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Testing the effect of time pressure on asymmetric dominance and compromise decoys in choice

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Abstract

Dynamic, connectionist models of decision making, such as decision field theory (Roe, Busemeyer, & Townsend, 2001), propose that the effect of context on choice arises from a series of pairwise comparisons between attributes of alternatives across time. As such, they predict that limiting the amount of time to make a decision should decrease rather than increase the size of contextual effects. This prediction was tested across four levels of time pressure on both the asymmetric dominance (Huber, Payne, & Puto, 1982) and compromise (Simonson, 1989) decoy effects in choice. Overall, results supported this prediction, with both types of decoy effects found to be larger as time pressure decreased.

Keywords: decision making, choice, context, asymmetric dominance, compromise, time pressure.

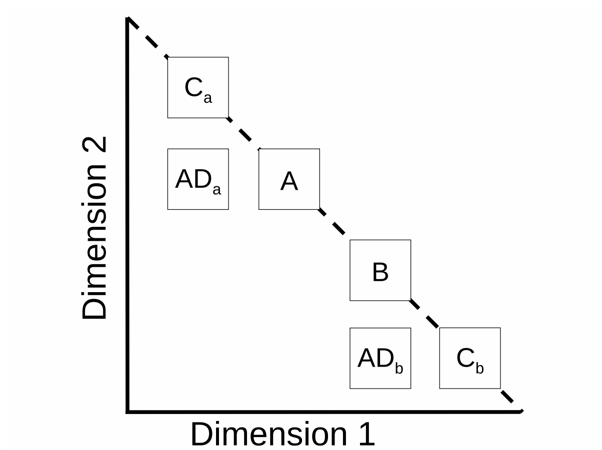
1 Introduction

A wide body of research has demonstrated the contextual sensitivity of preference, showing that preferences to some degree depend upon the set of inferior alternatives considered at the time of choice. Decoy effects, such as the asymmetric dominance (AD) (Huber, Payne, & Puto, 1982) and compromise effects (C) (Simonson, 1989), are common examples of this sensitivity. In particular, decoy effects are examples of preference reversals, situations in which the preference ordering between two alternatives changes with changes in context. Although much research has focused on demonstrating and explaining decoy effects, little work has been done to explore the effect that time pressure can have on the effect of the decoy. In this paper, we will give a brief overview of decoy effects, describe the predictions for the effect of time pressure from both traditional and dynamic connectionist models, and provide a test for those predictions.

1.1 Overview of decoy effects

Typically, decoy effects work by adding an alternative, the decoy, to a two alternative, multi-attribute choice set (Figure 1). In the absence of the decoy, subjects are largely indifferent to the target (A) and the competitor (B) due to the trade-off that would result from switching between them. With a decoy that targets A in the set, however, preference typically shifts toward A and away from B. By moving the decoy in the choice space so that it targets B, preference can be made to shift from alternative A to B creating a preference reversal. This result violates rational choice principles as decoys are inferior options that should be ignored when making a choice.

Figure 1: Locations in a choice set for the asymmetric dominance (AD) and compromise (C) decoys. Subscripts indicate the targeted alternative of the decoy, for which preference should increase when the decoy is included. Choice sets presented to subjects contained A, B, and one of the decoy alternatives.



The two decoys depicted here all increase preference for the target, in different ways. The Asymmetric dominance (AD) decoy is dominated by the target but not the competitor and is clearly inferior to the other options. Yet, preference is increased for the alternative that dominates it (Huber, et al., 1982), even though according to rational choice axioms the decoy should be ignored and

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have no effect on preference. The compromise (C) decoy is placed in the choice set as to extend the range of evaluation on both dimensions, thus placing the target in-between the decoy and the competitor in the choice set. The target becomes preferred over the competitor as subjects avoid the more extreme options in the set (Simonson, 1989). The C decoy is similar in overall utility to the other options, but like the AD decoy, is not frequently preferred.

