 options respectively. Which would you choose? (Please circle one.)

A
(Area: 530 sq ft)

B
(Area: 910 sq ft)



C
(Area: 905 sq ft)

Fruit (1)

Suppose you are thinking of having a snack. Which fruit would you choose?

A

B

C

Fruit (2)

Suppose you are thinking of having a snack. Which fruit would you choose?

A

B

C

Hotel Rooms

Suppose you are planning a three-day holiday to Los Angeles, California. The following hotels are still available. Which of the following would you choose?

A
$120/night

B
$180/night

C
$180/night

Mints

Suppose you could have one of the products below. Select the one you prefer.

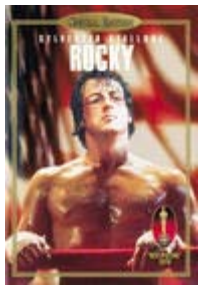
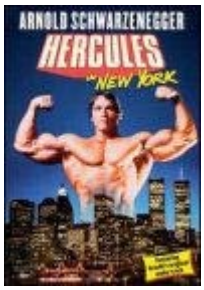
A

B

C

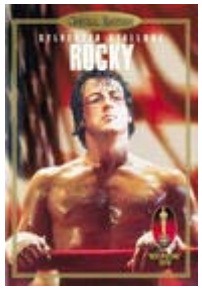
Movies (Decoy movie starring same actor as target movie)

[Suppose] you have just won a free DVD. Please select the one you would like.

Rocky  Sylvester Stallone	"His whole life was a million-to-one shot." A small time boxer gets a once in a lifetime chance to fight the heavyweight champ in a bout in which he strives to go the distance for his self-respect.
The Terminator  Arnold Schwarzenegger	"In the Year of Darkness, 2029, the rulers of this planet devised the ultimate plan. They would reshape the Future by changing the Past. The plan required something that felt no pity. No pain. No fear. Something unstoppable. They created 'THE TERMINATOR'" A human-looking, apparently unstoppable cyborg is sent from the future to kill Sarah Connor; Kyle Reese is sent to stop it.
Hercules in New York  Arnold Schwarzenegger	"It's Tremendous!! It's Stupendous!! It's Fun!!" After many centuries, Hercules gets bored living in Olympus (the home of the great Greek gods) and decides to move to... New York.

Movies (Decoy movie starring same actor as target movie)

[Suppose] you have just won a free DVD. Please select the one you would like.

The Terminator  Arnold Schwarzenegger	"In the Year of Darkness, 2029, the rulers of this planet devised the ultimate plan. They would reshape the Future by changing the Past. The plan required something that felt no pity. No pain. No fear. Something unstoppable. They created 'THE TERMINATOR'" A human-looking, apparently unstoppable cyborg is sent from the future to kill Sarah Connor; Kyle Reese is sent to stop it.
Rocky  Sylvester Stallone	"His whole life was a million-to-one shot." A small time boxer gets a once in a lifetime chance to fight the heavyweight champ in a bout in which he strives to go the distance for his self-respect.
Stop! Or My Mom Will Shoot  Sylvester Stallone	"Detective Joe Bomowski's mom is in town for a visit. She did the laundry, washed the windows and scrubbed the floors. Now, she's gonna clean up the streets." A tough detective's mother comes to visit him and begins to meddle in his life and career.

Movies (with Decoy movie bad sequel to target movie)

[Suppose] you have just won a free DVD. Please select the one you would like.

Speed  	A young cop must save the passengers of a bus that has a bomb set to explode if the bus goes below 50 MPH. “Get ready for rush hour.”
Grease  	The friendships, romances, and adventures of a group of highschool kids in the 1950s “Grease is the word”
Grease 2  	An English student at a 1960's American high school has to prove himself to the leader of a girls' gang whose members can only date greasers. “Grease is still the word!”

Movies (with decoy movie bad sequel to target movie)

[Suppose] you have just won a free DVD. Please select the one you would like.

Grease 	The friendships, romances, and adventures of a group of highschool kids in the 1950s “Grease is the word”
Speed 	A young cop must save the passengers of a bus that has a bomb set to explode if the bus goes below 50 MPH. “Get ready for rush hour.”
Speed 2 	A computer hacker breaks into the computer system of the Seaborn Legend cruise liner and sets it speeding on a collision course into a gigantic oil tanker. “Rush hour hits the water”

Popcorn (1)

Suppose you could have one of the products below. Select the one you prefer.

A

B

C

Popcorn (2)

Suppose you could have one of the products below. Select the one you prefer.

