Choice Amnesia: When Difficult Product Choices are Harder to Remember

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Consumers are frequently put in positions in which they would benefit from remembering their past product decisions. Yet how well do consumers remember the choices they have made, and is memory influenced by the difficulty of the decision? In Study 1, 403 participants were presented with pairs of products in an online survey and were asked to indicate which product of each pair they would rather buy. After completing a distraction task, participants were then tested for how well they could recall their previous decisions. As hypothesized, recall was worse for decisions that, according to a pretest, were more difficult to make. These results persisted after controlling for the type of product (i.e., shampoos, water bottles, salad dressings, and mugs). In Study 2, we examined a possible alternative explanation that these results were found only because participants selected the items they liked as opposed to actually remembering which items they had previously chosen. In this follow-up study, 301 participants made decisions between pairs of unpleasant items (i.e., bad- tasting jelly beans). All of these were disliked, and therefore participants could not simply select the items they liked. As hypothesized, among these disliked pairs, recall was again worse for decisions that were more difficult to make. Potential underlying mechanisms for these results are discussed.

Introduction

On a single grocery store run, consumers are faced with dozens of decisions - among them, which items to buy, which brands to choose, and within a brand, which flavor or variety to purchase. Consumer behavior is often dependent on an individual's ability to recall such prior decisions (e.g., which toothpaste did I select last time, and do I want to buy it again?). Yet how effectively do consumers remember past decisions? And what factors influence the accuracy of this recall? This thesis examines people's memory for the decisions they have made between products and assessed whether the difficulty of such decisions affects the accuracy with which people remember which product they chose. We investigate whether people exhibit a form off choice amnesia - that is, a tendency to forget a choice that one has previously made. Despite the fact that people overwhelmingly intuit that difficult decisions will be easier to remember (Chance & Norton, 2007) - perhaps because such decisions are thought to take more time and effort to make - «there is conflicting support for this proposition in the literature. It is unclear from past research whether decision difficulty impacts memory, particularly within the context of consumer decision making. Understanding how reliably consumers remember prior product decisions is vitally important feedback, not only to consumers themselves but also to businesses deciding how to allocate their marketing dollars. Rather than going solely towards attracting new customers, these funds may be better spent on reminding and reinforcing the decisions that consumers have already made.

The first part of this thesis reviews the extant literature on decision difficulty and memory. It then presents a series of studies that directly examine this relationship.

Literature Review

Decision difficulty has typically been studied as a moderator or correlate of other phenomena of human cognition. Here we walk through what is known about decision difficulty as it has been studied using these different frames.

Decision Difficulty and Dissonance

Abundant research has shown that making difficult decisions between products creates anxiety. Consumers experience the highest rates of anxiety when these decisions concern products that are valued to a similar extent, particularly similarly high-valued products (Shenhav & Buckner, 2014). Reported anxiety, tracked by activity in regions of the dorsal mPFC, has been found to be significantly lower for less difficult decisions, i.e., those in which only one product in the pair is valued highly (Shenhav & Buckner, 2014). Similar results were found in a study by Gerard (1967), in which participants made decisions between two paintings while hooked up to a device measuring their finger-pulse amplitude. When people made decisions between paintings that were similarly liked, they showed large changes in finger-pulse amplitude immediately after making their decision. This indication of stress was significantly less likely to be found for decisions between paintings that were disparate in value (Gerard, 1967). Being required to make a difficult decision has similarly been found to increase heart rate and galvanic skin responses, both of which are associated with increased levels of stress (Janis & Mann, 1976; Mann, Janis, & Chaplin, 969; Zhou et al., 2015).

This anxiety and discomfort experienced when choice alternatives are close in value is predicted by cognitive dissonance theory (Festinger, 1957). According to this theory, people experience discomfort when they hold conflicting attitudes, beliefs, or behaviors (Elliot & Devine, 1994). In order for a decision between two alternatives to be difficult, the chosen alternative must have some undesirable qualities, or the non-chosen alternative must have some redeeming qualities, or both. However, once the individual selects one item, these attitudes (against the chosen item, or in favor of the unchosen item) are in tension with the choice and therefore create dissonance (Brehm, 1956). Deciding on one of two nearly equal alternatives forces the individual to endure the undesirable features of the selected item and to forgo the positive features of the rejected item. Therefore, the more that alternatives are close in value, and the more difficult the choice then is, the more dissonance will be experienced.

Research has shown that strategies can be used to eliminate the discomfort induced by cognitive dissonance (Elliot & Devine, 1994). One such way to reduce dissonance is to forget that the event happened in the first place. Evidence suggests that stress and anxiety can lead to

memory suppression (Ashton et al., 2020; Benoit et al., 2016; Depue et al., 2006; Anderson & Levy, 2009). Inhibitory control is an executive function that serves to stop memory retrieval and: is engaged in the presence of stress to actively suppress memory (Anderson & Huddleston, 2012; Ashton et al., 2020). The dorsolatral prefrontal cortex, a key component of higher-order cognitive functions such as working memory, has been shown to have reduced activity following exposure to stress (McEwen & Morrison, 2013; Qin et al., 2009).