1.2 Models and predictions

Numerous traditional models have been proposed to try to explain these effects through mechanisms such as changes in the subjective value of the alternatives (Wedell & Pettibone, 1996), the dimensional weights given to each attribute (Mellers & Biagini, 1994; Wedell, 1998, Wedell & Pettibone, 1996), loss aversion (Kivetz, Netzer, & Srinivasan, 2004; Tversky & Simonson, 1993; Pettibone & Wedell, 2007), or reason based choice (Simonson, 1989; Wedell & Pettibone, 1997). In contrast to these models, several dynamic computational models have been proposed that can be demonstrated to explain multiple types of context effects, including decoy effects, through the simultaneous incorporation of traditional and perceptual mechanisms. Although decision field theory (DFT) (Roe, Busemeyer, & Townsend, 2001) and the leaky competing accumulators (LCA) (Usher & McClelland, 2004) models differ in several important ways as to exactly how AD and C decoys influence preference (see Tsetos, Usher, & Chater, 2010 for a review), they both model this influence as a series of shifts in attention across time rather than a static process of evaluation. This is in comparison to most traditional models that either take a static view of the decision process or simply do not consider time as a variable.

In the dynamic class of models (DFT and LCA), subjects are assumed to learn about the choice set through comparisons of the options on one attribute at a time. Preference for alternatives in a set increases or decreases across time as the number of comparisons increases and the results of these comparisons accumulate. This process should result in an alternative that is clearly preferred once enough time has passed for preference to stabilize. For decoy effects, subjects are assumed to be indifferent to the options at the beginning of their information search. As the search continues, preference increases for the targeted alternative while at the same time decreases for the decoy and the competitor through the results of these comparisons.

Interestingly, if this process were to be interrupted through limiting the amount of time that a subject has to consider the choice set, both models (DFT and LCA) would predict a disruption or diminishing of the decoy effect. Similarly, both models would predict an increase in the size of a decoy effect as deliberation time increases, although in a non-linear manner where preference for the target eventually no longer grows perceptually larger.

In contrast, most traditional models of decoy effects do not make this prediction, as they do not directly consider the effects of deliberation time on preference. Further, it can be argued that more general heuristic and emergent value based models of decision making may actually predict the opposite effect of time pressure. In general, heuristic based models suggest that, as the cognitive demands upon the decision maker increase (i.e. due to time pressure, in this case), the decision maker relies more and more on a heuristic approach based upon limiting information search (see Payne, Bettman, & Johnson, 1993, and Rieskamp & Hoffrage, 2008 for examples). Anchoring effects on equation solving, for example, have been shown to increase under time pressure (Smith & Windschitl, 2011) as subjects presumably do not have enough time to calculate the exact answer.

In the case of decoy effects, if a heuristic were based on a simple search for emergent values such as dominance (Pettibone & Wedell, 2000), then one could predict an increase or at least no decrease in the size of the decoy effect under time pressure. This prediction is somewhat weaker with the compromise decoy, as presumably more information search would be required to determine compromise than dominance. In both cases, however, deliberation beyond the initial search is unnecessary, and a decision would be made as soon as the emergent value is detected. While a heuristic based approach might predict that decoy effects can occur with limited information search, DFT and LCA seem to suggest that complete information search is a necessity for their formation, as is deliberation over the values of the alternatives.

Two prior studies provide some support for the prediction of dynamic, computational models that decoy effects will diminish under time pressure. First, Simonson (1989), demonstrated that subjects who selected the alternative targeted by a compromise decoy generated longer self-reports of their choice protocol when compared to those who chose other options. This result suggests that those who show a stronger compromise effect took more time, but it does not directly test the effect that limiting deliberation time would have on the decoy effect. Second, Dhar, Nowlis, & Sherman (2000), demonstrated a decrease in the size of the compromise effect when subjects were limited to 15 seconds of deliberation time vs. having unlimited time to make a decision. Although this is a direct manipulation of the effects of deliberation time, it is limited to only a single type of decoy and the lack of conditions with smaller amounts of deliberation time makes it difficult to infer how even greater time pressure would influence subjects. Further, although manipulation checks indicated that subjects felt time pressure, it was not stated exactly how long subjects took to make a decision in the unlimited condition. In these types of studies with a three item, two attribute choice set, 15 seconds is a relatively large amount of time in which to accumulate preference. It is quite possible that subjects used less than 15 seconds to make their decision in the unlimited condition.