A

B

C

Bottled Water

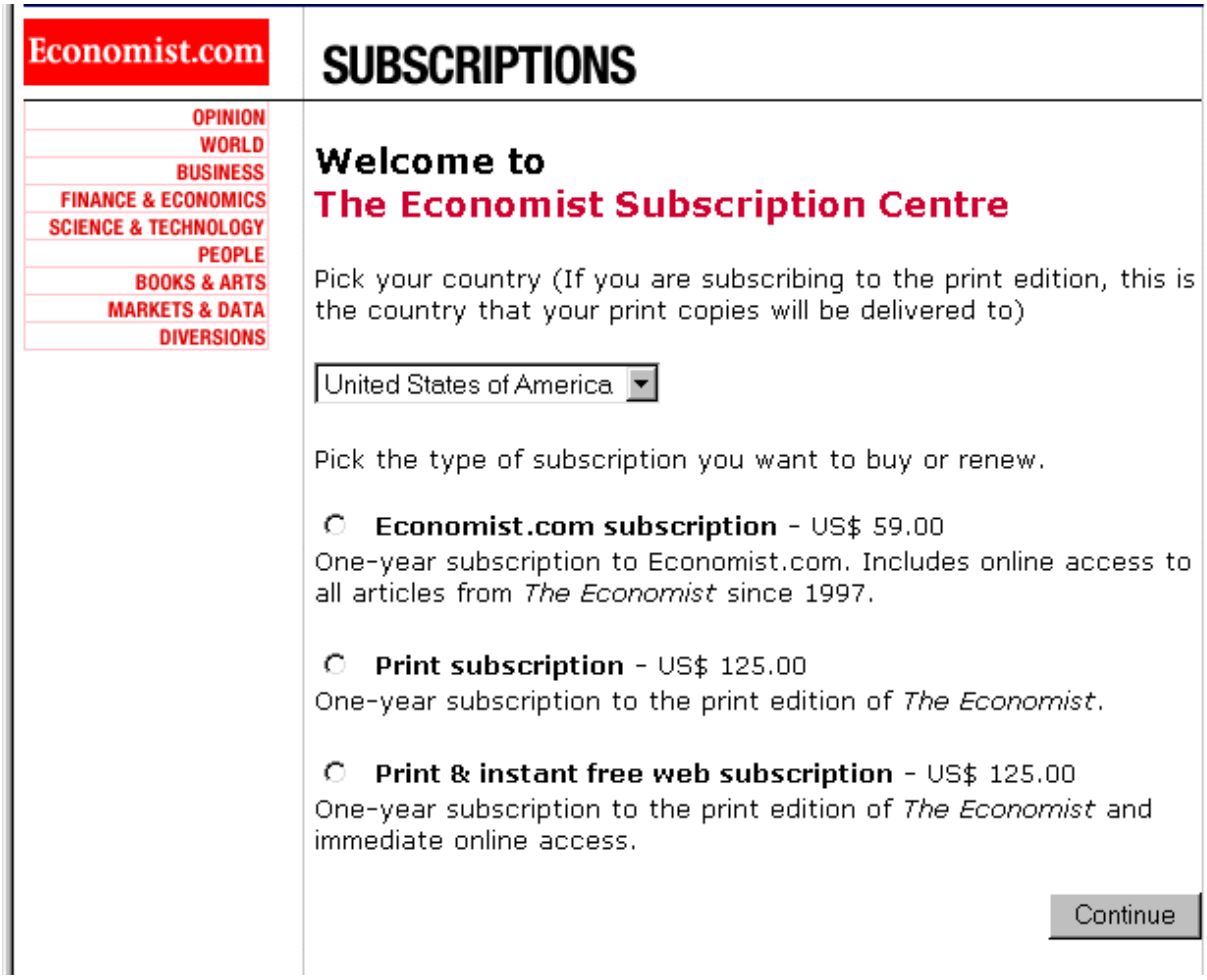
Suppose you could have one of the products below. Select the one you prefer.

	Penta
	Volvic Spring Water
	Duck Fart Spring Water

APPENDIX C1 – ATTEMPT TO REPLICATE RESULT REPORTED BY KIVETZ, NETZER, AND SRINIVASAN (2004)

Summary of Original Study

In an MBA classroom, Kivetz, Netzer, and Srinivasan (2004) asked 29 students to choose among one of three subscription options. A second group of 30 students were asked to select their preferred option from a smaller choice set that excluded the $125 "print-only" subscription listed second (which could be considered as a dominated option given that a print and web subscription was available for the same price). Consistent with an attraction effect, they report that the more expensive "combo" subscription was chosen significantly more often in the larger choice set that included the ostensible decoy (72% vs. 43%; $p < .02$).



Attempted Replications

Our first attempt to replicate this result involved a large (N = 515) sample of picnickers who completed a questionnaire in exchange for an ice cream bar. For half of our participants (N = 256), our materials and design were identical to those described. For the remainder (N = 259), we included a no purchase option. Neither design revealed an attraction effect.

Conditions	*Web (competitor)*	*Print + Web (target)*	*Print (decoy)*	*No choice*
Direct Replication	74% $_{85}$	26% $_{30}$	-----	-----
	69% $_{97}$	23% $_{32}$	9% $_{12}$	-----
Replication with no choice	38% $_{49}$	14% $_{18}$	-----	48% $_{61}$
	27% $_{36}$	15% $_{20}$	9% $_{12}$	48% $_{63}$

Later, we made a second attempt to replicate this result, using a large (N=2003) sample of respondents on Google Surveys. The materials and design were identical to those described above with two exceptions: (1) Respondents saw only the options themselves, not the rest of the screen shot; (2) We counterbalanced the order in which the two [or three] options were presented. Again, we found no evidence of an attraction effect, though the substantial fraction of respondents selecting the Print subscription confounds the interpretation of the non-effect.

Web (competitor)	*Print + Web (target)*	*Print (decoy)*
75% $_{753}$	25% $_{248}$	-----
69% $_{614}$	21% $_{211}$	18% $_{177}$

APPENDIX C2 – ATTEMPT TO REPLICATE SEN (1998)

Summary of Original Study

Sen (1998) conducted two studies involving short verbal descriptions of restaurants that differed in the quality of the food and atmosphere. In Study 1 from that paper, 96 subjects were randomly assigned to choose from either the core set (N = 50) or an extended set (N = 28) which included a restaurant whose description was intended to make it a decoy for the "good food, bad atmosphere" restaurant. Sen reported that adding an asymmetrically dominated decoy increased the choice share of the target (from 38% to 61%).[11]

Attempted replication

A total of 200 participants were recruited from Amazon Mechanical Turk. One was excluded for failing an instructional manipulation check. Participants chose between two (or three) Italian restaurants whose attributes were described. We randomized presentation order. A sample stimulus is presented. Restaurant A is the competitor, B is the target, and C is the intended decoy.

