Distribution Agreement

In presenting this thesis as a partial fulfillment of the requirements for a degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis in whole or in part in all forms of media, now or hereafter now, including display on the World Wide Web. I understand that I may select some access restrictions as part of the online submission of this thesis. I retain all ownership rights to the copyright of the thesis. I also retain the right to use in future works (such as articles or books) all or part of this thesis.

Nikita Dsouza April 13, 2020

Pinning Down Decision Preferences: Evaluating Role of Choice Architecture in Overcoming Choice Overload in Low-Stakes Subjective Decision Settings

by

Nikita Dsouza

Kelli Lanier
Adviser

Economics

Kelli Lanier

Adviser

Evan Saltzman

Committee Member

Reshma Shah

Committee Member

2021

Pinning Down Decision Preferences: Evaluating Role of Choice Architecture in Overcoming Choice Overload in Low-Stakes Subjective Decision Settings

By

Nikita Dsouza

Kelli Lanier

Adviser

An abstract of
a thesis submitted to the Faculty of Emory College of Arts and Sciences
of Emory University in partial fulfillment
of the requirements of the degree of
Bachelor of Arts with Honors

Economics

2021

Abstract

Pinning Down Decision Preferences: Evaluating Role of Choice Architecture in Overcoming Choice Overload in Low-Stakes Subjective Decision Settings

By Nikita Dsouza

This study evaluates how sequential tournament-styled decision models fare as an alternative to simultaneous decision models in low-stakes choice overload settings. Utilizing a between-groups experimental design, the study tracks decision satisfaction, confidence, and regret as undergraduate participants decide between sixteen decorative pins across three distinct choice architectures: an “all-at-once” simultaneous choice architecture, a sequential “two-options-at-a-time” binary choice architecture, and a sequential “four-options-at-a-time” quaternary choice architecture. In spite of the initial hypothesis that sequential decision-making models increase decision utility by making larger menus more manageable, the study found statistically significant evidence that – for low-stakes subjective decisions – participants foster higher decision utility when presented with simultaneous choice architectures as opposed to sequential choice architectures. This may be the result of several contributing factors, including but not limited to the low-stakes nature of the decision, the low-complexity nature of the decision, and the escalating feelings of commitment, indifference, and regret that arise when decision-makers navigate sequential decisions.

Pinning Down Decision Preferences: Evaluating Role of Choice Architecture in Overcoming Choice Overload in Low-Stakes Subjective Decision Settings

By

Nikita Dsouza

Kelli Lanier

Adviser

A thesis submitted to the Faculty of Emory College of Arts and Sciences
of Emory University in partial fulfillment
of the requirements of the degree of
Bachelor of Arts with Honors

Economics

2021

Acknowledgements

Thank you to my faculty advisor, Dr. Kelli Lanier, for all your help, guidance, and weekly Zoom calls throughout this year of research. I am also grateful to my committee members, Dr. Evan Saltzman and Dr. Reshma Shah, for their mentorship and impact as professors and educators. Finally, thank you to Dr. Stephen O'Connell for overseeing the Emory Economics Honors Program, and a special shout-out to the Emory Behavioral Economics thesis group for all your support: Yuqi Vicky Wang, Peter Lee, and Junaid Ahmed.

Table of Contents

Figures, Tables, & Visual Items

Introduction

As companies seek new ways to meet consumer interests, there is often an incorrect assumption that as the number of product options grows, so must consumer satisfaction. This assumption is predicated on the assumption of a rational decision-maker, whose preferences obey the law of transitivity. Thus, as the number of options increases, the rational consumer will be able to select the option that appropriately maximizes utility, above all else. In reality, however, such behavior rarely occurs. Instead, consumers of modern day society find themselves in a state of discontent, paralyzed by the number of options and unable to make a decision that they are fully assured by.

This phenomena is often called *choice overload* or *the paradox of choice*. Termed by businessman Alvin Toffler, choice overload refers to the idea that when consumers are presented with an excess of options, they generally experience high levels of anxiety that lead to inefficient decision-making (Toffler, 1970). This occurrence has been captured across multiple fields and behavioral economic studies, ranging from psychologist Barry Schwartz's informal anecdote about his local grocery store to Chernev and colleagues' robust meta-analysis on menu size and decision-making utility (Schwartz, 2004; Chernev, Böckenholt, & Goodman, 2015). In general, as a result of choice overload, consumers find themselves either "paralyzed" by the sheer quantity of options or in a state of decreased decision satisfaction, decreased decision confidence, and increased decision regret (Schwartz, 2004; Chernev, Böckenholt, & Goodman, 2015).

To better explore this phenomena, this study utilizes a between-groups experimental economics design, with the primary objective of establishing decision-reframing as a means of *choice overload* prevention. The design compares decision outcomes across three separate choice architectures: a simultaneous choice group, a sequential binary-choice group, and a sequential quaternary-choice group.

The simultaneous choice group serves as a control, in which participants make decisions with the standard *all-at-once* prompt: "Out of *X* amount of options, which do you prefer the most?" This is the typical choice architecture seen when shopping at malls, supermarkets, and restaurants. The sequential choice groups differ in that options are revealed in increments, as opposed to all-at-once. Sequential decision-makers look at small subsets of a menu at a time, making decisions in smaller groups before panning outwards to the bigger picture. Although less common, this form of decision-making can be seen in sport play-off brackets, multistage elections, and social media "favorite character" sorters. Sequential binary-choice architectures allow decision-makers to focus on *two* options at a time, and sequential quaternary-choice architectures allow decision-makers to focus on *four* options at a time.

By comparing participants' decision-making satisfaction, confidence, and regret between the sequential choice treatments and the simultaneous choice control, the study aims to clarify the role of choice architecture in choice overload and, ideally, alleviate choice overload via sequential decision reframing. The hypothesis guiding this study is that, if introspection can indeed be a medium for overcoming choice overload, consumers who

utilize sequential decisions will report higher ratings of decision satisfaction, decision confidence, and decision utility, as a result of being able to view large menus in smaller and more manageable subsets. However, if consumers find the experience of sequential decisions to be tedious or ineffective, this suggests a trade-off between decision speed and decision focus when choosing between simultaneous and sequential choice architectures, implying that the solution to choice overload paradigms rests elsewhere.

From a practical perspective, the results of this study will contribute to how consumers and brands navigate decision-making strategies and menu presentation: if sequential choice architecture successfully counteracts the harmful effects of choice overload, consumers may wish to utilize digestible subsets when faced with large menus and brands may wish to present large menus in smaller pieces at a time; if sequential choice architecture is ineffective in counteracting these effects, the "all-at-once" menu norm may actually be the ideal route for consumer decision-making.

The study proceeds by discussing the past literature on choice overload, investigating the potential causes of choice overload, and evaluating factors that may play a role in choice overload decisions. The paper then describes the experiment design, recruitment methods, and materials used, as well as the results and possible justifications. Contradicting the original hypothesis, the study found that participants display higher decision utility levels in the simultaneous treatment, with this difference reaching statistical significance between the simultaneous and sequential-quaternary choice groups.

Literature Review

Choice Overload as a Phenomenon

In 1970, businessman Alvin Toffler introduced the concept of *choice overload*, describing how "the advantages of diversity and individualization" could be easily canceled by the complexity of a decision-making process (Toffler, 1970). As time progressed, an increasing number of observations, studies, and explanations have been proposed regarding the relevance and roots of choice overload, as well as the need to overcome it.