1.3 Testing the effect of time pressure

If DFT and LCA models are to be used to explain decoy effects, then additional work needs to be done to determine the nature of the effect of time pressure on decoy effects. The goal of this study was to experimentally test the influence of time pressure on the size of both the AD and C decoy effects in order to provide a better test of the predictions of both the DFT and LCA models. Subjects were given 2, 4, 6, or 8 seconds to examine a three alternative, two attribute choice set containing either an AD or a C decoy before making a decision. Following the end of the deliberation period, the choice sets were removed and subjects were instructed to make their choice as fast as possible. Both the paradigm and the stimuli used are similar to those by Wedell and Pettibone (1996), but with the addition of four levels of time pressure. If decoy effects are dependent upon the accumulation of preference from repeated pair wise comparisons over time, then the AD and C effects should get weaker as time pressure gets stronger.

1.4 Method

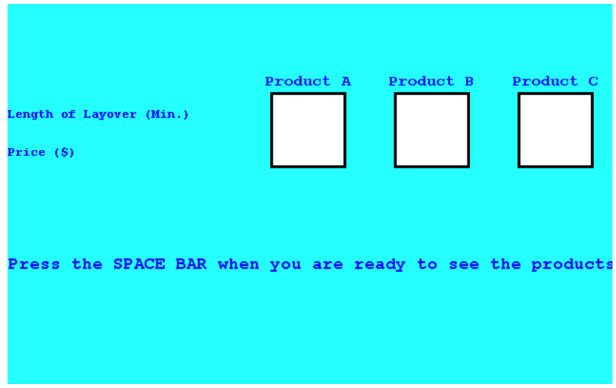
1.5 Subjects

A total of 164 subjects (80 with the AD decoy & 84 with the C decoy) from the psychology department subject pool at Southern Illinois University Edwardsville were given course credit for participation. Two subjects were dropped (1 from each condition) for taking an abnormally long time to make their decisions once the choice sets were removed from the computer screen (> 3 *sd* from average across all sets containing a decoy). Mean age for the remaining subjects was 19.67 years, with 74.4% of the sample being female.

1.6 Design

Subjects were shown 10 consumer product choice sets (cars, weed eaters, ect.) containing two equally attractive alternatives (A and B in Figure 1) described on two attributes (Miles per Gallon, Ride Quality, ect.). These sets also contained either an AD or a C decoy (manipulated between subjects). In any given set, the decoy could

Figure 2: Screen capture of the choice task prior to the display of the values of the alternatives.



target either alternative A or alternative B, thus manipulating the effect of the decoy within subjects. An additional 10 choice sets were presented that contained a third alternative placed half the distance from A and B on both dimensions as fillers. Within-subjects variables included context (decoy targeting A and B) and alternative (average percentage of choice across 10 trials for the Target and Competitor) and set (decoy favors A in choice sets 1–5 and B in sets 6–10 or favors B in sets 1–5 and A in sets 6–10). To simplify the presentation of the data, the context and the alternative variables were collapsed into a single context variable that reflected the percentage of time across all choice sets containing a decoy that either alternative A or B was selected when it was targeted by the decoy or when it acted as the competitor to the target. Analyses conducted using a separate alternative variable did not differ from the results reported here. Deliberation time, defined as the amount of time a subject had to view the information prior to being allowed to make a choice, was manipulated between subjects and had four conditions: 2 seconds, 4 seconds, 6 seconds, or 8 seconds. This type of manipulation was chosen to ensure that all subjects in each condition viewed the information for the same amount of time. It also served to remove the motor and planning responses from the time allotted to view the choice sets. The 8 second condition was selected on the basis of a preliminary study using the same stimuli where subjects had unlimited time in which to make their decision. The average time that subjects took to choose an alternative in that study was around 8 seconds.