	Food	Atmosphere
Restaurant A	Okay tasting food, average portions, only use commercial pasta	Flawless service; chic, beautiful, crowd in stunning elegant bistro
Restaurant B	Superb taste, hearty portions, often serve home-made pasta	Curt, unattentive waiters dirty tablecloths, patrons are too noisy
Restaurant C	Fair sized portions, nice food, home-made pasta on rare occasions	Extremely slow, rude service, screaming children amid tacky furniture

Results and Discussion

Our sample was over twice as large as the original study, and we found no significant effect ($\chi^2 = .05$; $p > .83$).

Competitor	*Target*	*Decoy*
53% $_{52}$	47% $_{47}$	-----
47% $_{47}$	49% $_{49}$	4% $_{4}$

APPENDIX C3 – ATTEMPT TO REPLICATE SIMONSON AND TVERSKY'S (1992) "PEN" STUDY

Summary of Original Study

Simonson and Tversky (1992) asked 221 participants to imagine they had received $6. Roughly half (N = 106) indicated whether they would exchange that money for a Cross pen. For the remaining half (N = 115), a less attractive *Bic* pen was added as a third option for which they could exchange any money they might receive. (Participants were told, truthfully, that some participants would receive the option they selected). As intended, the *Bic* pen was unpopular (only 2% chose it), though its presence increased the fraction choosing to exchange their money for the Cross pen from 36% to 46% -- a marginally significant effect ($t = 1.5$, $p < .10$).

Replication Method

Our replication attempt involved a total of 518 picnickers, who completed a longer study in exchange for an ice cream bar. The choices were hypothetical, but the study was otherwise essentially identical to that described above. (We crossed the choice set manipulation with the manner in which the exchange was phrased: either as trading away $6 for a pen, as in the original study, or as a choice between the presented options.)

Results and Discussion

We find no evidence of an attraction effect, regardless of the way the choice was phrased.

Frame	*$6 (competitor)*	*Cross pen (target)*	*Bic pen (decoy)*
Endowed Money	67% $_{79}$	33% $_{39}$	-----
	68% $_{99}$	30% $_{44}$	1% $_{2}$
Choice	62% $_{77}$	38% $_{47}$	-----
	58% $_{76}$	32% $_{42}$	10% $_{13}$

APPENDIX C4 – ATTEMPT TO REPLICATE SIMONSON & TVERSKY'S (1992) "PAPER TOWEL" STUDY

Summary of Original Study

Simonson and Tversky (1992) asked 221 participants to choose either a box of facial tissues or a roll of paper towels. Participants were given one of two questionnaire versions. One of the versions contained a slightly worse box of facial tissues as a decoy while the other contained a slightly worse roll of paper towels as a decoy. Participants were asked to choose the brand they preferred. Simonson and Tversky report an attraction effect for both paper towels and tissues (t = 1.7 and t = 2.2, respectively).

Facial Tissue +	*Paper Towel +*	*Facial Tissue -*	*Paper Towel -*
28% $_{32}$	63% $_{72}$	-----	10% $_{11}$
42% $_{44}$	52% $_{55}$	7% $_{7}$	-----

Attempted Replication

Simonson and Tversky (1992) do not report the brand of paper towels and facial tissues used in their study. To create corresponding stimuli, we conducted a pretest in which 128 participants rated the quality of seven brands of tissues and paper towels they were allowed to examine and evaluate on a seven point scale ranging from 1 (Low Quality) to 7 (High Quality). Among paper towels, *Bounty* rated highest (5.52) and *Tuf*, a Walgreens store brand, rated lowest (2.83). Among facial tissues, *Realsoft 3-ply* rated highest (5.19) and *Realsoft 2-ply* rated lowest (3.50). Thus, we selected *Bounty* and *Realsoft 3-ply* as our core options, *Tuf* as our paper towel decoy, and *Realsoft 2-ply* as our facial tissue decoy.

As part of a study they were paid $5 to complete, we randomly assigned 200 students from Yale university to indicate their preference between a set of paper products they were allowed to examine. Participants were randomly assigned to sample from the core set or an expanded set, and if from an expanded set with a tissue or paper towel decoy. Presentation order was randomized.

Results and Discussion

Though our study was somewhat underpowered, and results complicated by non-negligible fractions choosing the facial tissue decoy, we found little evidence for an attraction effect. The high quality paper towel was chosen more frequently when the choice set included the low quality paper towel decoy (27% vs. 24%) but this difference falls well short of statistical significance (χ^2= .16; p =.69). For the facial tissues, roughly one in four chose the decoy, so inferences are limited. Certainly, there is no violation of regularity (Luce, 1959; 1977).

Facial Tissue +	*Paper Towel +*	*Facial Tissue -*	*Paper Towel -*
76% $_{70}$	24% $_{22}$	-----	-----
66% $_{37}$	13% $_{7}$	21% $_{12}$	-----
69% $_{36}$	27% $_{14}$	-----	4% $_{2}$

APPENDIX C5 – ATTEMPT TO REPLICATE TRUEBLOOD ET AL. (2013)

Summary of Original Study

In exchange for course credit, Trueblood et al. (2013) recruited 49 undergraduates from the University of Newcastle. Each was required to make a total of 720 judgments of which of three rectangles is largest. On the 540 focal trials, two rectangles were constructed to have identical areas, but different dimensions, orientations, and vertical positions on the screen. In these focal trials, the decoy rectangle was presented in the same orientation as the target rectangle, but was smaller by virtue of being slightly narrower (180 trials), slightly shorter (180 trials), or both (180 trials). For the trials including a narrower decoy, the decoy increased the choice share of the target rectangle by about two percent, leading to a shift in choice share of about four percent when comparing two ternary choice sets with opposing decoys. With the large number of trials, this effect achieved significance (t(48)= 3.62, p <.001). For trials including a shorter decoy, there was no contextual effect (t(48)= 1.14, p >.26). For trials in which the decoy was both shorter and thinner than the target, there was a very small effect that just reached significance (t(48)= 2.09, p < .05). Between three and four percent of subjects chose the decoy.