American consumers of today are consistently bombarded with the issue of choice. When psychologist Barry Schwartz first described the paradox of choice, he used his local grocery store as an example: here, he counted 85 varieties and brands of crackers, 285 varieties of cookies, 85 flavors and brands of juices, 61 varieties of suntan oil and sunblock, 80 varieties of pain relievers, 40 types of toothpaste, and 230 options for soups alone (Schwartz, 2004). While Schwartz's experience may seem unusually intense, modern day business strategies do tend to prioritize consumer preference and variety. From a marketing perspective, the impression is that product variety acts as a quality cue for brands and that options help consumers find the ideal match that fits their unique needs (Berger, Draganska, & Simonson, 2007). Motivations like these push forth the notion of expanded menu sets and excessive product variety.

In reality, however, there is a limit to how many options a consumer can effectively navigate between. Past studies explore how decision-making changes when consumers are faced with a rising number of choices. These studies tend to utilize either experiments or surveys that require participants to select one option from a variety of choices, varying the menu size per trial and documenting both process-based and outcome-based indicators (Chernev, Böckenholt, & Goodman, 2015). Process-based indicators measure the decision-maker's subjective state, such as decision confidence, satisfaction, and regret. Outcome-based indicators measure observable actions, such as likelihood of deferring, likelihood of reversing choices, preference for assortment, and the nature of the chosen option.

According to a meta-analysis on choice overload, the general trend is that as the number of choices increases past the complexity threshold, decision confidence falls, decision satisfaction falls, and decision regret rises (Chernev, Böckenholt, & Goodman, 2015). This complexity threshold may vary per decision, but in general, cognitive psychologist George Miller cites the magical number of seven – plus or minus two – to be the upper limit on the capacity of items an individual can balance at once (Miller, 1956). The threshold is especially pressing for products with high stakes and multiple levels of differentiation, such health insurance purchases or car purchases, as these traits take larger tolls on the decision-maker (Schaller & Malhotra, 2015; Johnson et al., 2012; Gerasimou, 2018). As the number of choices increases past the complexity threshold, several process-based and outcome-based trends occur. From a process-based perspective, decision confidence falls, decision satisfaction falls, and decision regret rises (Chernev, Böckenholt, & Goodman, 2015). From an outcome-based perspective, decision-makers tend to defer choices, reverse

choices, prefer smaller assortments, and choose options with easy justifications (Chernev, Böckenholt, & Goodman, 2015).

The phenomena of choice overload is well documented across numerous product types, with past economic experiments observing choice overload in choices pertaining to chocolates, pens, toothpaste, flowers, ice-cream, and more (Chernev, Böckenholt, & Goodman, 2015).

Identifying Potential Roots

In identifying the roots of this phenomena, several cognitive biases appear to be at play. Namely, the decoy effect fallacy, aversion of the extremes fallacy, and decision fatigue fallacy seemingly work in conjunction to sway consumer rationality.

The decoy effect describes the event in which the presence of a third, but inferior, choice results in an agent changing their preference between two unrelated items (Kaptein, Van Emden, & Iannuzzi, 2016). Aversion of the extremes occurs when an agent chooses a middle-ground option, even when an extreme provides greater utility (Padamwar, Dawra, & Kalakbandi, 2018). Decision fatigue occurs when an agent makes inefficient decisions due to tiredness, confusion, or apathy (Vohs et al., 2008). The first two fallacies involve violations of the transitive preferences: an agent may prefer item A to item B, but when a distracting item C is introduced, the agent – irrationally – selects item B. These violations occur due to the presence of a distracting menu item, whether it be a decoy or an extreme.

The third fallacy occurs due to cognitive overload and mental exhaustion. Of these three fallacies, the former two can be resolved via binary choices, but the latter depends on the nature of the decision – whether it be in quantity, frequency, or intensity – the consumer receives in a given time period.

This theoretical distinction is important for the present study's methodology and primary objective. If it is indeed true that choice overload spawns from distracting menu items, then viewing smaller portions of an excessive menu at a time via sequential decisions should mitigate the issue of choice overload. However, if choice overload instead comes from an overwhelming number of decisions, regardless of decision-framing, the repeated nature of sequential decisions may actually exacerbate the issue of choice overload.

Past Studies, Factors, & Solutions

Past studies successfully found attribute alignment, consumer expectations, availability of an ideal, personality traits, cultural norms, option attractiveness, and decision focus to be valuable means of moderating choice overload (Gourville & Soman, 2005; Diehl & Poynor, 2010; Chernev, Böckenholt, & Goodman, 2015). When consumers are able to easily identify products with desirable attributes that align with their expectations, ideals, and cultural norms, they tend to be drawn to these options (Besedes et al., 2015). A pre-existing focus helps anchor consumers to a target, capitalizing on the "status quo" bias and minimizing the attention devoted to irrelevant options (Besedes et al., 2015). However, in the midst of

unfamiliar decision territory with no pre-defined focus, further guidance is needed (Gerasimou, 2018).

Rather than relying on past expectations and status quos, decision-reframing and introspection can also be valuable tools for overcoming choice overload in the present. In a 2012 study on decision staging, researchers found that decision-makers naturally tend to narrow down options for complex decisions, looking at menu subsets, comparing alternatives, and navigating their decisions in different stages (Johnson et al., 2012). Another 2016 study on assortment size and purchase likelihood found that reframing *choice overload* decisions into a series of two questions – the decision to buy and the decision to select – helped decrease choice deferrals (Gao & Simonson, 2016). Findings like these support the notion that decision-reframing can help consumers navigate previously-overwhelming decisions, providing further rationale to the thesis at hand. However, whereas Johnson and colleagues' findings apply to complex decisions, the study at hand explores if decision staging can benefit individuals who are deciding among simple products, as well. Likewise, whereas Gao & Simonson's study divides decision-making based on thought process, the present study divides decision-making based on the menu set itself.

A 2015 study on sequential decision-making falls much closer to the experimental design in question. Here, economists examined sequential choice architectures, similar to mine, with the goal of mitigating choice overload without reducing menu size. This study utilized monetary-based decision questions, where consumers were faced with probability

questions underscored with a true optimal value (Besedes et al., 2015). The researchers found that sequential tournament-styled choices indeed benefited the participants, and that participants who followed this model tended to be closer to the final optimal choice (Besedes et al., 2015). However, participants still preferred the simultaneous choice paradigm to the sequential tournament decision time (Besedes et al., 2015). Although the reasons for this preference are unclear, it is theorized that participants prefer simultaneous choice paradigms due to a familiarity and time constraints (Besedes et al., 2015).