1.7 Stimuli

Values for A and B in each choice set were determined based on a norming study such that subjects found them to be approximately equally attractive in a two alternative choice set. Values for AD decoys were chosen such that the decoy was dominated by either A or B but not both (similar to Wedell & Pettibone, 1996). Specifically, the value for the AD's worst dimension was constructed to be worse than its target by half the distance between A and B on that dimension, while the value on its best dimension was set to be equal to the target. Values for C decoys used the same value as the AD decoy on the target's worst dimension, but were constructed to be better than the target on its best dimension by half the distance between A and B (similar to Pettibone & Wedell, 2000). The appendix shows all stimuli used in this experiment.

1.8 Procedure

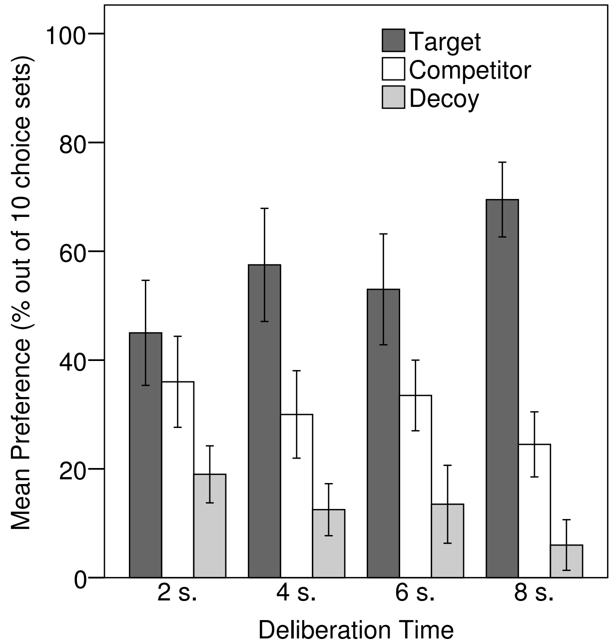
Subjects were instructed that they would see a series of three alternative choice sets composed of consumer products for a limited amount of time. Once that time had passed the stimulus values would be removed and they would need to decide which product in each set they would buy as fast as possible. Choice sets were presented on a computer screen as a 3 x 2 matrix with alternatives on the rows and attributes on the columns. Figure 2 shows a picture of a typical display.

Subjects were given a minimum of 3s to examine a description of a choice set and its attributes prior to presenting the actual values for the alternatives. When subjects were ready, they would press the space bar to see the values. The values for all alternatives were then displayed for 2, 4, 6, or 8 seconds for the choice sets containing a decoy. For the filler choice sets, deliberation time was randomly set to be any value between 2 and 8 seconds. The values for the alternatives (but not the labels) were then removed and subjects had to make their decision of which alternative they preferred as quickly as possible by using a mouse to move a pointer to the corresponding location on the screen. The pointer was reset to a central location equidistant from the locations of the alternatives prior to every choice. Note that subjects could not make a choice before the deliberation time was up. After each choice, subjects were told how long it took for them to make their decision once it was possible to do so in *ms* so that they could receive feedback on the speed of their decision. This was done in an attempt to prevent subjects from making further comparisons between the alternatives from memory after the end of the deliberation period. The presentation order of the 20 total choice sets was randomized for each subject. The order of presentation of the alternatives in each choice set on the screen was counterbalanced using one of six possible orders.

2 Results

Although deliberation times were fixed, the amount of time used to make a decision after removing the stimuli from the screen could vary. Two subjects (one in each decoy condition) had average decision times that were greater than 4 sec and were removed from the following analyses due to their consistent lack of compliance with the instructions. Across all conditions of the study, subjects took an average of 912 *MS* (*SD* = 394) to make a decision once possible to do so. Given the motor and planning requirements of the choice task, it is likely that this suggests that subjects made an honest attempt to make their decision as fast as possible. Table 1 describes decision times for the AD and C decoys broken down by deliberation time. Variability in these times was analyzed by a 2 x 4 between-subjects Analysis of Variance (ANOVA). Only the main effect of deliberation time was statistically significant, $F(3,154) = 3.27$, $p < .05$, partial $\eta^2 = .06$. Tukey's HSD indicated that across decoy type, subjects were slower to make a decision (following removal of the stimuli) when subjects had 2 seconds of deliberation time compared to 8 seconds. All other comparisons were not significant. This difference likely reflects the additional memory demands that the task places upon subjects in the 2 sec condition.