Attempted Replication

We recruited 276 participants from Amazon Mechanical Turk, but restricted our analysis to 179 who passed an attentional manipulation check (Oppenheimer, Meyvis, and Davidenko, 2009) placed at the end of the survey. Our design was very similar to that used by Trueblood et al. (2013), though not identical. We believe there were four main differences: (1) To reduce fatigue, our participants completed “only” 40 trials; (2) Rather than using two ternary choice sets with opposing decoys, we randomly assigned subjects to either a *control* condition (a judgment of which of two differently shaped and oriented rectangles was larger) and a *decoy* condition (involving those options plus a decoy option which was either narrower or shorter than either the “wider” or the “taller” rectangle). (3) Across trials, our rectangles were considerably more variable in both size and shape, though the two “core” rectangles always had the same area; and (4) The lower edge of the rectangles was aligned.

Results and Discussion

We failed to replicate their results. Subscripts represent choices. Since 179 participants were each asked to make 40 choices, the subscripts should sum to 7160. They sum to 7117, because a total of 43 items were skipped. We did not exclude anyone for skipping trials, although missing many trials correlated strongly with failing the manipulation check, so many of the respondents that skipped several items were excluded by this criterion.

Competitor	*Target*	*Decoy*
53% $_{2030}$	47% $_{1810}$	-----
51% $_{1666}$	42% $_{1363}$	8% $_{248}$

APPENDIX C6 – ATTEMPT TO REPLICATE RESULT REPORTED BY RATNESHWAR, SHOCKER & STEWART (1987)

Summary of Original Study

Ratneshwar, Shocker, & Stewart (1987) compared preferences between two options with preferences expressed in an expanded choice set that included a third option that was dominated by (or relatively inferior to) one of the two "core" options. For all respondents, quality levels were expressed with numeric indices, but for half of these respondents the numbers were accompanied by verbal descriptions. For instance, the frozen orange juice whose quality was 50 (out of 100) was described as "Medium fresh-orange character mingled with faint processed-orange taste." A second study was similar, except that they compared the choice share in ternary choice sets involving opposing decoys. The product categories were television sets and frozen orange juice in study 1. In study 2, they were beer, cars, light bulbs, and gas barbecue grills. Participants in study 1 were 213 undergraduates at a "southern state university" in the U.S. Participants in study 2 were 176 undergraduates at a "major private university." The authors found that the attraction effect was often (though not always) reduced when numeric quality ratings were supplemented with verbal descriptions.

Using a sample of picnickers near Boston, we attempted to replicate one of their results. We focused on frozen orange juice with a low quality decoy, because they had found a large attraction effect using numeric quality ratings, but no attraction effect when those numeric quality ratings were supplemented with verbal descriptions. We borrowed these descriptions, verbatim, to construct our materials. Our subjects were 275 Boston picnickers, who were recruited to fill out a packet of unrelated studies.

The table shows the original data, and our attempted replication in brackets. In the numeric condition, we replicated the findings of Ratneshwar, Shocker, & Stewart (1987); the addition of a "decoy" orange juice (which was only slightly cheaper, but much lower quality than the target) markedly increased the choice share of the target juice. Unlike their results, we found similar effects when the numeric ratings were supplemented with verbal descriptions, as the choice share of the target nearly doubled (from 14% to 26%). We also found a substantial main effect, as the verbal descriptions increased the attractiveness of the most expensive brand.

Attribute Representation	$2.00 Quality = 70 (*competitor*)	$1.20 Quality = 50 (*target*)	$1.10 Quality = 30 (*decoy*)

Numeric	65%$_{24}$ [74%$_{51}$]	35%$_{13}$ [26%$_{18}$]	-----
	26%$_{9}$ [43%$_{29}$]	68%$_{23}$ [56%$_{38}$]	6%$_{1}$ [1%$_{1}$]
Numeric + verbal	61%$_{22}$ [86%$_{60}$]	39%$_{14}$ [14%$_{10}$]	-----
	68%$_{23}$ [72%$_{49}$]	29%$_{10}$ [26%$_{18}$]	3%$_{1}$ [1%$_{1}$]

(Numeric only conditions)

Below you will find some brands of frozen concentrated orange juice. You know only the price and the quality ratings made by consumer reports. Given that you had to buy one brand based on this information alone, which would it be? (Circle I or II [or III])

Brand	Price per can	Quality Rating (100 = ideal)
I	**$2.00**	**70**
II	**$1.20**	**50**
[III	**$1.10**	**30]**

(Numeric + verbal conditions)

Below you will find some brands of frozen concentrated orange juice. You know only the price and the quality ratings made by consumer reports (100 = perfection).

Brand	Price per can	Quality Rating
I	**$2.00**	**70**
II	**$1.20**	**50**
[III	**$1.10**	**30]**

Detailed description of quality ratings:

Brand I: High fresh-orange character and quite flavorful

Brand II: Medium fresh-orange character mingled with faint processed-orange taste

Brand III: Distinct processed-orange character with slight flavor of fermented oranges

Given that you had to buy one brand based on this information alone, which would it be?

Brand I Brand II [Brand III]

It bears noting here that the addition of the decoy option (the foul orange juice) not only makes the target a dominating option; it also makes it both a compromise option (in attribute space) and a middle option (in physical space). Either of these may contribute to, or fully explain, the effect. The role of middle position could be accounted for by counterbalancing order, which we did not do in *this* study, and which is not typically done. A problematic feature of this study (as well as our own studies 3a and 3b) is that the descriptions chosen do not necessarily correspond with those numbers; respondents' interpretation of the quality levels implied by the numbers 70, 50 [and 30] is likely affected by the verbal labels. This confounds attribute *representation* (how quality is communicated) with attribute *levels* (the perceived quality of the options). Ratneshwar, Shocker and Stewart noted (p. 525) that they conducted a pilot study to "*assure that the elaborated product descriptions were perceived as comparable to the purely numeric scale descriptors*." However, achieving rough correspondence in the *mean* levels does not assure that the two conditions were in any way matched at the *respondent* level, which is what counts.

