Judgment and Decision Making, Vol. 3, No. 5, June 2008, pp. 396–403

# Biasing simple choices by manipulating relative visual attention

K. Carrie Armel[1], Aurelie Beaumel[1], and Antonio Rangel*[2]
[1] Department of Economics, Stanford University
[2] HSS & Computational and Neural Systems, California Institute of Technology

**Abstract**

Several decision-making models predict that it should be possible to affect real binary choices by manipulating the relative amount of visual attention that decision-makers pay to the two alternatives. We present the results of three behavioral experiments testing this prediction. Visual attention is controlled by manipulating the amount of time subjects fixate on the two items. The manipulation has a differential impact on appetitive and aversive items. Appetitive items are 6 to 11% more likely to be chosen in the long fixation condition. In contrast, aversive items are 7% less likely to be chosen in the long fixation condition. The effect is present for primary goods, such as foods, and for higher-order durable goods, such as posters.

Keywords: construction of preferences, visual attention, race-to-barrier models, neuroeconomics.

## 1 Introduction

Many behavioral scientists believe that individuals make choices by first assigning values to objects and then selecting the option with the highest value, perhaps with some noise. This raises several questions: How are the values that guide decisions (henceforth called decision values) computed? How are values compared? What are the properties of those processes?

These questions are receiving increasing amounts of attention in psychology, behavioral neuroscience, and neuroeconomics. In particular, several models of how the decision values are computed and compared have been proposed (for reviews see Bogacz, 2007; Rangel, 2008; and Smith and Ratcliff, 2004). These models are based on a simple idea. A decision value is a forecast, made prior to consumption, of the actual value that will be derived from consuming an item. The models assume that decision values are computed by making repeated noisy estimates of the consumption value that are then integrated over time. Interestingly, some of these models have received considerable empirical support in both human behavioral and monkey electrophysiology experiments.

These models make some striking predictions with important behavioral and economic implications. For example, they predict that the decision value assigned to an item, and thus the willingness-to-pay for it, can depend on the amount of time spent computing it (Armel & Rangel, 2008; Busemeyer & Townsend, 1993; Busemeyer & Diederich, 2002). In a series of experiments testing this prediction, Armel and Rangel (2008) showed that the willingness-to-pay for appetitive items increases significantly with computation time, and that the opposite is true for aversive items.

Krajbich, Armel, and Rangel (2008) extended this class of models to investigate the role of visual attention on binary choice. Their model, described in the next section, makes two stark predictions about the impact on choice of exogenous changes of visual attention. Firt, it predicts that it should be possible to increase the probability that an item be chosen by changing the relative amount of time that subjects fixate on the item during the decision-making process. Second, it predicts that the effect should be positive for appetitive items, and negative for aversive items. This paper describes the results of three behavioral experiments testing these predictions. To a large extent, the results are consistent with the predictions.

The properties of the value computation and comparison processes should be of interest to behavioral scientists since they determine the extent to which individuals are able to make quality choices, and the circumstances in which they are able to do so. For example, the results in this paper suggest that incidental variables that affect visual attention, such as displays or lighting conditions, migh affect the choices that are made. In addition, the properties of these processes could have important implications for the behavioral and welfare effects of practices such as in-store marketing.

Our work is related to the literature on the construction of preference in behavioral economics and marketing that has studied the impact of several incidental variables on

*Address: Caltech, HSS, MC 228–77, Pasadena, CA 91125. Email: rangel@hss.caltech.edu.

the computation of decision values (see Lichtenstein and Slovic, 2006, for an excellent compendium of articles). For example, Weber and Kirsner (1997) asked subjects to make choices between pairs of lotteries from a graphical display and compared two conditions: one in which larger payoffs were depicted with larger fonts, and one in which smaller payoffs were depicted with larger fonts. They found that subjects were more willing to choose the riskier gamble (with the potentially larger payoffs) in the first condition. A common interpretation of these results is that outcomes with the larger font size received more attention and that this lead to a relative overweithting of those outcomes. Related to this, Tversky and Kahneman (1992) have argued that the S-shaped probability weighting function of prospect theory is driven by perceptual biases that place excessive relative attention on very low and very high probability events, which as a result are overweighted relative to mid-range probabilities. In all of these results, what is manipulated is the relative attention received by different dimensions of the choice problem (e.g., probabilities or gains). In contrast, in this paper we show that changes in the relative amount of visual attention received by entire items can also affect the likelihood that they be chosen. Thus, our results do not depend on one dimension of choice being overweighted at the expense of another but, as highlighted in the model described in the next section, on the process of relative value comparison favoring one option at the expense of the other.