Figure 3: Mean preference for the targeted alternative, the competitor, and the decoy across deliberation time for the asymmetric dominance decoy. Error bars represent the 95% confidence interval.



2.1 Asymmetrical dominance decoy

To analyze the preference data, separate 2 (context) x 4 (deliberation time) x 2 (set) mixed ANOVAs were con-

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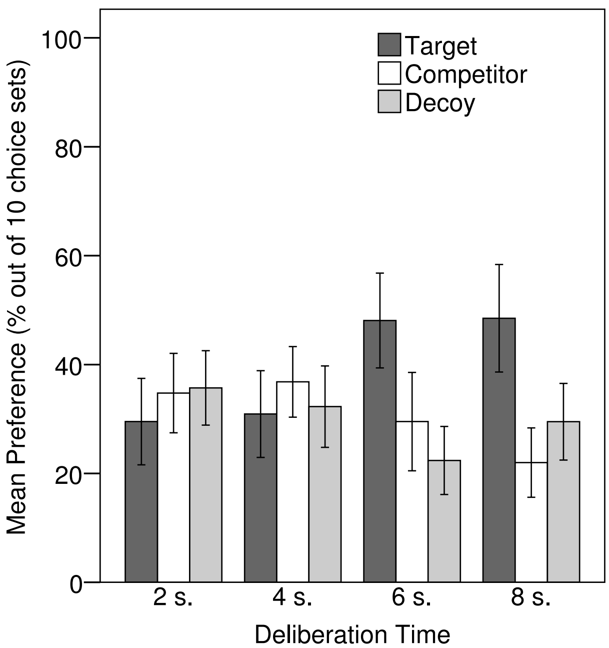
Table 1: Mean decision times for the preference task broken down by decoy type and deliberation condition.

Decoy Type	Deliberation time				
	2 s.	4 s.	6 s.	8 s.	Average
Asymmetrically Dominated	1062 (344)	1061 (641)	1003 (535)	711 (114)	959 (469)
Compromise	996 (203)	875 (345)	754 (269)	849 (335)	867 (302)
Average	1029 (280)	968 (510)	878 (430)	780 (259)	912 (394)

Notes: Decision times are provided in MS. Standard deviations are provided in parentheses.

Figure 4: Mean preference for the targeted alternative, the competitor, and the decoy across deliberation time for the compromise decoy. Error bars represent the 95% confidence interval.



ducted, one for each type of decoy. The dependent variable was the percentage of times (0 to 100) that a subject chose an alternative (Target, Competitor) out of ten possible trials. Results for the AD decoy can be found in Figure 3. A main effect of context, $F(1,71) = 46.78$, $p < .001$, partial $\eta^2 = .40$, indicated that overall, subjects preferred the targeted alternative (56% of trials) over the competitor (31% of trials). A two-way interaction of context x set was found ($F(1,71) = 5.94$, $p < .05$, partial $\eta^2 = .08$) but is not of particular interest as assignment of choice sets to the blocks of the set variable were arbitrary. The interaction of context by deliberation time was significant, $F(3,72) = 4.83$, $p < .01$, partial $\eta^2 = .17$, indicating that the main effect of contex varied across deliberation time. Planned comparisons between average preference for the target and competitor indicated a significant decoy effect (i.e., preference for the target) in the 4 ($t(19)$=3.1, $p < .01$), 6 ($t(18)$=2.31, $p < .05$), and 8 s. conditions ($t(19)$=7.8, $p < .001$), but not in the 2 second condition ($t = 1.09$). Overall, as can be seen in Figure 2, the size of the decoy effect generally increases as deliberation time increases as predicted by both DFT and LCA models. There was no higher order interaction with set.[1]

The increase in preference for the target as a function of deliberation time seems to coincide with a significant decrease in preference for the decoy. This observation was supported by a significant one way ANOVA conducted upon preference for the decoy across deliberation time, F(3,78) = 4.03, p = .01, $\eta^2 = .15$. At the 2 sec condition, the decoy is being chosen on an average of 19% of all trials. This declines to 12.5% in the 4 sec condition and further to 6% of trials in the 8 sec condition. Tukey's HSD indicates that subjects are selecting the decoy more often in the 2 sec condition compared to the 8 sec condition, but all other comparisons are not significant. This pattern may be due to a difficulty in detecting dominance at low deliberation times as subjects may not have enough time to attend to all possible comparisons in the set. As deliberation time increases, subjects may be able to more completely examine the choice set, dominance is detected more often, and overall preference shifts towards the target.