Not only does the experience of stress lead to lower working memory, it also has been shown to bring aboutentional forgetting, the process of actively suppressing information that one does! not wish to remember (Ashton, et al., 2020; Levy & Anderson, 2008; Anderson & Levy, 2009; Stramacchia et al., 2020). In order to. maintain a positive state of being, it may be beneficial to eliminate | access to unwanted emotional triggers by forgetting about these events. This can be done through various suppression mechanisms such as thought substitution - retrieving an alternative memory to: occupy awareness - or direct retrieval suppression - stopping the process of memory retrieval altogether (Stramacchia et al., 2020). When information causes people discomfort or dissonance, they have the ability - and motivation - to remove these thoughts from their minds.

Decision Difficulty and Amnesia

There is extensive research on selective amnesia and intentional forgetting of highly unpleasant memories, yet the present thesis examines selective amnesia for more mundane memories than those described thus far. Specifically, the goal of this study is to assess memory for difficult decisions and whether the dissonance created 1 by such decisions can bring about lower memory performance. We argue that it's possible that people may reduce cognitive dissonance by simply forgetting what decision they made altogether. Because the more difficult a decision is, the more dissonance it creates and the more motivation exists to reduce it, the tendency to forget what decision was made - a phenomenon we refer to as choice amnesia ~ is expected to increase as does the difficulty of a decision.

To this point, research examining the impact of decision difficulty on memory is very minimal. One study, however, did find | that recognition of a previously shown item among alternatives is. worse when the task is more difficult, as was determined by the similarity of the items and the length of time between presentation: of an item and recall (Klein & Arbuckle, 1970). ‘There is support | in the literature for the proposition that decisions among similar alternatives are recalled with less accuracy than are decisions among more disparate alternatives (Bower & Glass, 1976; Shepard & Podgorny, 1978; Weaver & Stanny, 1978). Lower confidence in a decision, which could be associated with how difficult it was to make the decision, is also associated with lower recall accuracy (Bower & Glass, 1976; Weaver & Stanny, 1978).

Relatedly, there is some evidence that difficult decisions lead to less extensive and more simplistic processing (Luce et al., 1997). When required to make a complex decision, such as one involving multiple alternatives, people are more likely to use decision strategies that eliminate the alternatives quickly and involve only limited search of information and evaluation of alternatives (Payne, 197; Payne et al., 1988). More difficult or complex decisions are also more likely to employ attribute-based decision strategies (Luce et al., 1997). For example, if making a difficult decision is too taxing, people often turn to a simplified rule of thumb and investigate the alternatives on a single attribute (e.g., always choose the least expensive shampoo bottle). If people investigate the choice alternatives less extensively and resort to simplified rules when making their difficult decisions, it seems plausible that these decisions would be forgotten at a higher rate.

In fact, preliminary studies conducted by Levari and Norton (2019) found that recall for difficult decisions is inferior to recall for decisions that are more easily made. Levari and Norton studied this phenomenon by presenting participants with a series of color pairs and asking them to indicate their preference in each pair. Participants were then surprised with a recall task in which they were again presented with the same pairs and were asked which alternatives they chose before. The results show that the more difficult a decision was to make (determined by a pretest of decision difficulty), the less likely people were to remember what choice they made. This relationship persisted not only when participants were again presented with the pair but also when they were present with the colors separately and asked, “Did you choose this colors when you saw it before?” This increased the likelihood that they were remembering or failing to remember the decision they made before, as opposed to simply re-choosing between the products. The relationship also persisted when the similarity of the paired items was controlled for, showing that the worse recall was not simply due to the options in the difficult pairs being more similar to one another. Finally, these studies found that, paradoxically, recall was worse for decisions that took longer to make, even controlling for the difficulty of the decision (Levari & Norton, 2019). These findings are somewhat counterintuitive given that people often assume that more time and attention directed towards a decision will lead to stronger memories for the decision that was made.

While Levari and Norton (2019) found that difficult decisions were harder to remember, there is some evidence suggesting that memory is better for tasks that require greater attention and cognitive effort. Yet many of these studies assess participants’ memory for words or paragraphs they've read, rather than decisions they've made between alternatives (Benton et al., 1983; Tyler et al., 1979). Some studies have examined recall for decision making and found that more difficult decisions were easier to remember. For instance, Jacoby et al. (1979) gave participants pairs of named items (e.g., crumb-tomato, bee-refrigerator) and asked them to decide, on a scale of 1 to 10, how large they believed the difference in size was between the two objects in the pair. The results of a recall task showed that more detailed processing, which was required when the pair items were similar in size, led to better recall of which item was paired with which. This assessment of recall differs from the present study, however,

1. Chance and Norton (2007) tested these intuitions, asking participants whether they thought they would be more likely to remember a decision that was hard or easy for them to make. Participants’ intuitions by and large go against the choice amnesia hypothesis; 82.8% of people anticipated remembering the difficult decision better, compared to only 17.2% who anticipated remembering the easy decision better. People also overwhelm ingly stated that they would be more likely to remember a decision they | spent a long time deliberating (Chance & Norton, 2007).

because it assessed memory for which items were paired together, as opposed to memory for what decision was previously made. Another study did find that when decisions among, items were more difficult, memory was better for minor attributes of the items (McClelland et al., 1987). Participants were presented with a list of cars as well as major and minor attributes about each car on the list. They were asked to make decisions about the cars that varied in difficulty. Memory for minor attributes was found to be better for the difficult decisions than it was for the easy decisions, likely because people use major attributes first when making a decision and only turn to the minor attributes when a difficult decision makes it absolutely necessary. Given that the present study 'examines recall for what choice was made, as opposed to recall for minor and major attributes about the items, we hypothesize that our results will better match Levari and Norton (2019), who found that recall is worse for more difficult decisions.