Our work is also related to the literature on the Mere Exposure Effect (MEE; Zanjonc, 1968, 2001). A typical experiment shows that the subjects' reports about how much they like seeing an stimulus (e.g., a Chinese ideogram or a foreign language word) can be increased through repeated and brief previous exposures to the items (for a review see Bornstein, 1989). There are two important differences between the MEE and the processes studied in this paper. First, the MEE is about how previous exposures affect the actual "consumption experience" of seeing the item, whereas we study how visual attention during the process of decision making affects the choices that are made. Thus, whereas MEE is about the impact of repeated exposures on learning across trials, the effect that we investigate is about the impact of exposure time within a single decision trial. Second, whereas the MEE is defined to be a "ramping up" of the positive liking ratings that result from consuming the items (even if they are aversive), our effect looks more like an "amplification effect" which is positive for appetitive items but negative for aversive ones.

As far as we know, this is the first experimental study of the impact on decisions of exogenously and explicitly manipulated fixation durations during the process of choice. The closest experiment is the work by Shimojo et al. (2003) who study the role of visual attention on judgments about facial attractiveness. Our experimental design is based on their work.

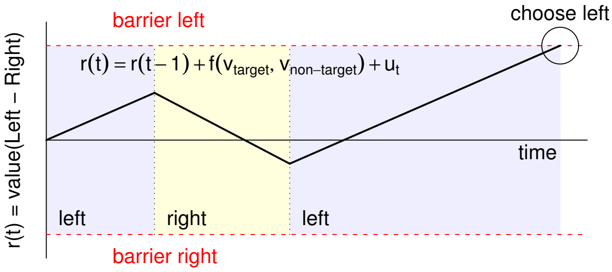


Figure 1: Summary of the Krajbich-Armel-Rangel (2008) decision model.

## 2 Theoretical background

The experiments in this paper are designed to test some stark predictions made by the decision making model of Krajbich, Armel and Rangel (2008) about the impact of exogenous shifts in visual attention on choice.

The basic idea of the model is illustrated in Figure 1. Consider the problem of choosing between two items, one displayed on the left ("left") and one displayed on the right ("right"). The model assumes that a relative value variable $r(t)$ is encoded at every instant $t$ within the trial. The variable denotes the current estimate of the relative value of the left item. Positive values of $r$ indicate that the left item is estimated to be better than the right item, and viceversa. At the beginning of the trial ($t = 0$), $r$ is equal to zero. Afterwards it evolves following a discrete Gaussian diffusion process. The key assumption of the model is that the mean drift is determined by the identify of the fixation. If the subject is looking at the left item, the value of $r$ increases with a mean drift proportional to $v_{left} - \theta v_{right}$, where $\theta \in (0, 1)$ denotes the bias in favor of the item that is being seen, and $v_{left}$ and $v_{right}$ denote the underlying value of the left and right items. In contrast, if the the subject is looking at the right item, the value of $r$ decreases with a mean proportional to $v_{right} - \theta v_{left}$. The model assumes that the identity of the first fixation is random and independent of the item's relative value. It also assumes that the duration of the fixations are randomly drawn from a common value-independent distribution. The model makes several stark predictions regarding the relationship between the fixation process and choices that are tested in Krajbich, Armel and Rangel (2008). For example, it predicts that there should be a bias towards choosing the first seen item, and that items that are fixated on longer should be more likely to be chosen.

Consider first the case of appetitive items, in which $v_{left}$ and $v_{right}$ are non-negative. Visual attention matters in this case because of the bias in the drift term: the relative value signal is more likely to move in favor of the item that is being looked at *even when the items have equal underlying value*. Now consider the case of aversive items, in which $v_{left}$ and $v_{right}$ are negative. Visual attention now has the opposite effect: with aversive items, the relative value signal is more likely to move away from the barrier of the item being looked at *even when the items have equal value*.

The two key predictions of the model follow immediately. Firt, it should be possible to increase the probability that an item be chosen by changing the relative amount of time that subjects fixate on the item during the decision making process. Second, the bias should be positive for appetitive items, and negative for aversive items. In the rest of the paper we test these two predictions by exogenously manipulating the duration of the fixations.