We conducted a follow up study with 517 Boston picnickers, who we recruited to fill out a packet of unrelated studies in exchange for ice cream. The study was similar to the prior one, with two key differences: (1) we omitted the numeric ratings of quality; we just provided the price and the verbal quality descriptions. (2) Half of the respondents were asked to translate the verbal quality descriptions on a 100 point scale of quality. This was done in part to test whether the presence of numbers – even self-generated numbers – would affect the strength of the attraction effect (as in study 3c). The data are reported below.

Attribute Representation	\$2.00 (*competitor*)	\$1.20 (*target*)	\$1.10 (*decoy*)
Verbal	$74\%_{95}$	$26\%_{23}$	-----
	$73\%_{105}$	$22\%_{32}$	$4\%_{6}$
Verbal + own rate	$79\%_{99}$	$21\%_{27}$	-----
	$78\%_{100}$	$19\%_{24}$	$4\%_{5}$

Most notably, we found no evidence of the attraction effect, which is consistent with our other failures to find such effects unless *both* attributes are numerically specified. The presence of *self*-generated numbers did not revive the effect. Moreover, returning to an issue raised above, although the *mean* ratings with elaborated descriptions (78, 44 [and 21]) were tolerably close to the "corresponding" numeric values used in their study (and in our replication), the alleged correspondence was rarely achieved if the data are analyzed at the individual level. In fact, only 10% of our respondents assigned numbers to the verbal descriptions that were within ± 10 of the values 70, 50, [and 30]. This is a reasonably forgiving criterion, as triplets such as (80, 40 and 40) or (60, 60, 20) would count as an acceptable degree of correspondence. This starkly illustrates an important drawback of this design (a critique that we acknowledge also applies to our own studies 3a and 3b).

(Numeric ratings omitted)

Below you will find some brands of frozen concentrated orange juice. You know only the price and the quality ratings made by consumer reports. Given that you had to buy one brand based on this information alone, which would it be? (Circle I or II) [Circle I, II, or III]

Brand	Price per can
I	$2.00
II	$1.20
[III	$1.10]

Detailed description of quality ratings:

Brand I: High fresh-orange character and quite flavorful

Brand II: Medium fresh-orange character mingled with faint processed-orange taste

[**Brand III:** Distinct processed-orange character with slight flavor of fermented oranges]

(Numeric ratings self-generated)

Below you will find some brands of frozen concentrated orange juice. You know only the price and the quality ratings made by consumer reports.

Brand	Price per can
I	$2.00
II	$1.20
[III	$1.10]

Detailed description of quality ratings:

Brand I: High fresh-orange character and quite flavorful

Brand II: Medium fresh-orange character mingled with faint processed-orange taste

[**Brand III**: Distinct processed-orange character with slight flavor of fermented oranges]

On a scale from 0 to 100, how positive are the verbal descriptions above, for each brand? Indicate below.

Brand I = _____ Brand II = _____ [Brand III = _____]

Given that you had to buy one brand based on this information alone, which would it be? (Circle I or II) [Circle I, II, or III]