Looking Forward: The Study at Hand

The present study builds on the past literature by presenting a new model for decision-making in the midst of large menu sizes. Building off of Besedes and colleagues' work (2015), my study evaluates the efficacy of sequential tournament-styled decisions in low-stakes settings. Deviating from Besedes and colleagues' work, my design addresses subjective preferences with no optimal solution, in hopes of reflecting the subjective nature of decisions that consumers make during a typical shopping trip. For example, in supermarkets and online shops, consumers are presented with a multitude of options that they themselves must subjectively choose between– there is no one "optimal" truth. Depending on the consumer's choice, their derived decision-making satisfaction, confidence, and regret may vary. Furthermore, my design aims to expand on Besedes and colleagues' work by identifying *why* decision-makers tend to prefer simultaneous choice paradigms, in spite of their inefficiency. My theory is that, upon realizing that tournament-styled decisions increase decision confidence and satisfaction, participants will

learn to value tournament-styled decision-making as a paradigm for future choices. If so, the results of this study will assist individuals in the course of day-to-day decision-making, encouraging “shelf-by-shelf” and “one decision at a time” frameworks. If sequential decisions prove advantageous to simultaneous decisions, corporations and brands may also use these results as an aid when designing displays for their menus, creating smaller groupings of products for consumers to sequentially work their way through, with add-ins like filters and piece-by-piece menu sorters.

Through this literature review, the presence, impact, and value of choice overload becomes increasingly evident for consumers, brands, and decision-makers alike. Choice overload is a phenomenon that has been documented anecdotally by psychologists and business leaders, empirically by economic experiments, and theoretically by explanations of the decoy effect and aversion of the extremes. While past studies have attempted to shed light on the paradox of choice via status quos, pre-defined decision foci, and controlled monetary sequential decisions, this present study aims to contribute to the literature by providing an alternative sequential choice paradigm that better reflects the subjective real-world decisions that consumers make.

Methodology

Participants

The sample for this study consisted of 108 participants recruited from Emory University's campus, a sample size that generated a statistical power of 0.61-0.65 given our study parameters.

The age of participants ranged from 18 to 35 (M = 20.45, SD = 1.93). The sample comprised of 60 females (55.56%), 45 males (41.67%), 2 non-binary individuals (1.85%), and 1 individual who chose not to disclose their gender (0.93%). Ethnically, 45 participants were Asian (42.06%), 30 participants were White (28.04%), 11 were Black or African American (10.28%), 9 were Hispanic or Latino (8.41%), and 12 were either multi-ethnic or identified as a separate ethnicity (11.21%). Participants came from a variety of academic majors, including but not limited to African American Studies, Business Administration, Economics, Psychology, and Human Health.

Participants were recruited via public chat forums, ListServ emails, and academic extra credit incentives. The eligibility criteria highlighted individuals with clearance to Emory University's campus during the COVID-19 pandemic. Data collection occurred in common spaces on Emory University's campus, such as the Emory Student Center, Dobbs Residence Hall, and Clairmont Student Activity and Academic Center. For participant safety,

social-distancing, sanitization, and mask precautions were strictly enforced throughout the duration of the study.

35 (32.41%) participants were randomly assigned to the simultaneous choice group, 38 (35.19%) participants were randomly assigned to the sequential binary choice group, and 35 (32.41%) participants were randomly assigned to the sequential quaternary choice group. No data points or outliers were removed from the sample. All participants provided informed consent prior to data collection, and participants received no monetary compensation for their involvement.

Materials & Measures

The materials required of this study include the decision-making item (decorative pins), the Informed Consent form, a Demographic Questionnaire, and the Post-Decision Questionnaire, which consisted of questions regarding the decision, questions from Sleddens and colleagues' *Impulsivity Scale* (2013), and questions from Fajkowska and colleagues' *Arousal Anxiety Scale* (2018):

Decorative Pins. Sixteen decorative pins served as the decision-making item of the study. These pins had a fixed size and function, but they varied in color and design. The color and design differences were meant to mimic the aesthetic differences present in products, such as clothing or merchandise, that consumers may encounter during a typical shopping trip. The specific designs are pictured below:

Figure 1. Designs of decorative pins.

Demographics Questionnaire. Participants self-reported their age, gender, ethnicity, primary major, secondary major, and minor. Participants also rated their involvement with the decorative pin product category on a Likert scale of 1 to 7. This questionnaire can be found under *Item A1* in the Appendix.

Decision-Making Task. The decision-making task varied depending on which treatment group participants were assigned to. Participants were shown sixteen pins in various choice architectures (all-at-once, two-at-a-time, four-at-a-time) and asked to select which

pin they preferred the most. The specifics regarding this task are detailed in the Procedure section below.

Post-Decision Questionnaire, Part 1. Participants submitted the pin they selected, in addition to a brief free-response description of their decision-making process and selection thoughts. Participants then indicated whether their randomly assigned decision-making model is the one they usually follow when presented with a menu of sixteen items and whether, if given the opportunity to choose, if they would follow the same model. Following this question, participants were presented with 7-point Likert Scales, asking them to rate how satisfied, confident, and regretful they were with their decision. Participants similarly rated how overwhelmed they were with the number of options, how thoroughly they reviewed each option, how important this decision was to them, how busy they were at the time of the decision, and how likely it was for them to choose the same item if they were to repeat the experiment. This questionnaire can be found under *Item 2A* in the Appendix.

Post-Decision Questionnaire, Part 2. Participants then submitted responses to psychographic and behavioral questions relating to impulsivity and anxiety. Thirteen questions were selected from Sleddens and colleagues' *Impulsivity Scale*, which was designed for a study examining children's self-reported impulsivity via 5-point Likert scales. This scale had a Cronbach alpha of 0.78 and item separation reliability of 0.77 (Sleddens et al., 2013). Seven questions were selected from Fajkowska and colleagues' *Arousal Anxiety* scale, which was designed to assess the arousal type of anxiety. This scale had a Cronbach alpha of 0.93 (Fajkowska et al., 2018).

Procedure

Upon recruitment, all participants received a verbal explanation of the experiment, signed a physical Informed Consent form, and completed a digital Demographics Survey. Participants were then randomly assigned to one of three groups: the **s**imultaneous **c**hoice group (SC), the sequential **b**inary **c**hoice group (BC), and the sequential **q**uaternary **c**hoice group (QC).

All groups were asked to make subjective preference decisions regarding an assortment of sixteen unique decorative pins. However, the choice architecture varied per treatment.

The simultaneous choice (SC) group viewed all sixteen pins at once, in a 4 x 4 array, in a fixed order. Prior to revealing the pins, the researcher read aloud the following prompt:*"You will be asked to make a decision regarding sixteen decorative pins. You will be able to keep the final pin that you select. Do you have any questions?*" Once the participant confirmed they had no questions, the researcher revealed the sixteen pins and read the secondary prompt: *"Out of these sixteen pins, which do you prefer the most?"* Participants then selected the pin they preferred and advanced to the Post-Decision Questionnaire component of the study.

The sequential binary choice (BC) group viewed two pins at a time, in a fixed tournament-style bracket architecture as displayed in *Figure A1* in the Appendix. Prior to revealing the pins, the researcher read aloud the following prompt:*"You will be asked to make a decision regarding sixteen decorative pins. I will show you the pins in pairs of two, and*

out of each pair, you will be asked to select the one you prefer the most. You will be able to keep the final pin that you select. Do you have any questions?" Once the participant confirmed they had no questions, the researcher revealed the first pair of pins (e.g. Pin A and Pin B) and read the secondary prompt: *"Out of these two pins, which do you prefer the most?"* After this decision, the researcher revealed two new pairs of pins (e.g. Pin C and Pin D), and the process repeated as depicted in *Figure A1* until one final outcome – the most preferred pin – remained. In total, this process repeated fifteen times, until all sixteen pins were viewed.