# 3 Experiment 1: Choices between appetitive food items

## 3.1 Method

60 undergraduates and local residents (ages 18–45) participated in the experiment.[1] All had normal or corrected to normal vision. Individuals were excluded if they had a history of eating disorders, used drugs regularly, had dieted in the past year, were vegetarian, disliked junk food, or were pregnant. These selection criteria were designed to recruit individuals who liked junk food and were not trying to control their diet. They were also required to sleep a minimum of six hours the night before the experiment, and to fast for four hours prior to the experiment, but to have eaten just prior to that time. The first requirement was designed to insure that subjects were sufficiently alert. The second requirement was designed to guarantee a minimal level of hunger at the time of the experiment. Individuals received $20 for their participation and provided informed consent. No deception was used in any of the studies.

The stimuli used in the experiment were 70 junk foods (e.g., Snickers Bars) that were presented using 4x4 inch high-resolution photographs (72 dpi) in which both the food and packages were visible. Subjects performed two tasks. First, they performed a liking-rating task. On each trial, a food appeared in the center of the screen for 3s. Then subjects had an unlimited amount of time to type their liking-rating, which was anchored by the question "how much would you like to eat this food at the end of the experiment?", on a scale of 0 to 100, where 50 denotes a neutral food. Responses were followed by an inter-trial period of 500ms. Each of the 70 foods was presented three times so that we could construct an average liking-rating for each item. The items were shown in random order. Second, subjects were asked to make 35 binary choices. These were real choices in that subjects were required to stay for 30 minutes at the end of the experiment and knew that the only thing that they would be allowed to eat during that time was the food that they chose on one of the trials. The trial that counted was randomly selected by drawing a ball from an urn.

Choice trials were structured as follows. A fixation point appeared in the center of the screen for one second. The pictures of the two food items then alternated, one at a time, with one presented for 300ms, and the other for 900ms on each alternation. Six alternations occurred, so that the items were presented for a total of 7200ms. The centers of the pictures were four inches to the left and right of the fixation point. The presentation duration and location of the first item were randomly determined. Afterwards the word "choose" appeared on the screen and the subjects made a selection by pressing either the left or right keys.

Each alternation was meant to simulate the natural process of alternating eye fixations that takes place in naturalistic settings when people make choices between two items that are in front of them. The design allowed us to investigate the effect on choice of making some of the fixations longer. In the experiment we controlled the duration of the fixations. In the real world, incidental variables such as packaging color and lighting, may affect the duration of the fixations.

All 70 items were used to construct the pairs and no items were repeated. Each subject faced a unique set of choice pairs that were constructed using their liking-ratings from the first task. Specifically, the computer constructed pairs using an algorithm that tried to minimize the difference in liking-rating between the two items (86% of the pairs were within 2 liking ratings of each other). We constructed the pairs in this way because the models motivating these experiments, as well as intuition, suggest that relative attention can generate sizable choice biases only for items of sufficiently similar value. Subjects were not provided with information about how the pairs were constructed or about differences in presentation duration.

## 3.2 Data cleaning

Trials with negatively rated foods (liking-rating<50) were dropped from the analysis because, since subjects were

[1] Data from five subjects is not included in the study because they failed to follow the pre-experiment instructions. Specifically, three subjects rated their tiredness as "ready to fall sleep" and two rated their hunger level as "completely full".

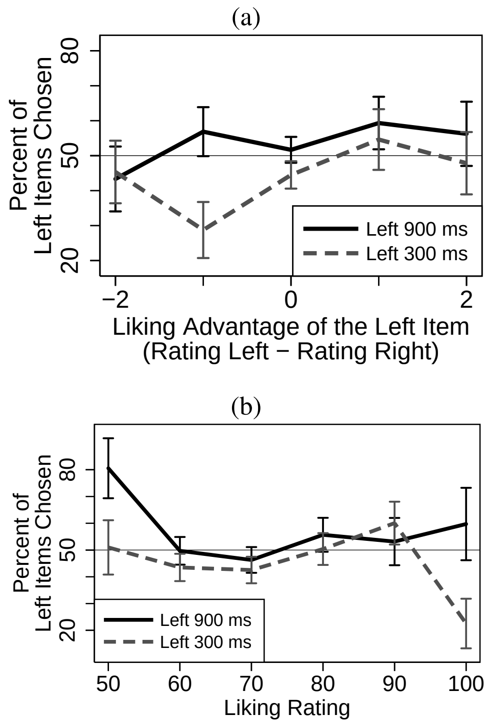


Figure 2: Results for Experiment 1. (a) Probability that the left item be chosen by presentation time and liking-rating advantage. (b) Probability that the left item be chosen by presentation time and average liking-rating of the pair.