Research Questions and Hypotheses

With the present studies we hope to add to our understanding of the relationship between decision difficulty and memory, extending the inquiry to the realm of consumer decision-making among products. There is very minimal extant research on the effects of decision difficulty on memory, particularly as it relates to consumer decision-making. The question this thesis attempts to answer is whether the difficulty of a decision between alternatives influences people's ability to remember which alternative they chose. Specifically, when consumers make decisions between products, which decisions do they remember more accurately, hard decisions or easy 'ones? We hypothesized that consumer memory would be worse for more difficult product decisions. That is, when the decision between two products is hard to make, people will have worse recall for which product they ultimately chose. To test this, in Study 1, we showed participants a series of product pairs and had them choose between the two items in each pair. Then during a recall task they were shown each item individually and were asked whether they had chosen it when they saw it before.

In Study 2 we tested a potential alternative explanation for our hypothesized findings. It is possible that rather than remembering which item they chose, participants are simply using a 'liking heuristic,' in which they select the items they like the most and. think, therefore, that they would have chosen before. We call this possibility the 'liking heuristic hypothesis.' It is possible that selecting the items they like the most is more challenging if the decision was more difficult to make. If, during the recall task, participants are simply selecting the items they like the most, it is more likely that they will claim to recall having chosen an item they did not in fact choose if the initial decision was difficult to make. So perhaps, we could get the same results that "recall" accuracy is worse for more difficult decisions, yet this would not relate to memory at all. In order to rule out this alternative explanation, we conducted a second study using pairs of disliked items. If, among pairs of disliked items, the choice amnesia results hold, this would suggest that participants are not simply selecting the items they like, given that they presumably do not like any of the items in this disliked category. We hypothesized that difficult decisions between disliked pairs would be remembered worse than easy decisions. The research questions and hypotheses for Study 1 and Study 2 are summarized in Table 1 following.

Study 1: Q1: Which decisions between products are remembered more accurately, hard decisions or easy ones?	H1: Recall accuracy will be worse for more difficult product decisions.
	H2: Decisions between pair-items that are liked to a similar extent will be more difficult to make and will have worse recall accuracy than decisions between pair-items more disparate in liking.
Study 2 Q2: Are difficult decisions recalled less accurately or are participants simply claiming to have chosen the items they like?	H3: Difficult decisions between disliked pairs will be remembered worse than easy decisions between disliked pairs.
	H4: Among disliked pairs, decisions between pair-items that are liked to a similar extent will be more difficult to make and harder to recall than decisions between pair-items more disparate in liking.

Table 1. Research Questions and Hypotheses

The goal of Study 1 was to assess whether the difficulty of a decision between products influences people's abilities to later remember what decision they made. In Study 1, participants made decisions of varying levels of difficulty, after which they were tested for how well they could recall their decisions. Decision difficulty and product liking were determined via two pretests. In Pretest Ta, we asked participants to choose between products and indicate how difficult each decision was to make. Decision difficulty was operationalized as participants' self-reported ratings of how difficult each decision was on a scale from one to five. In Pretest 1b, instead of asking participants to decide between two products, we asked them to rate the products on a scale of 0 to 100. We used these ratings to determine mean pair-liking for the two options in each pair as well as the difference in liking between the pair's two options, We will refer to this difference in liking as the pair's liking gap. We assembled pairs of products in four different product categories ~ shampoos, water bottles, salad dressings, and mugs. These domains were selected so that any results we obtained would generalize beyond one particular product category. Each pretest and the main study were conducted as separate 8-10 minute online studies, administered through Mechanical Turk (MTurk), Amazon's online crowd-sourcing platform. A different set of U.S. adults participated in each pretest and the main study, and they were each paid $0.80-$1.00 USD for completion.

Study 1 Methods

In Pretest 1a, participants (N = 237, 53% male, Mage = 38.05) were presented with 40 pairs of products, one pair at a time, and were asked to select which product they would rather buy in each pair (see Image 1). After each choice, participants rated how difficult the choice was on a 5-point Likert scale from "not at all difficult" to "extremely difficult." To prevent fatigue, participants were randomly assigned to see pairs of products from only 2 of the 4 product domains. In the second pretest, participants (N = 240, 58% male, Mage = 38.13) were presented with 40 pairs of products, one pair at a time, and were asked to indicate how much they liked each product in the pair on a scale of 0 to 100. Unlike Pretest 1a, participants were not asked to make choices between the items in the pairs. The same product categories and product pairs as Pretest 1a were used. Again, to prevent fatigue, participants were randomly assigned to see products from only 2 of the 4 product categories. Pairs were created by randomly selecting two products from the category, and once they were created, pairs were kept constant for both pretests and the main study. Both the order in which the pairs were presented and the order of the products within each pair were randomized.