The sequential quaternary choice (QC) group viewed four pins at a time, in a similar fixed tournament-style bracket architecture as displayed in *Figure A2* in the Appendix. Prior to revealing the pins, the researcher read aloud the following prompt:*"You will be asked to make a decision regarding sixteen decorative pins. I will show you the pins in groups of four, and out of each group, you will be asked to select the one you prefer the most. You will be able to keep the final pin that you select. Do you have any questions?*" Once the participant confirmed they had no questions, the researcher revealed the first group of pins (e.g. Pin A, Pin B, Pin C, and Pin D) and read the secondary prompt: *"Out of these four pins, which do you prefer the most?"* After this decision, the researcher revealed four new pins, and the process repeated as depicted in *Figure A2* until one final outcome – the most preferred pin – remained. In total, this process repeated five times, until all sixteen pins were viewed.

After selecting the final pin, participants completed several reflection questions on the decision they just made in a Post-Decision Questionnaire. To operationalize choice

overload, participants responded to three seven-point Likert scale ratings: one for decision-making satisfaction, one for decision-making confidence, and one for decision-making regret. The sum of these scores was then converted into one total quantity, reflecting the level of decision utility obtained from the final choice. In the Post-Decision Questionnaire, participants rated other aspects of their decision, provided an open-ended response describing how they felt about their decisions, and submitted self-report ratings to psychographic questions from Sleddens and colleagues' *Impulsivity Scale* and Fajkowska and colleagues' *Arousal Anxiety Scale* (Sleddens et al., 2013; Fajkowska et al., 2018).

After completing all survey items, participants received a debrief of the experiment, explaining that their responses will help motivate a study that explores various models of decision-making and decision preference. Participants received the research team's contact information, in addition to the final pin that they selected as a thank-you for their participation.

Data Analysis

All data analyses were conducted on RStudio Version 1.1.456, using an alpha level of $p < 0.05$. Descriptive statistics were first calculated for all relevant variables, followed by analysis of variance (ANOVA) tests to assess how decision-making emotions (confidence, satisfaction, regret, etc.) varied across the three treatment groups. See *Table A1* in Appendix for descriptive statistics of demographics and the observed measures.

Results

Preliminary Analyses: Establishing Decision Context

Prior to formal hypothesis testing, it is important to establish the context of this study to gauge how invested participants were in the product category and to gauge how "successful" the quantity of items were in inducing choice overload.

For most participants, the pins reflected a relatively low-stakes decision, with the average participant rating their involvement with the pin product category a 2.92 on a 7-point Likert Scale (SD = 1.78). On average, participants were moderately overwhelmed by the quantity of pins (M = 3.57 on a 7-point Likert Scale, SD = 1.81). Additional preliminary analysis summary statistics are displayed in *Table A1* in the Appendix.

This context is valuable as future modifications of the study may utilize different decision-making items and quantities, shifting the participants' perception of the stakes, the level of overwhelm, and the operationalized levels of choice overload.

Primary Analysis: Decision Utility v. Choice Architecture

	Simultaneous Choice (SC)	Binary Choice (BC)	Quaternary Choice (QC)
Decision Utility (3-21)	***M*=19.20(*), *SD*=1.76**	*M*=18.21, *SD*=2.55	***M*=17.66(*), *SD*=2.88**
Satisfaction (1-7)	*M*=6.40, *SD*=0.81	*M*=6.23, *SD*=0.83	*M*=6.09, *SD*=0.82
Confidence (1-7)	*M*=6.31, *SD*=0.83	*M*=6.00, *SD*=0.92	*M*=5.77, *SD*=1.21
Regret (1-7)	*M*=1.51, *SD*=1.07	*M*=2.17, *SD*=1.55	*M*=2.20, *SD*=1.55
Overwhelmed (1-7)	*M*=3.89, *SD*=1.76	*M*=3.54, *SD*=1.86	*M*=3.29, *SD*=1.81
Thoroughness (1-7)	*M*=4.14, *SD*=1.40	***M*=4.71(*), *SD*=1.47**	***M*=3.66(*), *SD*=1.33**
Importance (1-7)	*M*=3.49, *SD*=1.95	*M*=3.46, *SD*=1.77	*M*=3.17, *SD*=1.58
Likelihood of Repetition (1-7)	***M*=6.09(*), *SD*=1.07**	*M*=5.71, *SD*=0.86	***M*=5.17(*), *SD*=1.34**

Inspired by the three markers of choice overload discussed in prior studies, a proxy for decision utility was calculated by summing participants' self-reported value of decision satisfaction, self-reported value of decision confidence, and the reverse-coded self-reported value of decision regret. This calculation quantified decision utility on a scale of 3 to 21, with higher values indicating higher utility.

The analysis of variance (ANOVA) test comparing decision utility to choice architecture found a significant difference between mean utility values reported across two of the three groups (F = 3.639, p = 0.030*). The follow-up Tukey Tests found that, while there was no significant difference between the BC and QC groups and the SC and BC groups, the SC group reported significantly higher levels of utility than the QC group on average (p = 0.024*), contradicting the initial hypothesis of the study. This seemingly contradictory result is further explored in the Discussion.

This trend was supported by the additional responses that participants provided regarding their choice architecture preferences. Whereas 97.1% of SC participants indicated that they would follow the same simultaneous choice model of decision-making for future studies, only 71.1% of BC participants and 57.1% of QC participants responded that they would use the same model for future decisions.

Furthermore, there was a significant difference in how likely participants in the SC and QC were to choose the same item if given the menu again, with SC participants reporting a mean repeat-decision likelihood of 6.08 out of 7 and QC participants reporting a mean repeat-decision likelihood of 5.17 out of 7 (p = 0.002*). The mean likelihood of choosing the same item again for participants in the BC group landed between these two values, at 5.74 out of 7, but the difference between this mean and the others did not prove statistically significant in the follow-up Tukey Tests (p = 0.077).

Finally, the mean thoroughness ratings varied across the three groups. Not surprisingly, BC participants had the highest mean rating of how thoroughly they reviewed each option (M = 4.71, SD = 1.47). This difference proved to be statistically significant when compared to the QC mean (p = 0.005*), but not the SC mean (p = 0.199), in follow-up Tukey Tests.

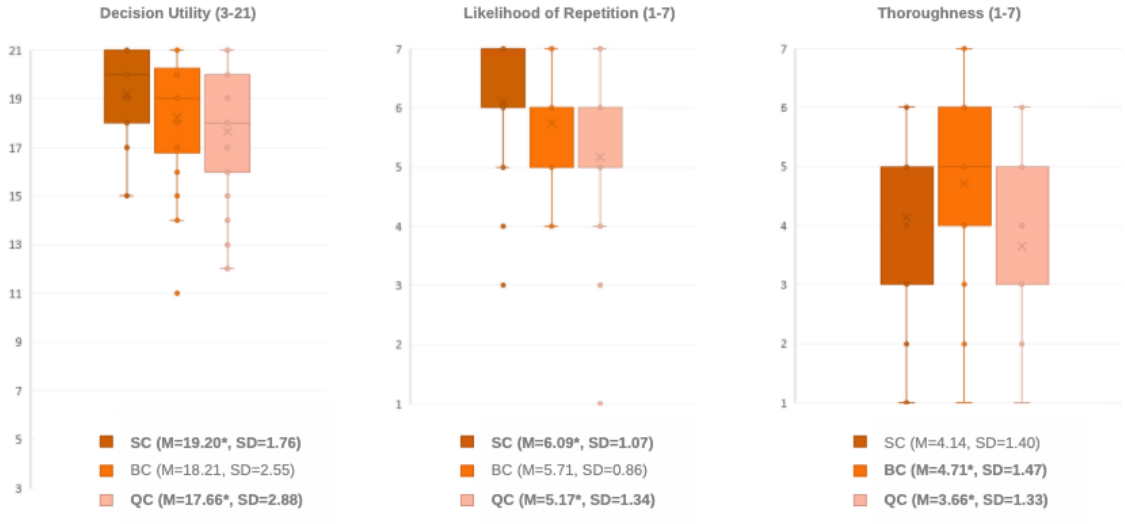

Figure 2. Decision-Making Utility v. Choice Architecture (Left)