Brand I **Brand II** **[Brand III]**

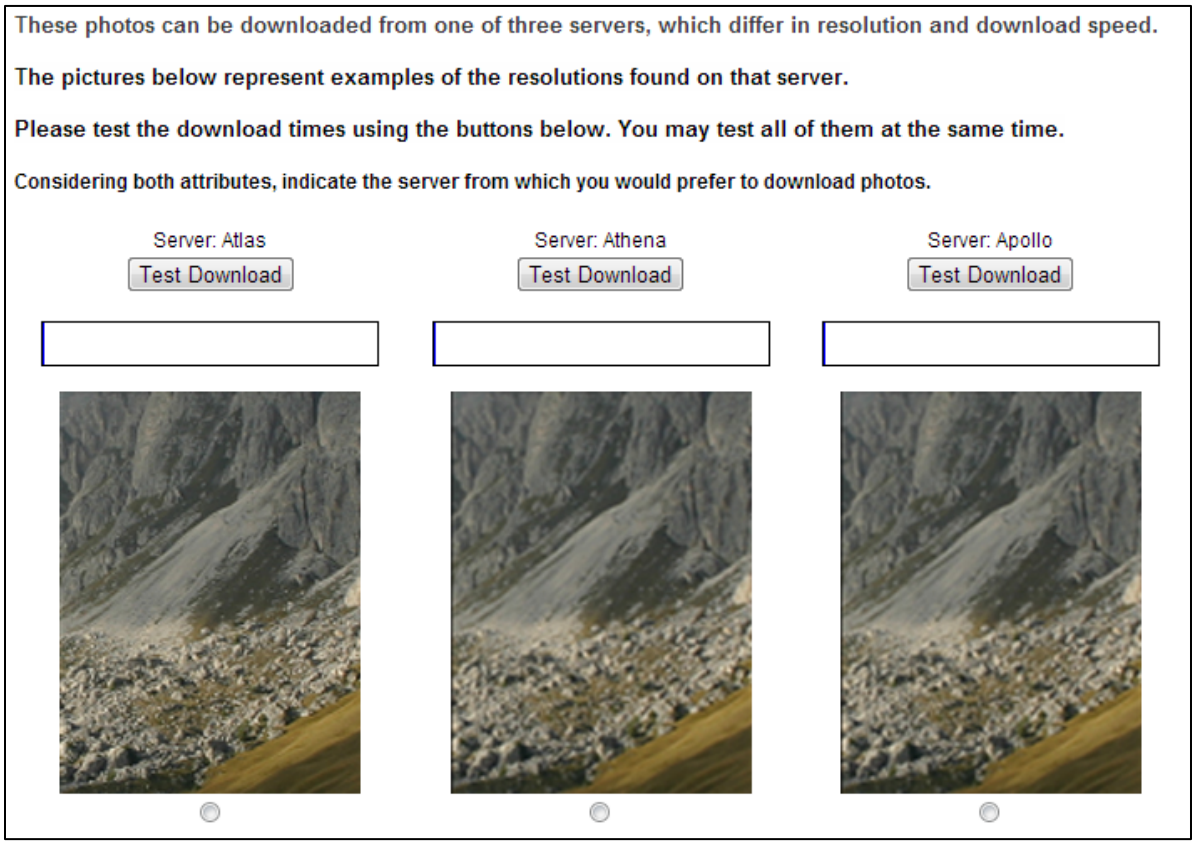
APPENDIX D – ADDITIONAL STUDY ON IMAGE QUALITY AND DOWNLOAD TIMES

Method

We recruited a total of 1288 participants from Amazon's Mechanical Turk and an online panel, but restricted analysis to 1088 respondents who passed an instructional manipulation check. Participants were asked to select servers they would use for the study under the pretense that the study would involve downloading photographs to rate. The servers varied in terms of image quality (480p or 1080p) and download time (10, 20, or 14 seconds). The core set consisted of a high resolution (1080p) photo that downloaded slowly (20 seconds) or a lower resolution (480p) photo that downloaded more quickly (10 seconds). The decoy option was a low resolution (480p) photo that downloaded in 14 seconds.

We manipulated how image resolution and download time were represented. Image quality was represented either visually (as shown), or numerically (1080p, 480p) or both (the numeric metric of quality was printed next to the picture). Similarly, download time was depicted by a progress bar (which participates saw as gradually being filled, as below), by number of seconds (20, 10, or 14), or both (respondents experienced the duration of the depicted number of seconds).

The six experimental variations are listed in the table. The figure displays the case in which both dimensions were experienced:



Results and Discussion

We found no significant attraction effect whether the data are pooled or in any of the six studies treated separately.

Experimental Variation	*Representation*	*1080p 20 sec (competitor)*	*480p 10 sec (target)*	*480p 14 sec (decoy)*
1	Duration quantified	57% $_{54}$	43% $_{41}$	-----
	Image quality quantified	42% $_{44}$	51% $_{54}$	7% $_{7}$
2	Duration experienced	33% $_{29}$	67% $_{58}$	-----
	Image quality quantified	38% $_{33}$	46% $_{40}$	16% $_{14}$
3	Duration experienced and quantified	43% $_{40}$	57% $_{53}$	-----
	Image quality quantified	38% $_{28}$	58% $_{43}$	4% $_{3}$
4	Duration quantified	79% $_{78}$	21% $_{21}$	-----
	Image quality experienced	65% $_{55}$	29% $_{24}$	6% $_{5}$
5	Duration quantified	76% $_{71}$	24% $_{22}$	-----
	Image quality experienced and quantified	72% $_{63}$	20% $_{17}$	8% $_{7}$
6	Duration experienced	67% $_{68}$	33% $_{34}$	-----
	Image quality experienced	49% $_{40}$	45% $_{37}$	6% $_{5}$
	Pooled across conditions	60% $_{340}$	40% $_{229}$	-----
		51% $_{263}$	41% $_{215}$	8% $_{41}$

ENDNOTES:

[1] In all cases, we simply report the raw percentages choosing the target with and without the decoy. However, our statistical tests were conducted on adjusted values that were maximally conservative with respect to claiming violations of regularity. Namely, when the decoy increased the choice share of the target (suggesting attraction effects), we attributed the fraction choosing the decoy to the competitor. When the decoy reduced the choice share of the target (suggesting repulsion effects), we attributed the fraction choosing the decoy to the target. The distinction is significant only when the fraction choosing the decoy becomes appreciable. Without this correction, we would, of course, find a few more instances of repulsion and attraction effects that reached conventional levels of statistical significance.

[2] For a perceptual example, someone who estimates the temperatures of a tepid and a warm bucket of water will regard them as differing more than someone who first experiences a hot bucket of water before estimating the respective temperatures of the two cooler buckets (i.e., the hot bucket will make the two cooler buckets seem more similar).

[3] The decoy was rarely chosen in either condition, suggesting that the dominance relation was salient in both. Moreover, the mean judgments in study 2c reveal a close correspondence between the stated probability and the probability as judged from the pictures. The "safe" gamble was estimated to have a 71% of winning (truth = 73%). The risky gamble (and its decoy) were estimated to have a 28% chance of winning (truth = 28%).

[4] We edited the figures to remove the white boundary of the arrows. Also, we used black and white printing, with the winning part black, and the remainder grey.

[5] Though the effect was orthogonal to our interests, the request to estimate probability before choosing increased the choice share of the safer, higher probability gamble (71% vs. 62%; $\chi^2 = 4.63$; $p < .03$)

[6] On Google surveys, the focal question is sprung upon web surfers who had not expected to be asked any questions. Their "payment: for providing *an* answer is faster access to the sought after webpage, and their "payment" for considering the question carefully was the mere satisfaction of having their preferences accurately represented. Thus, we anticipated that many would simply answer randomly to get to their desired website as quickly as possible, though that we might still be able to extract a signal from the subset who gave the question some consideration.

[7] For our mTurk participants, we also manipulated *how* those judgments were made: either with numbers (from 1 to 100) or on an unmarked slider bar whose endpoints were labeled "Poor" and "Excellent." The manner of the ratings did not have an appreciable effect, so we pooled across this manipulation.

[8] We conducted six related studies in which we explored various ways of representing image quality and download time. We found no significant contextual effects in any of them (though sample sizes were modest due to the number of experimental variations). Thus, though the study supported our contention that the attraction effect is rare outside of fully numeric specifications, it did not foster our goal of clarifying boundary conditions. For these reasons, and because the conditions were not easily summarized, we relegated it to Appendix D. We nevertheless wanted to include it for completeness, and as some protection against the (rarely encountered) accusation that we only reported studies which *failed* to show significant effects.