In Study 1, a different set of participants (N = 403, 50% male, Mage = 42.18) was presented with the same pairs of products as were used in

Image 1. Choice Task. Products are shown in pais and participants are asked which of the two they would rather buy.

Pretests 1a and 1b. During the choice task, participants were randomly assigned to see pairs from one of the four product categories (shampoos, water bottles, salad dressings, and mugs). For each pair, they were asked to indicate which product they would rather buy. After all the choices were done, they completed a distraction task in which they colored an unrelated image for one-minute. After doing so, participants were surprised with a recall task in which their memories were tested for the products they chose during the choice task. The exact same products from the choice task were shown again in a random order - individually, rather than in pairs - and participants were asked, "When you saw this product before, did you choose it?". During the recall task, products were shown individually so as to limit participants' abilities to simply rechoose which product in the pair they would rather buy. Participants' demographic information was then collected through post-task questions.

Study 1 Results

Did the difficulty of the decision affect the accuracy with which the decision was recalled?

To examine whether the difficulty of a choice predicted recall accuracy, we fit a generalized linear mixed model to our data in R (RCore Team, 2020) using the Ime4 package (v1.1.25; Bates et al, 2015). The dependent variable was the accuracy with which each decision was recalled. Recall for a particular product was accurate if participants correctly recalled choosing the item or correctly recalled not choosing the item. The independent variable was the mean rating of decision difficulty, as was determined in Pretest 1a, We included mean decision difficulty as a fixed effect in our model. As random effects, we included intercepts for (a) participants (who may have entered our study with different thresholds) and (b) products. The mean percentage of choices each participant recalled accurately was 80.81% (SD = 11.39%).

As predicted, the main results from Study 1 yielded a significant, inverse relationship between mean difficulty and recall accuracy (l -2.68, SE = 1.02, $p < 0.01$). For each individual choice alternative, participants are less likely to remember it accurately when it came from a choice that was more difficult to make (see Figure 1).

Did the ratings of the two items in a pair determine the accuracy with which the decision was recalled?

To examine whether the rating of the products in the pair predicted recall accuracy, we fit a generalized linear mixed model to our data in R using the Ime4 package. The dependent variable

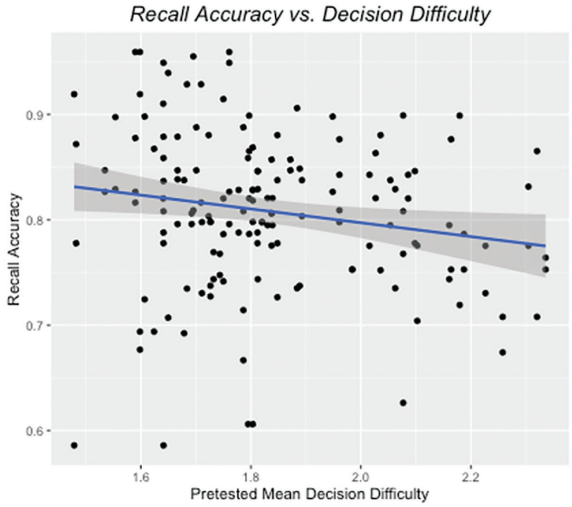

Fig 1. Results for Study 1, shows the relationship between the difficulty of the decision a product was in and the recall for that product across all participants who saw it. The x axis shows the mean decision difficulty, and the y axis shows the recall accuracy for each product

was the accuracy with which each decision was recalled. The independent variable was the mean pair-liking, as was determined in Pretes 1b. We included mean pair-liking as a fixed effect in our model. As random effects, we included intercepts for (a) participants (who may have entered our study with different thresholds) and (b) products. A significant, inverse relationship was found between mean pair-liking and recall accuracy (b = -0.91, SE = 0.34, $p < 0.01$). For each individual product, participants were less likely to remember it accurately when it came from a pair in which products were, on average, rated highly.

Did the relationship between decision difficulty and reduced recall accuracy depend on the closeness in ratings of the two items in the pair?

To examine whether, in predicting recall accuracy, there was a significant interaction between decision difficulty and pair liking gap, we fit a generalized linear mixed model to our data in R using the Ime4 package. This model answers whether the association between decision difficulty and recall accuracy depends on the size of the liking gap between the two products. The dependent var able was the accuracy with which each decision was recalled. The independent variables were (a) mean rating of decision difficulty and (b) the liking gap between the two items in the pair, as well as (c) the interaction between these two variables. We included mean decision difficulty and mean liking gap (and the interactions between them) as fixed effects in our model, We included as random effects, intercepts for (a) participants (who may have entered our study with different thresholds) and (b) products. The interaction 'was not statistically significant (b = 0.06, p = 0.73).