not required to consume the foods, negatively rated food were not treated as aversive when making decisions. We also dropped trials in which reaction time was greater than two standard deviations from the mean of all trials (3734ms) to eliminate cases in which the subjects were distracted. Finally, we dropped trials in which the items were more than two liking-ratings apart (14% of the trials) because less than half of the subjects had observations in this range. After implementing these cutoff criteria the average liking-rating is 18 (SD = 12.4) and the average reaction time was 694ms (SD = 445).

### 3.3 Results

To determine if presentation duration affects choices we computed for every subject a difference variable measuring the percentage of the time that left was chosen when it was shown in the long exposure minus that the percentage of time that it was chosen when it was shown for the short exposure. We then computed the average effect across subjects and performed a t-test. We found that the probability of choosing the left item increased by 7.34% with the longer exposure, although the effect was only marginally significant ($p < 0.068$). Figure 2(a) provides a graphical illustration of the result. Figure 2(b) graphs the fraction of times that the left item was chosen as a function of the liking-rating average of the pair. The graph shows that the effect was particularly strong for neutral and highly liked items.

A potential concern with our result is that it might be driven mostly by subjects who made fast and careless choices, but that those with longer reaction times, and presumably more careful deliberations, were not affected by exposure time. If this concern is correct, the size of the individual effects should have been negatively correlated with reaction times. This was not the case. The correlation across individuals between the size of the effects and the average reaciton time was 0.02 ($p = 0.85$).

## 4 Experiment 2: Choices between aversive food items

### 4.1 Method.

105 undergraduates and local residents (ages 18–32) participated in the experiment.[2] The screening criteria were identical to those of Experiment 1 with two exceptions: we allowed individuals who did not like junk food, and we excluded foreigners and those raised by more than one guardian who grew up in a foreign country. The latter exclusion criteria was used because during pilot testing it became clear that many subjects in this group find our food items appetizing rather than aversive. Subjects provided informed consent and were paid $25 for their participation.

The stimuli used in the experiment were 35 foods, such as Spam and various baby foods, which were found to be aversive for a large fraction of our subject pool during pre-testing. To induce an aversive value for the foods, subjects were strongly encouraged (but not required) to eat at least three spoonfuls of the item that they chose on the randomly selected trial, and to remain in the lab for 10 additional minutes before eating or drinking anything else. All of the subjects complied with the request.

The procedures were very similar to those of Experiment 1 with the few exceptions described here. First, subjects provided their liking-ratings of the foods using a scale of $-100$ to 100, with zero indicating neutral foods. We changed the scale to make it easier for the subjects to identify aversive foods. Also, subjects entered their ratings by clicking with a mouse on an analog scale, instead of typing a number. Next, subjects made real choices between 17 pairs of foods. As before, the pairs were constructed to minimize the liking-rating difference between the two items in the pair.

[2]Data from seven subjects is not included from the analysis for reasons similar to those in the previous footnote.