Figure 3. Likelihood of Repetition v. Choice Architecture (Center)

Figure 4. Decision-Making Thoroughness v. Choice Architecture (Right)

Secondary Analyses: Demographics, Psychographics, & Context

	Decision Utility (Adjusted R^2)
Age	-0.001
Impulsivity	0.016
Arousal Anxiety	-0.003
At-the-Moment Busyness	0.033
Product Category Investment	-0.011
Final Decision Importance	-0.005

The above table displays the Adjusted R^2 values, indicating correlations between demographics, psychographics, and contextual information obtained and the overall decision utility that participants reported. Of these, there were no statistically significant findings. However, because demographic, psychographic, and contextual relationships to decision utility were not the primary aim of this study, no conclusions should be drawn from this data and further investigation is needed to properly explore this subtopic.

It is also worth noting that although female participants indicated higher mean investment in the decorative pin product category (M = 3.45, SD = 1.74) than males (M = 2.08, SD = 1.48) (p = 0.000*), there was no statistically significant difference in final mean decision utility across the two groups.

Discussion

This study began with the intent of clarifying the role of choice architecture in choice overload, with the hypothesis that, by breaking large decisions into multiple smaller components, decision-makers could increase their utility when making choices when faced with excessive menu sizes. This hypothesis was predicated on the prior literature that discussed how, in the midst of excessive options, cognitive biases such as the decoy effect and aversion of extremes could distract individuals and cause them to arrive at less-than-optimal decisions (Kaptein, Van Emden, & Iannuzzi, 2016; Padamwar, Dawra, & Kalakbandi, 2018).

The results of the study, however, paint a different story: when young adult participants are presented with decorative pins in a low-stakes controlled setting, they tend to report *higher* levels of decision utility when presented with the options all at once, as opposed to in pairs or in groups of four. This distinction is especially notable when comparing the all-at-once choice architecture to the four-at-a-time choice architecture.

In explaining these unexpected findings, several theories and justifications come to play. Most of these theories and justifications are connected by the common thread of the trade-off between simultaneous and sequential choice decisions: simultaneous decisions require less time and less mental energy, but sequential decisions provide greater decision focus. Although further data collection is required to pinpoint the true motivation driving these results, this discussion section utilizes past behavioral economics literature and the

open-ended responses provided by current study participants to further analyze the results, exploring factors within the nature of the decision, the nature of the decision-maker, and the nature of the study itself.

Nature of the Decision

This task required participants to make a subjective preference decision in a controlled research environment with a low-stakes decorative pin incentive. Based on prior literature and variations on choice overload studies, it is possible that this combination of external factors may have led to the findings at hand.

Objective versus Subjective Decisions. A large portion of this study was inspired by Besedes and colleagues' simultaneous versus sequential study design, in which participants received a menu of payoffs and probabilities in a similar format to the study at hand (Besedes et al., 2015). Similar to this study, Besedes and colleagues were seeking to identify a means of mitigating choice overload without removing options from a menu. However, unlike this study, Besedes and colleagues' menu had an optimal response: the item that would maximize the payoff that participants received. Because of this, the participants knew certain choices would have objectively higher payoffs than others, and researchers could rate how accurate a decision was based on its resemblance to the optimal response. Because the decision in the present study was purely preference-based, there were no "right" or "wrong" answers, hence no objective means to evaluate decision accuracy. This was noted in several free responses, in which participants highlighted their own subjective

preferences and motivations (e.g. colors, designs, gut reactions) for choosing responses. This lack of an optimal answer is one of the key differences between Besedes and colleagues' study and the study at hand. While further studies are needed to assess the impact of objective versus subjective decisions, it is possible the lack of pressure or pleasure to identify the "true" right answer reduced participants' overall decision satisfaction in the sequential choice architectures.

High versus Low Stakes. Another external factor influencing how participants reacted to the choice architecture is the stakes of the decision at hand. As indicated in the self-report ratings on the 7-point Likert Scales, participants generally had low investment with the decorative pin product category (M = 2.92, SD = 1.78) and regarded their decision with moderate importance (M = 3.32, SD = 1.76). The low-stake item was selected to mimic the relatively simple items utilized in previous choice overload studies, such as chocolates and jams, but the low-stakes nature of this decision may have also contributed towards a preference for the simultaneous choice model. As stated in the literature review, sequential decision-making – albeit less common – tends to take place in the realm of complex high-stakes decisions, such as government elections and NBA play-offs, where each menu candidate must be thoroughly reviewed, given the hefty weight of the outcome. Likewise, there is a connection between decision weight and the amount of time and mental energy individuals are willing to invest in making a decision. It is not unreasonable that the low-stakes nature of this decision contributed to the participants' favoring of a fast and low mental energy simultaneous choice architecture.

Simple versus Complex Cues. Similar to decision stakes, decision complexity also has an influence on how much time and mental energy individuals allocate to the decisions they make (Gerasimou, 2018). This is seen in Gerasimou's study on indecision, which noted how decision strain increases when an individual must balance, compare, and contrast multiple aspects of the menu items in question (Gerasimou, 2018). The present study utilized a simple menu, with colors and designs serving as the sole differentiating factors of the decision-making item. Likewise, in the free-response section, multiple participants attributed their decision to one or two simple visual cues (e.g. "*dull colors*" or "*plants or cacti*"). The lack of complex cues may have also led participants to favor the faster simultaneous choice group, as there was simply less of a cognitive need for participants to scrutinize the menu in smaller sequential sets.

Nature of Decision-Maker

Beyond the nature of the decision, there are other cognitive biases and factors that come from within the decision-maker itself. This study's hypotheses were largely motivated by the decoy effect and aversion of extremes, but there are other internal biases that may have influenced or skewed how participants responded to the three choice architectures, regardless of the options at stake.

Decision Fatigue. As stated prior, decision fatigue occurs when an agent makes inefficient decisions due to tiredness, confusion, or apathy (Vohs et al., 2008). Due to the psychological costs associated with making decisions, decision-makers involved in lengthy or convoluted

decision-making sessions may face decision fatigue, resulting in poorer choices and reduced decision utility. Given that QC participants were required to complete five back-to-back decisions and BC participants were required to make fifteen back-to-back decisions, it is not unreasonable to believe that decision fatigue may have played a factor in the reduced utility seen in the results. Several of the QC and BC participants mentioned this directly in their free response submissions (e.g. "*I felt a little overwhelmed with having to continuously make decisions [...]*" (BC)). Thus, a sequential choice architecture that requires less repeated decisions, such as an "eight pins at a time" group, may elicit better outcomes than the lengthier "four-at-a-time" and "two-at-a-time" brackets.