Study 1 Discussion

The first study examined whether recall accuracy is better for hard decisions or easy decisions between products. Results supported our first and second hypotheses, that recall was worse for more difficult decisions, both overall and after controlling for the type of product. We also found support for our hypothesis that decisions between pair-items that are liked to a similar degree are more difficult to make and have lower recall accuracy as compared to decisions in which one item is liked significantly more than the

other. These results make intuitive sense. If one product in a pair is liked much more than the other, the decision-maker will likely not have a hard time choosing that product. If the products are liked to a similar extent, however, the decision-maker is not clearly drawn to one product over the other and will likely face a more difficult decision when choosing just one. We also examined whether the magnitude of the association between decision difficulty and recall accuracy depended on how much the products in the pair were liked, yet the results were not significant. This means that regardless of whether the products were well-liked or disliked, more difficult decisions were recalled with lower accuracy. We also assessed whether, in predicting recall accuracy, there was an interaction between decision difficulty and the liking gap between the products in the pair. The results were similarly not significant; regardless of the size of the liking gap, more difficult decisions were recalled with lower accuracy. This analysis suggests that there is more to making a decision difficult ~and hard to remember - than just how close together liking is of the two options in the pair.

Yet on its own, Study 1 does not confirm that decision difficulty is responsible for the decrease in recall accuracy for difficult pairs. Although difficulty is one possible explanation for the low recall accuracy, it is not the only one. It is also possible that participants were following a 'liking heuristic.' That is, during the recall task, rather than attempting to recall which products they actually chose in the choice task, participants may have simply applied a rule of thumb that they probably chose the products they liked. So when they were shown items that they liked during the recall task they simply claimed they chose them before. This 'liking heuristic" could be less accurate for more difficult decisions. For instance, someone could be given an easy choice between products (e. a brand new sweater or a pack of dryer sheets) and a hard choice between products (e.g., a clothes hanger or a shoe-lace string). When shown each item individually in the recall task, if participants just claim they chose the items they liked the most, they would accurately claim having chosen the sweater from the easy pair more often than accurately claiming that they chose whichever item they picked from the difficult pair. As our analysis from Pretest 1b suggests, more difficult decisions are those in which the pair items are liked to a similar extent as one another. If both products in the difficult pair are disliked, participants could get the recall task wrong by saying that they did not choose either product, or both products in the difficult pair are liked, participants could claim they did choose both of them. Therefore, if participants are simply using a 'liking heuristic, they would more often answer the recall task correctly for the easy decisions than for the difficult decisions, even if they aren't actually using their memory.

Study 2

In this study, we examined a possible alternative explanation to our primary hypothesis that memory is worse for more difficult decisions. Specifically, this study assessed the 'liking heuristic hypothesis,' that participants were simply selecting the items they liked as opposed to remembering which items they had previously chosen. To assess this alternative explanation, we tested whether the relationship between decision difficulty and recall held for choices, between unpleasant options; specifically, pairs of bad-tasting jelly beans. During this recall task, participants were not able to simply select the options they like and infer that they would have chosen them before, because participants presumably did not like any of the disliked flavors. If the only reason participants had lower recall accuracy for difficult decisions in Study 1 was because they selected the items that they liked in the recall task, then, for Study 2, in which all items are disliked and participants are not able to do this, we would not expect the same results. If choice amnesia is not found among disliked pairs, this would suggest that recall accuracy was worse for difficult decisions because, for these decisions, it is more challenging to use the 'liking heuristic' However, if, as hypothesized, Study 2 shows lower recall accuracy for difficult decisions between disliked items, that would suggest that participants are in fact relying on their memory, and that poor memory for difficult decisions accounts at least in part for the decrease in recall accuracy.

It is important to note, however, that even among unpleasant options, some items may be disliked more than others (e.g, someone might not like the taste of eggplant but hate the taste of earwax). Therefore, when shown a pair of eggplant- and earwax-flavored jelly beans in the recall task, the participant may use the 'liking heuristic; claiming that they previously chose eggplant only because it is better than the other disgusting options. In order to preclude participants from simply choosing the less disliked options, we could include mixed pairs in which one jelly bean comes from the liked domain and one comes from the disliked domain. With the inclusion of these mixed pairs, if, during the recall task, participants see an option from the disliked domain that is good compared to other disliked options, they cannot simply assume they would have chosen it, given that it could have originally been paired with a flavor from the liked domain, Therefore, if results show that difficult pairs of disliked items are recalled worse than easy pairs, this, association would likely be due to a difference in memory rather than a difference in the accuracy of the 'liking heuristic' for easy versus difficult decisions.