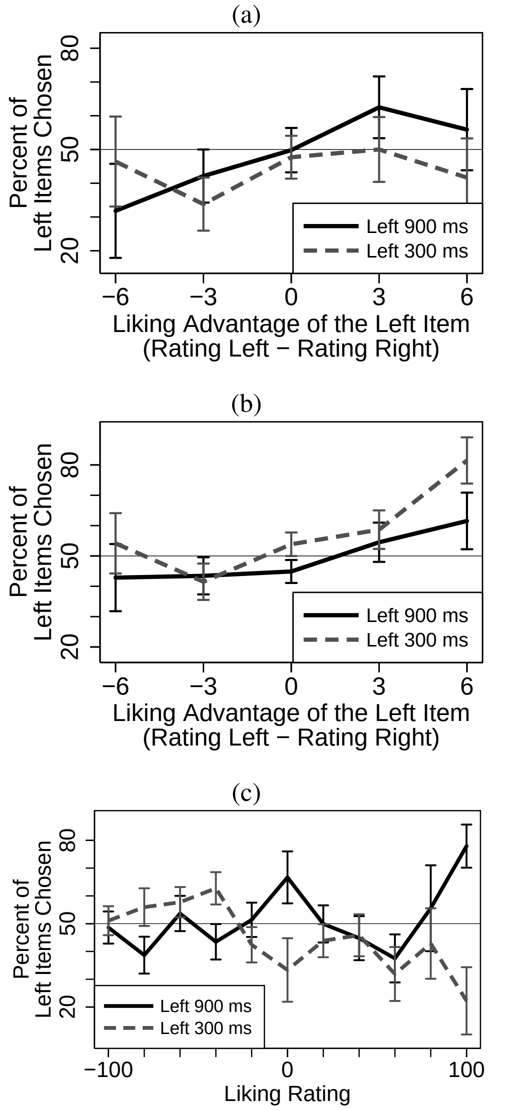


Figure 3: Results for Experiment 2. Probability that the left item be chosen by presentation time and liking-rating advantage for non-aversive (a) and aversive items (b). (c) Probability that the left item be chosen by presentation time and average liking-rating of the pair.

### 4.2 Data cleaning

As before, we dropped trials in which reaction times were greater than two standard deviations from the mean of all trials (5063ms). We also dropped trials in which the two items are more than seven liking-ratings apart (17.7% of trials). We needed to use a wider range of liking-rating advantages than in Experiment 1 because (1) the rating scale was twice as wide, and (2) there were half as many trials per subject, which made it hard to construct pairs with close liking-ratings. Unlike Experiment 1, no trials were dropped due to the valence of the items. This was because subjects knew that they would have to eat the food regardless of its valence, and as result both positive and aversive foods retained their value at the time of making decisions. After implementing these cutoff criteria the average reaction time was 836ms (SD = 722), and the average liking-rating was 34 (SD = 28) for positive items and −54 (SD = 34) for negative items. To deal with the limited precision subjects exhibited with the analog liking-rating scale, we defined negative items as those with liking-rating $< -2$, positive items as those with liking-rating $> 2$, and neutrals as those in between.

### 4.3 Results

We analyzed the data separately for negative and non-negative items using same approach described above. First consider the results for non-negative items, which is the case analogous to the first experiment. The probability of choosing left increased 11.2% with longer exposure ($p = 0.047$). This effect was 50% stronger than in the first experiment. As before, there was no significant correlation across subjects between the size of the effect and the average reaction time ($r = -0.10$, $p = 0.37$). In contrast, the impact of relative exposure was negative for aversive items: the probability of choosing left decreased by 7% with longer exposure ($p = 0.04$). The correlation with average reaction times was also non-significant in the negative case ($r = -0.04$, $p = 0.71$).

Figures 3(a) and 3(b) provide a graphical illustration of this result. Figure 3(c) graphs the fraction of times that the left-item was chosen as a function of the liking-rating average of the pair. As in Experiment 1, the impact of relative attention was particularly strong for neutral and highly liked items.

## 5 Experiment 3: Choices between art posters

### 5.1 Method.

98 undergraduates and local residents (ages 18–34) participated in the experiment. All had normal or corrected to normal vision. Individuals with neurological or psychiatric disorders, or those who use drugs regularly, were not allowed to take part in the experiment. Subjects provided informed consent and were paid $20 for their participation. They made choices between art posters instead of foods. Otherwise the procedures were almost identical to those of Experiment 2. The only difference was that subjects got the poster that they chose in a randomly selected trial through the mail. Thus, the prize was received a few days after the experiment.

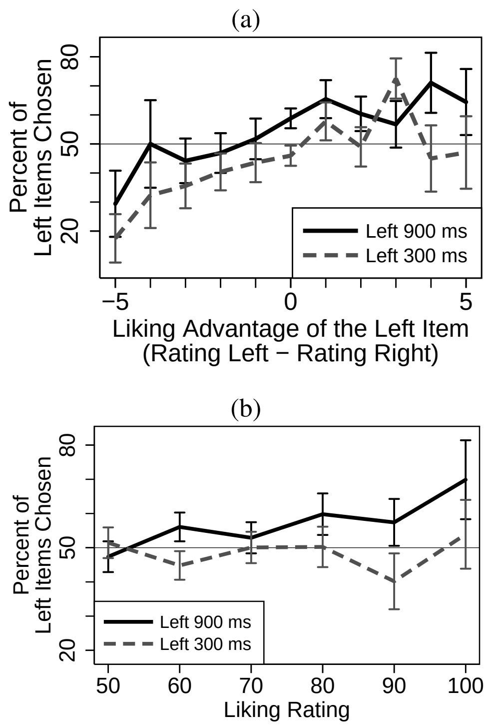


Figure 4: Results for Experiment 3. (a) Probability that the left item be chosen by presentation time and liking-rating advantage. (b) Probability that the left item be chosen by presentation time and average liking-rating of the pair.