[9] Ariely's featured example is identical to one discussed earlier in Kivetz, Netzer, and Srinivasan (2004). They report effects that are somewhat less incredible, though still striking, as the presence of the decoy option increased choice share of the target from 43% to 72%.

[10] Aaker (1991) proposed that the presence of the decoy may sometimes help the competitor option by making it more unique, but her "black sheep" effect is not about dominance *per se*. It would predict that the choice share of apple would be increased by adding a second perfect orange to a choice set consisting of a perfect apple and a perfect orange.

[11] The sample sizes do not add to 96, because in the extended set, Sen excluded 18 respondents who chose the decoy. This practice confounds treatment effects with selection effects, and is especially problematic when the decoy has substantial choice share. Chen and Risen (2010) discuss a related problem with the interpretation of many cognitive dissonance studies.

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Table 1: Product Categories and Attributes for Studies 1a-1s

Product Class	Attributes	Attribute Levels of		
		Competitor	Target	Decoy
Fruit	Type, Appearance	Apple	Orange	Moldy Orange
		Orange	Apple	Bruised Apple
Apartments	Photo of view floor space	Ocean view, 530 sq. feet	Apartment view, 910 sq. feet	Apartment view (dirty window), 905 sq. feet
Hotel Rooms	Photo of décor, Price	Average décor, $120 a night	Very nice décor, $180 a night	Nice décor $180 a night
Jellybeans	Flavor and color	Cherry (Red)	Plum (Grey)	Pepper (Grey)
		Apricot (Orange)	Chocolate (Brown)	Dirt (Brown)
		Banana (Yellow)	Apple (Green)	Grass (Green)
		Blueberry (Blue)	Marshmallow (Beige)	Ear Wax (Beige)
Kool-Aid	Flavor and concentration	Grape	Cherry	Dilute Cherry
		Cherry	Grape	Dilute Grape
Mints	Brand, Flavor	*Certs*, Spearmint	*Altoids*, Spearmint	*Altoids*, Ginger
Movies	Actor, Title (with verbal description)	Stallone, Rocky	Schwarzenegger, The Terminator	Schwarzenegger, Hercules in New York
		Schwarzenegger, The Terminator	Stallone, Rocky	Stallone, Stop! Or My Mom Will Shoot
Movies with sequels	Film (with verbal description)	Speed	Grease	Grease 2
		Grease	Speed	Speed 2
Popcorn	Brand, Flavor	*Popz*, Butter	*Act-II*, Butter	*Act-II*, Jalapeno
		Act-II, Butter	*Popz*, Butter	*Popz*, Jalapeno
Bottled Water	Brand, Type (with picture of bottle)	Penta Water	Volvic Spring Water	Duck Fart Spring Water
Drinks	Drink Type, Price	Milk $2.50	*Tropicana* OJ $3.95	*Stop & Shop* OJ $3.75

Table 2: Results of Studies 1a-1s

Product Category	*No decoy*		*Decoy present*		*% Change in target's share due to decoy*
	Target		*Target*	*Decoy*	
Apartments (n=256)	43%	→	48%	2%	+5%
Fruit (n=187)	62%	→	63%	0%	+1%
(n=184)	38%	→	38%	1%	0%
Hotel Rooms (n=129)	70%	→	67%	13%	-3%
Jellybeans (n=327)	52%	→	46%	6%	-6%
(n=348)	35%	→	32%	2%	-3%
(n=404)	64%	→	56%	10%	-8%
(n=305)	55%	→	52%	4%	-3%
Kool-Aid (Cherry target) (n= 256)	47%	→	48%	8%	1%
Kool-Aid (Grape target) (n=260)	53%	→	39%	6%	-13%
Mints (n=251)	55%	→	49%	6%	-6%
Movie Actors (n=170)	55%	→	55%	10%	0%
(n=165)	45%	→	40%	7%	-5%
Movie Sequels (n=166)	44%	→	36%	6%	-8%
(n=162)	56%	→	48%	10%	-8%
Popcorn (n=74)	39%	→	31%	5%	-8%
(n=68)	61%	→	33%	7%	-28%
Bottled Water (n=241)	70%	→	52%	2%	-18%**
Drinks (n=681)	41%	→	39%	13%	-2%

** $p < .01$ using χ^2-test.

Table 3: Results of Study 2a

Probability representation	*73% chance to win $197* (*competitor*)	*28% chance to win $516* (*target*)	*23% chance to win $507* (*decoy*)
Numeric	86% $_{111}$ 71% $_{90}$	14% $_{18}$ 28% $_{35}$	----- 2% $_{2}$
Visual	76% $_{100}$ 74% $_{89}$	24% $_{31}$ 26% $_{31}$	----- 0% $_{0}$

Note: The subscripts are counts from which percentages are computed.

Table 4: Results of Study 2b

Probability representation	*73% chance to win $12* (*competitor*)	*28% chance to win $33* (*target*)	*28% chance to win $30* (*decoy*)
Numeric	79% $_{156}$ 63% $_{125}$	21% $_{42}$ 37% $_{73}$	----- 0% $_{1}$
Visual	66% $_{125}$ 65% $_{132}$	34% $_{65}$ 35% $_{71}$	----- 0% $_{1}$

Note: The subscripts are counts from which percentages are computed.

Table 5: Results of Study 2c

Conditions	*73% to win $12* (*competitor*)	*28% to win $33* (*target*)	*28% to win $30* (*decoy*)
choices precede numeric estimates	60%$_{75}$ 64%$_{84}$	40%$_{51}$ 30%$_{39}$	----- 6%$_{8}$
numeric estimates precede choices	71%$_{81}$ 71%$_{99}$	29%$_{33}$ 23%$_{32}$	----- 6%$_{9}$

Note: The subscripts are counts from which percentages are computed.