Study 2 Methods

For Study 2, we used the basic design of Study 1, except that instead of showing participants pairs of consumer products, we showed them pairs of jelly bean flavors. We used jelly beans because it is a product for which both pleasant and unpleasant options exist - pleasant flavors can be found in typical stores, and unpleasant flavors are sold by brands such as BeanBoozled" or Harry Potter. As was confirmed by a pretest, twenty of the jelly bean pairs we assembled contained two pleasant flavors, twenty pairs contained two unpleasant flavors, and twenty pairs contained one pleasant and one unpleasant flavor. We used a mixture of existing jelly bean flavors as well as supposed flavors that were "created" for the study. Each flavor had a name and an image, some of which were real and some we created. The liked domain of jelly beans includes flavors such as bubblegum, very cherry, and mint chip, and the disliked domain includes flavors such as garbage, anchovies, and horse manure (see Appendix B for a complete list). Different sets of U.S. adult participants were recruited through Amazon's MTurk for each of Pretest 2a, Pretest 2b, and Study 2. In Pretest 2a, participants (N = 183, 44% male, Mage = 38.56) completed a choice task in which they chose between two jelly beans in a pair. After each choice, they rated how difficult the choice was, to make. In Pretest 2b, participants (N = 213, 51% male, Mage = 38.31) were shown the same jelly bean pairs, yet instead of choosing between them, they rated each of the jelly beans on a scale of 0 to 100. In Study 2, participants (N = 301, 50% male, Mage = 39.11)

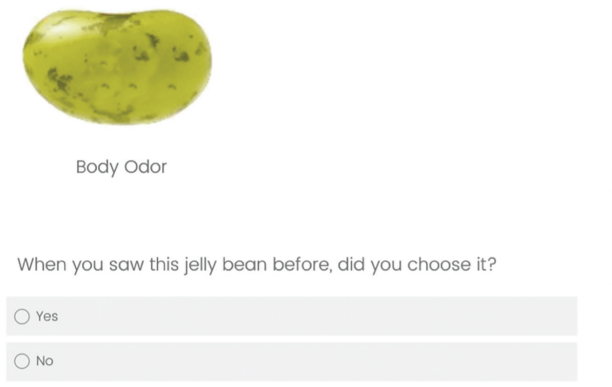

Image 2. Recall Task for Study 2. A single jelly bean is presented and participants are asked whether they previously chose it during the choice task.

completed the same choice task as Pretest 2a, but after a one-minute distraction task, they were given a recall task in which they were tested for how well they recalled the choices they previously made (see Image 2). Identical to Study 1, in this recall task, jelly beans were presented individually so that participants would not be able to simply re-choose between the two items in the pair. Pretest 2a results found that among the liked pairs, there was very little variability in decision difficulty; all decisions between two liked jelly beans were rated as similarly easy to make. As a result, these liked pairs were removed from the main study and analysis below. A potential limitation of the Study 2 design is that although participants could not select items they like, they could still select: items they like most. That is, even though participants likely would not choose to eat any of the unpleasant flavored jelly beans, they may prefer eating some flavors more than others. During the recall task, they could potentially still use the 'liking heuristic' to infer that they would have chosen these flavors before. This is partially controlled for, though, by the fact that mixed pairs are included. With the mixed pairs included, participants cannot assume they would have chosen the unpleasant flavors they dislike the least given that if it came from a mixed pair, the participant likely would have chosen the pleasant flavor from that pair. Perhaps even more importantly, though, the results from the pretests suggest that none of the unpleasant flavors are liked significantly more than others. 'As can be seen in Figure 2, the disliked jelly bean flavors (shown in red) were all similarly disliked. Given that the range of liking for these disliked pairs is so minimal, participants were not able to see an item in the recall task and assume that they had chosen it before just because it was better than the other disliked options,

Study 2 Results

Did the difficulty of the decision affect the accuracy with which the decision was recalled?

To examine whether the difficulty of a choice between disliked items predicted recall accuracy, we fit a generalized linear mixed 'model to our data in R using the lme4 package. The dependent variable was the accuracy with which each decision was recalled. Recall for a particular jelly bean flavor was accurate if participants correctly recalled choosing the item or correctly recalled not choosing the item. The independent variable was the mean rating of decision difficulty, as was determined in Pretest 2a. We included mean decision difficulty as a fixed effect in our model. As random effects, we included intercepts for (a) participants (who may have entered our study with different thresholds) and (b) jelly bean flavors. As predicted, the main results yielded a significant, inverse relationship between mean difficulty and recall accuracy ($b = -2.44$, $SE = 0.77$, $p < 0.01$). Among these disliked pairs, for each individual item, participants were less likely to accurately remember what choice they made when the decision was difficult to make compared to when it was easy (see Figure 3).

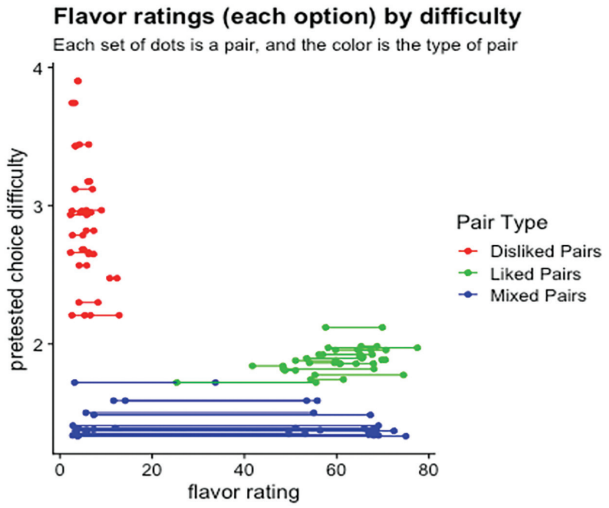

Fig. 2. Results for Study 2. In this graph, each dot represents a single jelly bear flavor, connected by a line to the other flavor in the pair. The graph shows the relationship between flavor rating and the difficulty of choosing between the flavors in the pair. The x axis shows the flavor rating, and they axis shows the difficulty of the choice. Disliked pairs are shown in red, liked pairs in green, and mixed pairs in blue.