### 5.2 Data cleaning

As before, we dropped trials in which reaction times were greater than two standard deviations from the mean of all trials (3170ms). We also dropped trials in which the items were more than five liking-ratings apart (9.7% of trials). Finally, we also dropped negatively rated posters because, since subjects did not have to use them, they might not have been treated as aversive at the time of choice. After implementing these cutoff criteria the average reaction time was 699ms (SD = 505) and the average liking-rating was 16 (SD = 13).

### 5.3 Results

We evaluated the effect of increased relative exposure using the same methods as before. We found that the probability of choosing left increased 9.7% with longer exposure (p = 0.003) and that, as before, there was no significant correlation across subjects between the size of the effect and the average reaction time ($r$ = 0.001, p = 0.99). Figure 4(a) provides a graphical depiction of this result. Like in Experiments 1 and 2, Figure 4(b) shows that the effect of relative exposure was larger for highly liked posters. Unlike those experiments, however, the effect was not larger for neutral posters.

## 6 Discussion

When subjects make choices in naturalistic settings (e.g., at the supermarket shelf), they alternate fixations between the different items that they are considering. The model of Karjbich, Armel, and Rangel (2008) predicts that changes in the duration of the fixations can affect choices by changing the decision values that are computed, and that this effect should be positive for appetitive items, but negative for aversive item. The results from the three experiments are largely consistent with this prediction: increases in relative visual attention increase the probability of choosing appetitive items, and the opposite is true for aversive items.

The experiments also revealed another interesting pattern: the choice bias was particularly large for neutral and highly liked items (although the effect for neutral items was present only in two of the three experiments). This is somewhat at odds with the model in Karjbich, Armel, and Rangel (2008) which predicts that the effect should be stronger for the most extreme values (positive or negative) and smallest for neutral items. One possible explanation is that the model has the wrong functional form for the drift term of the diffusion process.

Some features of the experiments are worth emphasizing. First, since the experimental manipulation takes place within subjects, a potential concern is that the results are driven by experimental demand. The change in the sign of the effect between appetitive and aversive items is important because it rules out experimenter demand as a potential explanation. Second, another potential concern is that subjects do not have enough time to properly evaluate items in the short fixation condition (300ms). This concern is unjustified for several reasons: (1) subjects are sensitive to the relative liking-rating of the two items, which suggests that they are processing the decision value of the short item; (2) the total exposure to the short item is 1800ms; and (3) extensive debriefing during piloting showed that subjects had no problems identifying the short exposure item. Third, we did not fine-tune the experiment by trying a range of presentation parameters during piloting in order to select the ones that generate the largest effects. Instead, we selected the parameters used on the related study by Shimojo et al. (2003). In fact, the results in Armel and Rangel (2008) suggest that larger effects could have been obtained if we had used less iterations and shorter total presentation times for both items (e.g., one presentation at 500ms and another at 1000ms). The reason is that computation time seems to have most of its impact on decision values during the first 2000–3000ms. Fourth, some readers might be concerned that we did not give subjects enough time to make their decisions. To put our design in context, Krajbich, Armel and Rangel (2008) study binary choice using eye-tracking and the same stimuli as in Experiment 1. In their study subjects have unconstrained fixations and reaction times. They find that the mean reaction time is under 2s, that the mean fixation duration is under 500ms, and the mean number of fixations is approximately 3. Thus, our subjects spent more time deliberating than they do on their own. Fifth, the collection of liking-ratings prior to the choice might have induced a desire in some subjects to make choices consistent with those ratings. This might have introduced a bias against the effect of interest, which could have lead to an underestimation of the size of the effect. Unfortunately there is no clean way of testing whether this was the case.