Escalating Levels of Commitment. Commitment and precommitment are decision-making concepts that denote decision-makers' motivation to maintain a consistent aspiration (Cialdini, 2008). Typically, when a decision-maker commits to a choice, whether consciously or not, there is a cost involved with "breaking" that commitment in favor of a new behavior. Although no formal commitments were made in the sequential choice architecture, many BC and QC participants noted escalated levels of attachment that arose from past decisions they made, suggesting that prior choices marked some form of commitment for them. One BC participant wrote, "*I felt burdened by my first pick (1) and I felt like I should stick with it throughout the decision making process.*" Another BC participant noted, "*It's easy to make decisions out of two unknown items, but it was hard to choose between two items that were already favorites in other categories."* This level of fondness for past items chosen complicated the final decisions for sequential participants, as they then had to choose between items that they previously expressed attachment

towards. The strain of the final decision, as noted again in multiple free-response submissions, may have also contributed to lower decision utility in the sequential choice architecture.

Escalating Levels of Regret. Regret refers to the fear of realizing non-optimal decisions in hindsight. Meta-analyses of regret show that anticipated regret serves as a better predictor of behavior than other anticipated negative emotions and risk evaluations, establishing the importance of regret in the behavioral realm (Brewer et al, 2016). Further studies on regret point to the existence of *cumulative regret*, a type of regret that accumulates and worsens during decision executions every time a non-optimal decision is made (Pepels et al., 2014). In the sequential BC and QC groups, there is a high likelihood of cumulative regret occurring over past decisions, weighing on participants' minds and reducing the utility of future decisions made. This can be seen in the free response answers that participants provide, as multiple submissions cite regret from earlier decisions, holding onto these past negative emotions and mourning past losses when making future decisions (e.g. "*[I] regretted the first two choices I made*" (QC)). This escalation of repeated regret was absent in the simultaneous choice group, and this added internal pressure once again may have contributed to the lower decision utility of the sequential choices.

Escalating Levels of Indifference. Extraneous or "off-the-equilibrium path" decisions refer to decisions that do not actually have an impact on the realized outcome. These excess decisions can also contribute to decision fatigue or feelings of mental wastefulness, as decision-makers know that the choices they make in these decisions will not actually

matter. Whereas the SC participants faced one decision with one impactful outcome, eleven of the fifteen BC decisions and three of the five QC decisions did not involve the final selected item at all. While some participants still took these extraneous decisions seriously, the free-responses indicate that multiple participants were able to identify decision sets that involved pins that they knew would not be within the final contenders (e.g. "*For some pairs, I didn't like either so I didn't really focus on the choice because I [k]new I would need to compare it with another pair later*" (BC)). This experience of knowingly undergoing unnecessary decisions and incurring undue time costs may have also reduced decision utility scores in the sequential models.

Status Quo Bias. Status quo bias refers to the tendency for individuals to favor the familiar and to repeat past behaviors (Samuelson & Zeckhauser, 1988). There are various explanations underlying status quo bias, but many theorists attribute our innate preference of the familiar to ambiguity aversion, regret avoidance, and a need for control (Samuelson & Zeckhauser, 1988). In this study, there was evidence pointing to all-at-once decision-making as the status quo. Not only are consumer choices typically displayed in an "all-at-once" manner, but SC participants themselves indicated that this was the model that they typically made decisions in: 68.6% of SC participants indicated that, when given a menu of sixteen items, they typically utilized their treatment model for making decisions; this number overwhelmingly exceeded the 22% of BC participants and 20% of QC participants who felt the same way. Given how common it is to view menu items all at once and given how infrequent it is for one to view menu items four-at-a-time, status quo bias may also play a role in why participants reported higher levels of utility in the SC group, especially when

compared to the QC group. Whereas individuals will frequently make decisions all at once or compare two items at a time, it is less common for decision-makers to weigh four items at a time, as in the model proposed by the QC choice architecture.

Nature of the Study

Finally, it is important to acknowledge that the results may simply be due to the nature of the study, the sample utilized, and the study limitations present. While the above justifications and theories are plausible explanations as to why participants in the simultaneous choice group enjoyed higher levels of decision utility, reported higher willingness to engage in the same decision-making model, and reported higher likelihoods of repeating their decision, it is important to recognize the limitations of this study design, which are detailed in the following section.

Design Considerations & Future Directions

Strengths

Individual decision-making plays an integral role in societal transactions, consumer culture, and day-to-day quality of life. Given the increasing number of decisions that consumers face, it is important to acknowledge the costs and benefits of the lengthy menus driving our current decision-driven climate. This study successfully addressed the growing issue of choice overload, proposing and assessing alternate methods of choice architecture for low-stakes subjective decisions. Although the results of the study were unexpected, strengths of this study design include its sampling method, design set-up, reliance on both quantitative and qualitative measures, novelty, and relevance for real-world applications.

Sampling Method. This study elicited a sample of 108 individuals from Emory University's campus, generating statistical power of 0.61-0.65. There was a somewhat even gender breakdown, with a 60-45-2 ratio of females to males to non-binary individuals (1 individual chose not to disclose their gender). Furthermore, this study sampled individuals from diverse ethnic backgrounds and individuals across approximately forty majors, utilizing various recruitment platforms to ensure adequate representation across different identity groups. The size and diversity of the sample enabled the study to collect demographic data for secondary analyses and to improve the representation of participants utilized in behavioral economics studies.

Design Set-Up. The choice architecture, product category, and decision framework utilized in this study was meant to replicate the low-stakes subjective decisions that participants may face during typical shopping trips to the grocery store or supermarket. The decorative pin product category was carefully chosen after exploring past literature warning how confounding factors, such as pre-existing expectations, status quo biases, and cultural norms, may bias consumer decision-making. Because the study utilized sixteen unique pin designs as the decision-making item, it is unlikely that past expectations or pre-existing favorites would influence which design participants chose, as participants had never viewed or decided between these designs before. In spite of the added effort of in-person data collection during COVID-19, the use of tangible pay-offs also benefited the study, as prior behavioral economics papers show that hypothetical pay-offs tend to skew participant behavior (Xu et al., 2018).

Quantitative & Qualitative Measures. The surveys utilized in this study generated both quantitative and qualitative data from participants, requesting participants to quantify emotions, behaviors, and decisions via Likert scales and soliciting free-response descriptions of the decision-making experience. The quantitative values that participants provided helped quantify the decision-making satisfaction, confidence, and regret each participant faced, ultimately leading to an operationalized proxy for decision utility. The qualitative free-responses that participants provided helped rationalize their decision-making process and provided context as to what cues, emotions, and drawbacks participants faced across the three choice architecture groups. The qualitative responses were especially useful when navigating the discussion section, as they supplemented and

corroborated the pre-existing literature on challenges individuals face when making decisions in simultaneous and sequential settings.

Novelty & Relevance. Lastly, this study's primary strength rests in its novelty and relevance for consumer culture in today's world. Although past studies have established the presence of choice overload, explored its factors, and investigated potential solutions, there is a gap in the literature when it comes to solutions to choice overload that occur without requiring prior knowledge or without reducing the number of choices available. While this study failed to establish decision-reframing via sequential choice architecture as a solution to choice overload in this setting, the free-response answers and discussion section still provide noteworthy takeaways for consumers, producers, and decision-makers alike.