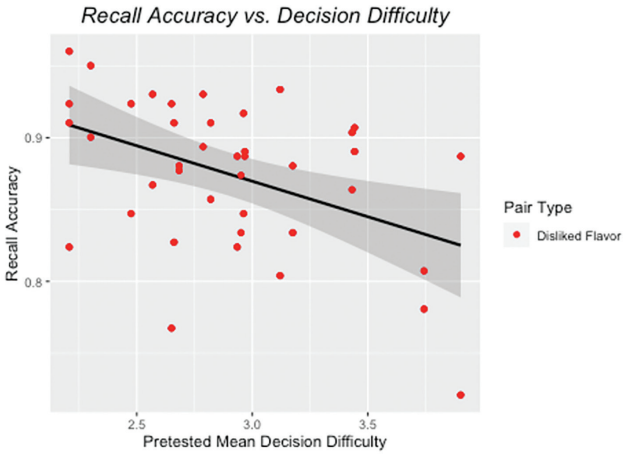

Fig. 3. Results for Study 2. In this graph, each dot represents a single jelly bean and shows, across all participants who viewed it, the relationship between the mean difficulty of making the decision involving that jelly bean and the mean accuracy as to whether it was chosen. The x axis shows the decision difficulty, and the y axis shows the recall accuracy for each jelly bean. Only the disliked pairs were included.

Did the relationship between decision difficulty and reduced recall accuracy depend on the closeness in ratings of the two items in the pair?

To examine whether, in predicting recall accuracy, there was a significant interaction between decision difficulty and pair liking gap, we fit a generalized linear mixed model to our data in R using the lme4 package. In other words, this model assessed whether the association between decision difficulty and recall accuracy depended on the size of the liking gap between the two items in the pair. The dependent variable was the accuracy with which each decision was recalled. The independent variables were (a) mean

rating of decision difficulty and (b) liking gap between the two 1 items in the pair, as well as () the interaction between these two variables, We included mean decision difficulty and mean liking gap (and the interactions between them) as fixed effects in our model. 1 We included as random effects, intercepts for (a) participants (who may have entered our study with different thresholds) and (b) jelly bean flavors. This interaction was also not statistically significant (b=-0.09, p= 0.84).

Study 2 Discussion

The results of this study support Hypothesis 3, that, among disliked pairs, recall is worse for difficult decisions than for easier ones. The fact that these results were found among disgusting jelly bean choices demonstrates that participants did not simply have higher recall accuracy for easier decisions because they could claim: they chose the items they like. The results suggest that, instead, poor memory — or choice amnesia — accounts for the lower recall accuracy for difficult decisions.

Support was also found for Hypothesis 4, that decisions between pair-items that are liked a similar amount are more difficult to make and harder to recall than are decisions in which the liking 1 gap between the two items is larger. Although each jelly bean came from the "disliked" domain, if one jelly bean in a particular pair was | liked much more than the other, it would likely be a relatively easy | decision to choose that item. If the choice alternatives are disliked « to a similar extent, though, there would not be a clear choice and the decision would presumably be more challenging.

General Discussion

This thesis explores the relationship between decision difficulty and memory, specifically examining whether difficult decisions between products are remembered less-well than easier ones Study 1 demonstrated that recall accuracy is lower for more difficult decisions between products, and Study 2 tested - and did not find support for - the alternative explanation that these results were only found because participants in the recall task selected the items they liked the most and therefore thought they would have chosen. The fact that people may have trouble remembering their previous choices, particularly those that were difficult to make, has important implications for consumer decision-making and purchasing behaviors. In order to use previous decisions to help guide current purchasing behavior, consumers must first remember what decisions they have made. Consumers - and the businesses that serve them ~ may rely on the assumption that they will be able to remember their past product decisions. This thesis suggests, however, that this is not always the case. Perhaps, then, both consumers and businesses could benefit from more attention and marketing dollars being directed at reminding consumers of the decisions they have already made.