The model of Krajbich, Armel and Rangel (2008), together with the evidence presented in this paper, suggest a concrete mechanism for how visual attention affects choices. Visual attention matters because it affects the integration process that is used to construct the relative value variable that is used to make choices. In this experiment we controlled visual attention by exogeneousy manipulating the content and duration of fixations. In naturalistic settings, many variables are likely to influence the fixation process — from bottom-up attentional mechanisms driven by the visual properties of the display to top-down attentional influences. The model of Krajbich, Armel and Rangel predicts that any such variables will have an impact on choices through their effect on the integration process. Interestingly, the evidence presented in Krajbich, Armel and Rangel (2008) suggests that free fixations are not afffected by the value of the items.

Is the effect that we have identified a bias? The answer depends on whether the changes in relative fixation times affects only the decision values that are used to make choices, or also the experienced utility at consumption. Our hypothesis is that this is a bias, but the evidence in the paper is not sufficient to establish this. In particular, given the literature in the Mere Exposure Effect discussed in the introduction, one cannot rule out the possibility that changes in relative visual exposure during the decision-making process might have an impact in the actual consumption experience. Note that even if there is a consumption effect, a bias might still exist if the impact of changes in visual attention is stronger on decision values than on consumption utility. Investigating these issues is an important question for future research.

Our results have obvious implications for decision-making in real world contexts. Retailers believe that consumption decisions can be influenced by manipulating attention at the point of sale. For example, substantial resources are invested in designing salient packaging and in renting prime shelf space in supermarkets. A common justification for these investments is that, given the large number of items in a typical store, consumers only consider the small number of goods that capture their attention. The results in this paper provide a more basic mechanism for why retailers should care about the relative attention paid to their products: visual attention matters because, by increasing computation time, it affects the decision values assigned items. Interestingly, our results suggest that the manipulation of relative attention is no marketing panacea: it only works for items that the consumer already views as appetitive.

Our results also raise questions for positive theories of decision-making. First, to avoid these biases individuals need to allocate their visual attention evenly among the options under consideration. As shown in Krajbich, Armel and Rangel (2008), individuals are able to do so in the absence of incidental variables that manipulate visual attention artificially. Second, it is likely that there are a number of item characteristics, such as lighting or some forms of packaging, that are irrelevant for the value of consuming an item, but that reliably affect relative attention. The extent to which such variables affect choices remains an important open question.

## References

Armel, C. & Rangel, A. (2008). The impact of computation time and experience on decision values. *American Economic Review*, 98, 163–168.

Bogacz, R. (2007) Optimal decision-making theories linking neurobiology and behavior. *TRENDS in Cognitive Science, 11,*118–25.

Bornstein, R. F. (1989). Exposure and afffect: overview and metaa-analysis of research, 1968–1987. *Psychological Bulleting, 106*, 265–289.

Busemeyer, J. R., & Diederich, A. (2002). Survey of decision field theory. *Mathematical Social Sciences, 43*, 345–70.

Busemeyer, J. R., & Townsend, J. T. (1993). Decision field theory: A dynamic cognition approach to decision making. *Psychological Review, 100*, 432–59.

Krajbich, I., Armel, K. C., & Rangel, A. (2008). The role of visual attention in goal-directed choice. Caltech manuscript.

Lichtenstein, S. & Slovic, P. (Eds.) (2006) *The construction of preference*. New York: Cambridge University Press.

Rangel, A. (2008). The computation and comparison of value in goal-directed choice. Forthcoming in *Neuroeconomics: Decision-making and the brain*. P. Glimcher, C. Camerer, E. Fehr, & R. Poldrack (eds). New York: Elsevier.

Shimojo, S., Simeon, C., Shimojo, E., & Scheier, Y. (2003). Gaze bias both reflects and influences preference. *Nature Neuroscience, 6*, 1317–1322.

Smith, P. L., & Ratcliff, R. (2004). Psychology and neurobiology of simple decisions. *TRENDS in Neurosciences, 27*, 161–168.

Weber, E. U. & Kirsner, B. (1997). Reasons for rank-dependent utility evaluation. *Journal of Risk and Uncertainty, 14*, 41–61.

Tversky, A., & Kahneman, D. (1992). Advances in prospect theory: cumulative representations of uncertainty. *Journal of Risk and Uncertainty, 5*, 297–323.

Zajonc, R. B. (1968). Feeling and thinking: preferences need no inferences. *Americal Psychologist, 35*, 151–175.

Zajonc, R. B. (2001). Mere exposure: A gateway to the subliminal. *Current Directions in Psychological Science, 10*, 225–228.