Table 6: Results of Study 3a

Representation of picture quality	*High quality $503* (*competitor*)	*Medium quality $350* (*target*)	*Low quality $339* (*decoy*)
Numeric	67% $_{40}$	33% $_{20}$	-----
	42% $_{25}$	57% $_{34}$	2% $_{1}$
Visual	47% $_{28}$	53% $_{32}$	-----
	64% $_{38}$	35% $_{21}$	2% $_{1}$

Note: The subscripts are counts from which percentages are computed.

Table 7: Results of Study 3b

Representation of picture quality	*High quality $503*	*Medium quality $350*	*Low quality $339*
Numeric	71% $_{714}$	29% $_{292}$	-----
	56% $_{563}$	28% $_{281}$	16% $_{161}$
Visual	76% $_{771}$	24% $_{244}$	-----
	70% $_{703}$	17% $_{174}$	13% $_{130}$

Note: The subscripts are counts from which percentages are computed.

Table 8: Results of Study 3b With Zeroed Decoy

Representation of picture quality	*High quality $503*	*Medium quality $350*	*Low quality $339*
Numeric	90% $_{473}$	10% $_{51}$	-----
	77% $_{403}$	23% $_{120}$	zeroed
Visual	92% $_{576}$	8% $_{49}$	-----
	93% $_{573}$	7% $_{44}$	zeroed

Note: The subscripts are counts from which percentages are computed.

Table 9: Results of Study 3c

Conditions	*High quality $503 (competitor)*	*Medium quality $350 (target)*	*Low quality $339 (decoy)*
Choices precede ratings	66% $_{307}$ 58% $_{293}$	34% $_{158}$ 37% $_{189}$	----- 5% $_{27}$
Ratings precede choices	66% $_{321}$ 49% $_{239}$	34% $_{167}$ 41% $_{197}$	----- 10% $_{47}$

Note: The subscripts are counts from which percentages are computed.

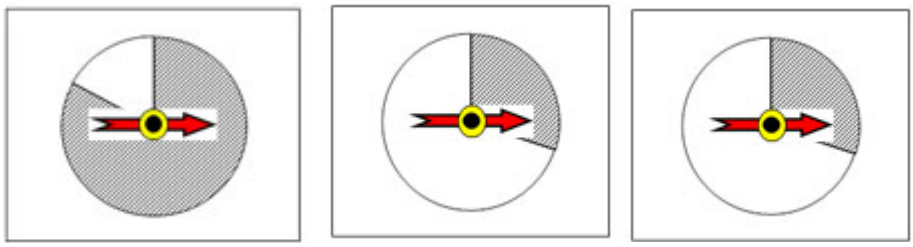
Figure 1: Stimuli from Study 2a

Suppose that for the gambles below, you get to spin the pointer, and if it lands anywhere in the **black** area, you win the amount shown. Which of the gambles below would you choose?

$197 **$516** **$507**

Figure 2: Stimuli from Study 2b

Suppose that for the gambles below, you get to spin the pointer, and if it lands anywhere in the shaded area, you win the amount shown. Which of the gambles below would you choose?



$12 **$33** **$30**

Figure 3: Stimuli from Study 3a

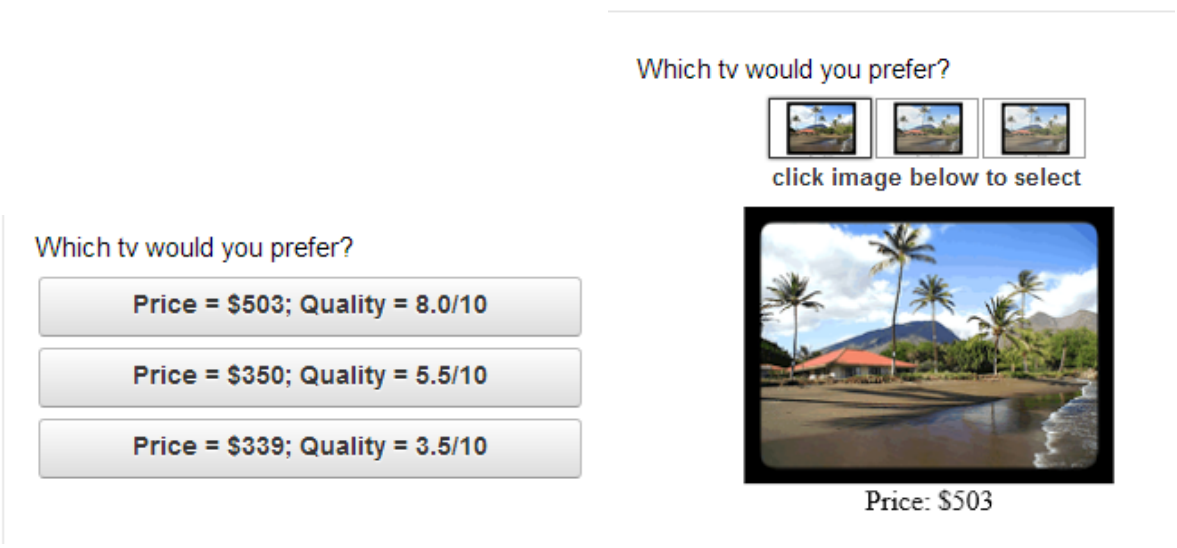
Suppose you are buying a second television. Assuming that all the ones below have the same screen size, which would you choose? (Please select one.)

A
(Price: $503)

B
(Price: $350)

C
(Price: $339)

Figure 4: Example of Study 3B Stimuli



Note:--The left panel shows example stimuli when picture quality was represented numerically, while the right panel shows the corresponding stimuli when picture quality was represented visually.