It is interesting to note that, although difficult decisions likely involve more effort, in our study, this increased effort did not translate to better memory. If, during the recall task, participants had instead been asked, "did you decide between this pair during the choice task?" it is possible that they would have had better memory) for the pairs that were more difficult to decide. Levari and Norton's unpublished studies (2019) found this result for decisions between colors; for difficult pairs, people remembered that they were faced with two particular options, they were just worse at remembering which one they ultimately chose. Difficult choices likely take more time and cognitive attention, and therefore, perhaps, people would have better memory for the fact that they decided between the two particular options in the pair. Yet remembering choosing between two products is different from remembering which product you chose. Perhaps part of what makes difficult decisions more effortful is that, in coming to a final choice, the decision-maker actively contemplates choosing each option. if both options are considered, then, when the individual is later trying to recall their decision, they may have more trouble remembering which one they eventually chose. For instance, if someone who likes pasta much more than salad is choosing between items on a menu, then when later asked to recall which item he ordered, he will likely easily remember that she chose the pasta. Yet if he likes pasta and pizza similar amounts and has to actively contemplate choosing each one before coming to a decision, then when later asked what decision he made, he will likely have a harder time remembering. Perhaps another psychological mechanism responsible for this choice amnesia, and a reason why it could be an adaptive strategy, is cognitive dissonance reduction. Individuals may be motivated to reduce the dissonance that is created by making a difficult decision and forgetting their difficult choices may be one effective way to do so. Other cognitive dissonance reduction strategies include post-hoc rationalization and spreading apart of the value of choice alternatives. Yet rather than going through the effort of justifying their decisions, perhaps in some situations, a more adaptive (although unconscious) strategy is to simply forget about the decision altogether.

Limitations and Future Directions

The present study contains several limitations that could be addressed in future research on choice amnesia. One such limitation is that different sets of participants completed the pretests determining decision difficulty and the main studies assessing recall. Although certain decisions are likely substantially more difficult than others, people's personal opinions about which product decisions were difficult are likely somewhat varied. It would be helpful in future studies to use a single group of participants in order to examine whether the same people who find a particular decision difficult actually have a harder time remembering what choice they made. Another limitation is that the range of difficulty of all the decisions in the study only spanned from 1.48 to 2.34 on a scale from 1 to 5. It is possible that the relationship between decision difficulty and recall accuracy is different outside this restricted range. For instance, we have suggested that extremely difficult decisions (.e., those rated close to 5 on this scale) will be remembered with the lowest accuracy. But perhaps that is not so; it could be that for these decisions, the immense difficulty would lead to superior memory as compared to only semi-difficult decisions, Future studies should attempt to create a set of decisions with a wider range of difficulties, so as to assess whether the relationship found in this study holds for extremely easy or extremely difficult decisions. Additionally, there are undeniable differences between the decision-making scenarios presented in these studies and real-life decisions between products. First of all, the amount of time between the choice task and recall task in these studies was very short. Future studies on choice amnesia should examine whether similar results are found when the period between choice and recall is greater,

perhaps by several days or weeks. Additionally, when consumers make decisions between products, they typically have the experience of using the selected product before they are back in a position in which they need to decide between products again. Surely, the experience of using the product could affect one's memory for what decision they made before. It is likely that recall accuracy would be substantially higher when people are given the opportunity to use the product, yet perhaps the results would still hold that recall accuracy would be worse for difficult decisions than for easier ones.

It is also important to note that different types of decisions leave different amounts of residual evidence of the decisions after they have been made. For instance, when an individual chooses a/ salad dressing at a restaurant, they use it and it disappears almost immediately along with any evidence of what choice was made. In contrast, other decisions lead to ownership of the chosen item, which, creates more or less enduring evidence of the choice. A shampoo. bottle may last for weeks and a mug may last for years. It is possible that one's ability to recall what decision they made is moderated by whether this behavioral residue exists. Perhaps, for instance, the relationship between decision difficulty and recall accuracy would be weaker for products that one still owns given that the residual evidence of the decision could overpower any impact of decision difficulty on recall accuracy. Future studies in which participants are given the opportunity to use these different types of products would shed light on this possibility.

An important next step for choice-amnesia research is to conduct studies that employ real-world purchasing scenarios. For instance, at a convenience store, participants could be asked to make various decisions among products and could be able to keep the items they selected from each pair. At a follow-up appointment, their memory for the products they chose could be tested. This study design would more closely replicate the experience of deciding among products and would also address some of the limitations of the current study; namely, there would be a longer break between choice and recall, participants would have the opportunity to use the products they chose, and the same participants who stated decision difficulty would complete the recall task.

Conclusion

The findings of this thesis offer key additions to the existing research on decision difficulty and recall accuracy. Consumers are frequently put in positions in which they would benefit from remembering their past choices e.g., "Last time I went to the store, did I choose Crest or Colgate toothpaste? At Chipotle, did I order barbacoa or steak in my burrito? When I bought Nike shoes, did I decide on size 7 or 8?" Without knowledge of this study's findings, sellers may erroneously assume that consumers will have better memory for more difficult decisions, perhaps because making these decisions typically requires greater time and cognitive) effort. Consumers may like to think that their product decisions are well-informed and are guided by their knowledge of their past purchasing behaviors. Yet when a previous choice was difficult to J make, consumers' ability to remember their decisions and apply those past experiences to their current product decisions seems to be impaired. While future studies are needed to demonstrate the choice-amnesia effect in the context of real-world product decisions, the studies presented in this paper offer preliminary evidence of a perhaps counterintuitive inverse relationship between decision difficulty and memory. Basing current purchasing based on past product decisions could be a helpful way of reducing the effort involved in making such decisions. Yet in order to do so, people must first remember the choices they have made. Ironically, the decisions that require the most effort and that consumers would most benefit from remembering are precisely the ones they're more likely to forget.

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