Although the average decision utility for SC participants exceeded that of BC and QC participants, the free-response section reveals that several of the sequential decision-makers valued and appreciated the choice architecture they were faced with. Some indicated greater security in their decision, due to being able to closely view the options in smaller, more focused groups (e.g. "*I am satisfied with my decision, it ensured the best option*." (BC)); others indicated that viewing the menu in subsets allowed them to relax more and feel less overwhelmed (e.g. "[...] *getting to decide between only two at a time made it way easier*" (BC); "*Felt good to make choices between fewer option then choose a final answer"* (QC)). Thus, whereas the overall averages suggest simultaneous choices result higher decision utility, the nature of the decision-maker and the nature of the decision may play a role in which choice architecture is best suited for which situation.

From a brand perspective, the information gauged from the results and the discussion can also help producers in their search to optimize the consumer experience. As seen in the free-response section, a sequential choice architecture does have some merit in alleviating choice overload, especially for complex and high-stake decisions. Because participants in the study indicated that they themselves naturally gravitate to simultaneous decision-making, brands that offer complex and high-stakes products may take it upon themselves to utilize decision-staging and choice-architecture to appropriately present consumers with manageable option subsets. This can be accomplished via sequential decision structures on online purchase apps (e.g. "Guarantee Your Favorite" product sorters) or by chunking decisions into various parts (e.g. providing filters for consumers to make decisions in smaller phases, rather than viewing all options at once). While such measures may not be beneficial in low-stakes settings, consumers acquiring high-stakes products with high decision complexity may appreciate the added security, thoroughness, and thoughtfulness this sequential architecture provides, even if it is not the choice architecture they would choose on their own.

Limitations

In spite of its novelty and relevance, this study faced several shortcomings that may be addressed and improved upon in future iterations. Due to the COVID-19 pandemic, several data collection limitations and precautions had to be enforced, restricting the amount of data and interaction present in the study. Other study limitations include the convenience

sampling method, missing decision-making context, reliance on self-report data, missed data collection opportunities, limited choice architecture models, and time and social pressures.

Sampling Method. Although this study was able to recruit a sample size of ≥30 per treatment group, a larger sample would improve the statistical power of the study, providing greater credence to the results. Furthermore, because the sampling method utilized was not truly random (many students took part due to familiarity with the research team or due to extra credit incentives), it is possible that the convenience sampling method utilized may have biased the nature of participants recruited. Ideally, a larger and more randomized sample would improve the statistical soundness of the study in future iterations.

Context of Decision-Making Item. It would also have been beneficial to gauge participants' prior knowledge and interest in the decision-making item product category. Although the question *"On a scale of 1 to 7 with 1 being not involved at all and 7 being very involved, how invested are you in the product category of decorative pins?"* was meant to serve as a proxy for participant interest, the wording of this question may have been problematic in operationalizing decision stakes. Product involvement is a multi-faceted concept, and whereas the term "investment" typically refers to decision input, the term "stakes" refers to decision outcome. Thus, increased precision and variety in question terminology, such as using a question for "stakes" in addition to the question for "investment," may result in more clear responses. Furthermore, additional questions on participants' interactions with

product categories similar to decorative pins, such as jewelry and charms, may also bolster the context of the study's sample and help researchers tease out the nature of the decision.

Reliance on Self-Report Data. This study exclusively relied on self-report data, provided directly from participants themselves. While research fueled by self-report is common in the behavioral economics realm, it is important to acknowledge that this data may not always be as honest, accurate, or precise as other more objective metrics. Furthermore, different interpretations of common terms – such as "decision satisfaction" or "decision regret" – may skew the results in ways that bias study findings. This may especially be the case for the term "investment," as discussed above. Increased precision with terminology and the assurance of participants' understanding of the terms would benefit the study.

While it may be challenging to assess decision utility through a more objective lens, behavioral and biometric measures may be used to assess how participants navigate decisions in future studies. For example, instead of asking participants to subjectively rate how thoroughly they viewed each menu option, an eye-tracker biometric would be able to quantify the amount of visual attention the participant provided to each choice, providing a more objective means of analyzing decision-making thoroughness. Metrics like these would also allow us to more precisely time the decisions and compare participants' actual decision-making time to their relative perceptions of time spent.

Missed Data Collection Opportunities. One of the key discussion points of this paper is the trade-off that arises between decision time and decision focus, where simultaneous choice

architectures allow for increased decision speed and sequential choice architectures allow for increased decision focus. However, whereas the BC and QC groups tended to take longer periods of time to process decisions, there was no time data collected to track how long each decision took. Future studies may wish to explore decision time as an additional decision factor.

Limited Choice Architecture Models. Due to limited time and limited sample, this study utilized three treatment groups (SC, QC, BC) and sixteen decision-making items that were revealed in a fixed pattern. However, by exploring more models and by varying the total number of decision-making items, a more robust analysis of choice architecture may be revealed. Whereas this study design successfully presented a potential model for future studies to follow, more variations and diversity in product choice, product presentation, and product groupings will reveal more findings pertaining to the role of choice architecture in overcoming choice overload.

Time & Social Pressures. Although there was no explicit time restriction to the decision, multiple participants – especially those in the sequential groups – felt a time pressure associated with their choices, most likely due to the presence of the researcher awaiting their response. This time pressure may have rushed BC and QC participants, resulting in lower satisfaction ratings from both groups and lower thoroughness ratings from QC participants. To mitigate potential time pressures, social pressures, or experimenter demand effects, a digital survey option or added prompts may be utilized, to assure participants that they may navigate the decisions at their own pace.

Future Directions

Based on the strengths, limitations, and relevance of the study, future studies and extensions are highly encouraged to further explore the role of choice architecture in mitigating choice overload in different settings.

As stated prior, this study was limited by a restricted sample size, reliance on self-report data, missed data collection opportunities, limited choice architecture models, and time and social pressures. Future studies may improve upon the current one by increasing the sample size utilized, offering behavioral and biometric measures that go beyond self-report, collecting data on decision time and decision speed, expanding on the choice architecture models utilized, and reassuring participants that there is no time or social pressure attached to their decision. While the demographics and psychographics collected in this study served for secondary analysis only, it would also be interesting to formally investigate if certain demographics or psychographics, beyond impulsivity and anxiety, correspond to different choice architecture preferences, helping decision-makers better understand themselves and the choice architectures that suit them.

Future variations may also choose to investigate the theories proposed in the discussion section, assessing how choice architecture preference may vary across decisions of different stakes and complexities. The decorative pin product category was utilized to reflect a simple, subjective, and low-stakes decision, such as the ones made in grocery stores and day-to-day shopping settings. However, more complex product categories with

higher stakes may elicit different responses from consumers. This differentiation could also be expanded to include menu sets in which participants already typically use sequential decision-making in, such as government elections, or to include menu sets in which some outcomes are objectively more favorable to others, such as health insurance plans. By analyzing how these responses vary per decision type, we can obtain a better picture of which choice architectures are more fitting to which contexts.

Conclusions

Choice overload is a valid and growing concern in today's consumer culture, and as decision menus increase in size, complexity, and frequency, there is ample behavioral economics evidence pointing to decreased decision utility.