2.2 Compromise decoy

Results for the C decoy can be found in Figure 4. Overall, the main effect of context was significant, $F(1,75) = 5.46$, $p < .05$, partial $\eta^2 = .07$, with the targeted alternative being chosen in 39% of all trials compared to in 31% of all trials for the competitor. As with the AD decoy, the interaction of context X deliberation time was significant, $F(3,75) = 5.39$, $p < .01$, partial $\eta^2 = .18$, indicating that the effect of the decoy varied across deliberation time.

[1]In a regression of the difference Target−Competitor against deliberation time as a numeric variable, the linear trend was significant, with a slope of 5 percent/sec, $t(82) = 3.83$, $p = .005$.

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Planned comparisons indicated a significant preference for the target over the competitor in the 6 ($t(21)$=2.31, $p < .05$) and the 8 s. ($t(19)$=3.69, $p < .01$) conditions, but no significant differences in the 2 sec and 4 sec conditions ($t < 1.00$ for both). Although not significant, it is interesting to note a slight preference for the competitor over the target in the 2 sec and 4 sec condition. The target is not the most frequently selected alternative until subjects have at least 6 seconds to consider their options. No significant higher order interactions were found with the set variable.

As with the AD decoy, preference for the C decoy was shown to decline as deliberation time increases $F(3,79) = 2.76$, p < .05, partial $\eta^2 = .10$. A linear contrast combining the 2 sec and 4 sec conditions where there was no significant decoy effect and comparing them to the 6 sec and 8 sec conditions where there was a decoy effect indicated a significant difference between the groups, $t(79) = -2.36$, p , .05. The decoy was chosen on average in 34% of trials in the 2 sec and 4 sec conditions. In contrast, the decoy was chosen on average in 26% of trials in the 6 sec and 8 sec conditions. In comparison to the AD decoy, this reflects the fact that the C decoy is not strictly dominated and is a viable option. Still, the decline in preference for the C decoy by the 6 sec condition again supports the conclusion that it becomes less viable as more information is gathered about the choice set.[2]

3 Discussion

In general, these results support the prediction of both DFT and LCA that the size of AD and C effects will increase as deliberation time increases. The methods used here provide the most direct test to date of this prediction, and supports the previous findings of Simonson (1989) and Dhar, Nowlis, & Sherman (2000) that the size of the C effect diminishes under time pressure while demonstrating a similar effect with the AD decoy. Specifically, in this study, subjects demonstrate the AD effect with as little as 4 sec of exposure to the stimuli and this effect increases with more exposure. The C effect appears to take more time to develop, with no significant effect occurring until 6 sec of exposure to the stimuli.

For the AD decoy, results support the conclusion that it takes time for subjects to detect the relationships between the dominated decoy, the target, and the competitor. It seems logical to assume that subjects are using this time to make comparisons between the alternatives as is suggested to occur in both of the diffusion based models discussed here. The detection of asymmetric dominance can only be made once all comparisons are made—a difficult task with only 2 seconds with which to do so. By 4 seconds, subjects appear to be able to make enough comparisons for the decoy effect to manifest. By 8 seconds, the effect size approaches that seen in other studies that allow for unlimited deliberation time (Wedell & Pettibone, 1996; Pettibone & Wedell, 2000) as the results of additional comparisons accumulate. The 6 second condition, while indicating a significant decoy effect, did not follow this trend exactly for reasons that are difficult to determine.

For the C decoy, although some of the effect can be explained through a decrease in preference for the decoy across deliberation time, this decrease is much smaller than seen with the AD decoy. This contributes to a smaller overall effect than other decoys as the decoy is a valid choice. Also unlike the AD decoy, subjects seem to somewhat prefer the competitor to the target at first, switching preference to the target only at longer deliberation time intervals. This is what is predicted by both DFT and LCA across deliberation time. According to simulations run using both models (see Roe, Busemeyer, & Townsend, 2001 and Tsetsos, Usher, & Chater, 2010 for examples), the extreme options (the competitor and the decoy) start out higher in choice probability. Preference for the target arises over time as a result of the lateral inhibition function between the alternatives. Although the differences in preference between the target, competitor, and decoy are not significant in the 2 sec and 4 sec condition, they are largely in line with the predictions of both dynamic models.

3.1 Comparisons to traditional models

In contrast to other models of decision biases and some models of decoy effects that are heuristic based this data would suggest that the AD and C effects result from greater information search- not less. Subjects in this study may well be shifting to a compensatory strategy under extreme time pressure, but if they are, it does not result in decoy type context effects. These results also do not completely rule out other explanations, such as loss aversion (Tversky & Simonson, 1993) and value-shift based models (Wedell & Pettibone, 1996). They do imply, however, that some dynamic component needs to be added. The information search needed for those processes to create context effects takes time, and their operation would appear to depend upon the relatively complete evaluation of the information in a choice set. Simply suggesting the use of a heuristic under time pressure instead of these more complete information search modes would not account for these results.

Interestingly, these results do provide some evidence against models that suggest multiple processes are neces-

[2] In a regression of the difference Target−Competitor against deliberation time as a numeric variable, the linear trend was significant, with a slope of 6 percent/sec, $t(78) = 2.92$, $p < .001$.

sary in order to capture both compromise and asymmetric dominance effects (Yoon & Simonson, 2008; Pettibone & Wedell, 2000), as the effect of time pressure on both decoys was similar to what was predicted by both DFT and LCA. The work of Yoon & Simonson (2008) in particular has suggested that the asymmetric dominance effect results from focusing attention upon the dominating option, while the compromise effect results from focusing attention upon the contextual set. Both of the dynamic models examined here suggest that equal consideration of all alternatives and attributes is important for both effects, and that similar information search patterns could result in both. One key finding from their study was that preferences were more stable over time (1 week) when they were generated from a set of alternatives containing an asymmetric dominance decoy than those from a set containing a compromise decoy.

This result could possibly be explained from a dynamic viewpoint due to the observation that the compromise effect seems to take more time to develop. Because of individual differences in how long subjects take to make their decision, it is more likely with the compromise decoy than with the asymmetric dominance decoy that the competing options may still be considered as viable or even equal options when the decision is made. Thus, one week later, preference is constructed again from the last iteration of values created during the initial search which may not clearly favor any alternative. The longer information search continues the more stable the preference should be. Although not directly tested here, it would be useful for future studies to control deliberation time and bring subjects back a week later to directly test this hypothesis. If true, the stability of preference with the compromise effect should approach or equal that of the asymmetric dominance effect as deliberation time increases.

3.2 Alternative explanations

The current data cannot speak to exactly what information subjects are gathering across time nor can we be sure that information search is continuing across deliberation time. Possibly, subjects could sample the relatively simple stimulus values very quickly and use the remaining time to evaluate the information. Process tracing data could determine what information subjects are examining prior to making a decision. These data will allow for a more fine grained analysis of what subjects are doing with their time. Additionally, individual differences such as perceptual and processing speed may be worth exploring in the extreme time pressure conditions. It is possible that some subjects are able to evaluate the choice sets fast enough for decoy effects to arise even in the 2 and 4 second conditions.

An alternative explanation for these data is that the increase in the size of decoy effects across deliberation time is not due to accumulating preference for the target, but more simply due to a decrease in the frequency of random choice. Subjects at short deliberation times may be choosing more or less at random because they may not remember the stimulus values. Although this is possible, the study was designed to prevent this by fixing deliberation time for all subjects. Subjects did not have to try to examine the choice set and make a choice in that time; they only had to examine the set, allowing for full use of the deliberation time for stimulus sampling. Thus, 2 sec may well be enough time to view the information completely, but not enough time for the effect of context to accumulate through attentional shifts as predicted by dynamic decision models. This possibility is supported by the observation that in the AD condition subjects were usually able to avoid choosing the dominated decoy even with only 2 sec to view the stimuli. This fact suggests that some information about the choice set was retained at choice.

Another argument against this interpretation comes from an analysis of decision times following the removal of the stimulus values. If subjects were choosing at random in the shorter deliberation time conditions, one could argue that their decision times would be the same or shorter than decision times in the longer deliberation time conditions. This was not the case, as subjects took longer to make their decision in the 2 sec condition compared to 8 sec. Presumably, subjects are using the extra time to consider their options. While this is against the instructions that they were given (i.e., to make a decision as fast as possible), it would be an adaptive response to time constraint, and one that would make sense if subjects remembered something about the stimuli. As memory demands decrease, decision times decrease somewhat as well, reflecting increased attempts at complying with the instructions. A direct test of this explanation would require probing memory after each trial for the stimulus values to be sure that subjects have viewed the information. This data, unfortunately, was not collected in this study.

Finally, for the asymmetric dominance condition, we can get a rough estimate of the frequency of random choice from the choice of the decoy. To a first approximation, we can assume that choice of the decoy can result only from random choice. If so, then some of the choices of the target and competitor are also the result of random choice, and we can estimate the percent of "true" choice of these by subtracting from each the percent of decoy choice. When we do this, several values were 0 or less, so we eliminated subjects with these values. For the remaining 58 subjects, the ratio of Competitor−Decoy to Target−Decoy decreased with deliberation time as numeric variable (linear trend of −0.17, $t(56) = -3.40$, $p = .001$). This ratio is a rough estimate of "true competitor responses" to "true target responses", and the decline with deliberation time suggests that the proportion of true responses going toward the target increases with time.

3.3 Conclusion

In conclusion, examining how time pressure influences the AD and C effects has provided some information as to the time course of these commonly studied context effects. That information seems to point towards support of models of these that rely on more complete evaluation of information rather than less. They also suggest that additional information about context effects in general that involve information search can be learned by studying them as a dynamic process. Although more work needs to be done to better understand exactly what subjects are doing when they have a limited amount of time and a decoy to deal with, the overall pattern of behavior supports the predictions of dynamic decision models such as DFT and LCA. This work also suggests that incorporating the principles of dynamic decision making rather than taking a simple static approach can yield new information about context effects. Unfortunately, as both DFT and LCA make the same predictions in this paradigm, these results do not allow for distinguishing between them.

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Appendix Choice sets used in experiments

Domain/Dimension	A	B	AD_A	AD_B	C_A	C_B
Computers						
1. Size of hard drive (GB)	800	600	800	500	900	500
2. Speed (gHz)	2.1	2.3	2	2.3	2	2.4
Laptops						
1. Speed (gHz)	2	1.66	2	1.49	2.17	1.49
2. Battery life (hrs.)	3	4	2.5	4	2.5	4.5
Plane Tickets						
1. Length of layover (min.)	80	130	80	155	55	155
2. Price ($)	250	220	265	220	265	205
Riding Lawnmowers						
1. Horsepower (HP)	23	15	23	11	27	11
2. Cut width (in.)	38	46	34	46	34	50
Private elementary schools						
1. Travel time (min.)	30	45	30	52.5	22.5	52.5
2. School rating (0–100)	60	80	50	80	50	90
Electric keyboards						
1. Tone quality rating	85	75	85	70	90	70
2. Number of features	9	17	5	17	5	21
Microwaves						
1. Length of warranty (mo.)	14	8	14	5	17	5
2. Cooking power (watts)	1000	1600	700	1600	700	1900
Cars						
1. Ride quality	80	60	80	50	90	50
2. Miles per gallon (MPG)	26	30	24	30	24	32
TVs						
1. Screen size (in.)	46	37	46	32.5	50.5	32.5
2. Contrast ratio	2400/1	3000/1	2100/1	3000/1	2100/1	3300/1
Cordless powerdrills						
1. Power (volts)	20	14	20	11	23	11
2. Battery life (min.)	30	40	25	40	25	45