This study set out with the intent of inspiring more satisfying, more confident, and more efficient decision-making in the midst of excessive menus, looking to sequential choice architectures as a potential solution to choice overload. The motivation underscoring this proposal came from past studies that highlighted how the cognitive load of excessive menus debilitated consumers, resulting in behavioral fallacies and distractions, such as the decoy effect and aversion of extremes (Kaptein, Van Emden, & Iannuzzi, 2016; Padamwar, Dawra, & Kalakbandi, 2018). Thus, this study evaluated two sequential tournament-styled alternatives to the default simultaneous choice architecture: binary "two-at-a-time" decisions and quaternary "four-at-a-time" decisions.

In spite of the motivating hypothesis that sequential decision models would mitigate the paradox of choice, the study found that participants reported higher levels of decision utility with the simultaneous decision model; furthermore, participants in this model reported that they were more likely to reuse the simultaneous model for making decisions and that they were more likely to choose the same decision-making item underneath this choice architecture. This was especially the case when comparing the simultaneous choice participants to the quaternary choice participants.

Although surprising, several explanations exist as to why these results were found. Whereas further studies are required to pinpoint the exact cause, the low-stakes, low-complexity nature of the decision, coupled with innate traits regarding the nature of decision-maker, may have caused participants to value simultaneous choice architectures in this particular setting. Further studies with different choice presentations and product categories are encouraged to better understand how choice architecture influences decision utility in more robust and complex decision settings.

Overall, it is important to remember the power that we as decision-makers hold when viewing decision menus and selecting options. Whereas the decision-makers in this study, on average, reported higher levels of decision utility with the simultaneous model, the free responses provided shed light on the value that sequential choice architectures may hold for others. By understanding oneself and one's decision-making preferences, we can better navigate the issue of excessive menus, gaining a better understanding of when different choice architectures are valuable and adjusting the presentation of the choices to best suit our decision-making needs.

Works Cited

Berger, J. A., Draganska, M., & Simonson, I. (2007). The Influence of Product Variety on Brand Perception and Choice. *Marketing Science*, 26 (4), 460-472. http://dx.doi.org/10.1287/mksc.1060.0253

Besedes, Tibor, et al. (2015.) "Reducing Choice Overload without Reducing Choices." *Review of Economics and Statistics*, vol. 97, no. 4, pp. 793–802. EBSCOhost, doi:http://www.mitpressjournals.org.proxy.library.emory.edu/loi/rest.

Brewer, N. T., DeFrank, J. T., & Gilkey, M. B. (2016). Anticipated regret and health behavior: A meta-analysis. *Health Psychology*, 35(11), 1264-1275.

Cialdini, R.B. (2008). *Influence: Science and Practice, 5th ed*. Boston: Pearson.

Chernev, A., Böckenholt, U. and Goodman, J. (2015). Choice overload: A conceptual review and meta-analysis. *Journal of Consumer Psychology*, 25: 333-358. doi:10.1016/j.jcps.2014.08.002

Diehl, K., & Poynor, C. (2010). Great expectations?! Assortment size, expectations, and satisfaction. *Journal of Marketing Research*, 47(2), 312–322. https://doi.org/10.1509/jmkr.47.2.312

Fajkowska, Małgorzata, Domaradzka, Ewa, & Wytykowska, Agata. (2018). Types of anxiety and depression: Theoretical assumptions and development of the anxiety and depression questionnaire. *Frontiers in Psychology*, Vol 8. doi: https://dx.doi.org/10.3389/fpsyg.2017.02376

Gao L, Simonson I (2016). The positive effect of assortment size on purchase likelihood: The moderating influence of decision order. *Journal of Consumer Psychology* 26(4): https://doi.org/10.1016/j.jcps.2015.12.002

Gerasimou, G. (2018). Indecisiveness, Undesirability and Overload Revealed Through Rational Choice Deferral. *Econ J*, 128: 2450-2479. doi:10.1111/ecoj.12500

Gourville, John & Soman, Dilip. (2005). Overchoice and Assortment Type: When and Why Variety Backfires. *Marketing Science*. 24. 382-395. 10.1287/mksc.1040.0109.

Johnson, E. J., Shu, S. B., Dellaert, B. G.C., Fox, C. R., Goldstein, D. G., Häubl, G., Larrick, R. P., Payne, J. W., Peters, E., Schkade, D., Wansink, B., & Weber, E. U. (2012). Beyond nudges: Tools of a choice architecture, *Marketing Letters*, 23, 487-504.

Kaptein, M., Van Emden, R. & Iannuzzi, D. (2016). Tracking the decoy: maximizing the decoy effect through sequential experimentation. *Palgrave Commun* 2, 16082. doi:10.1057/palcomms.2016.82

Miller, G. A. (1956). The magical number seven, plus or minus two: some limits on our capacity for processing information. *Psychological Review*, 63(2), 81–97. https://doi.org/10.1037/h0043158

Padamwar, P.K., Dawra, J. & Kalakbandi, V.K. (2018). Range effect on extremeness aversion. *Decision* 45, 345–355. https://doi.org/10.1007/s40622-018-0197-5

Pepels, T., Cazenave, T., Winands, M.H.M., Lanctot, M. (2014). Minimizing Simple and Cumulative Regret in Monte-Carlo Tree Search. In: Cazenave T., Winands M.H.M., Björnsson Y. (eds) *Computer Games. CGW 2014. Communications in Computer and Information Science*, vol 504. Springer, Cham. https://doi.org/10.1007/978-3-319-14923-3_1

Samuelson, W., & Zeckhauser, R. J. (1988). Status quo bias in decision making. *Journal of Risk and Uncertainty*, 1, 7-59.

Schaller, T.K. and Malhotra, N.K. (2015). Affective and Cognitive Components of Attitudes in High-Stakes Decisions: An Application of the Theory of Planned Behavior to Hormone Replacement Therapy Use. *Psychol. Mark.*, 32: 678-695. https://doi.org/10.1002/mar.20809

Schwartz, B. (2004). *The Paradox of Choice.* New York: ECCO.

Sleddens, Ester F. C., et al. (2013). “Impulsivity Scale.” PsycTESTS, *EBSCOhost*, doi:10.1037/t63078-000.

Toffler, Alvin. (1970). *Future Shock*. New York: Random House.

Vohs, K. D., Baumeister, R. F., Schmeichel, B. J., Twenge, J. M., Nelson, N. M., & Tice, D. M. (2008). Making choices impairs subsequent self-control: A limited-resource account of decision making, self-regulation, and active initiative. *Journal of Personality and Social Psychology*, 94, 883-898.

Xu, S., Pan, Y., Qu, Z. et al. (2018). Differential effects of real versus hypothetical monetary reward magnitude on risk-taking behavior and brain activity. *Sci Rep 8, 3712*. https://doi.org/10.1038/s41598-018-21820-0

Appendix

Item A1.

Demographic Survey

Q1. Age: _____

Q2. Gender:

☐ Male ☐ Female ☐ Non-binary ☐ Prefer not to disclose

Q3. Ethnicity:

☐ American Indian or Alaska Native
☐ Asian
☐ Black or African American
☐ Hispanic or Latino
☐ Native Hawaiian or Other Pacific Islander
☐ White
☐ Other

Q4. Primary Major: _____

Q5. Secondary Major: _____

Q6. Minor: _____

Q7. On a scale of 1 to 7 with 1 being not involved at all and 7 being very involved, how invested are you in the product category of decorative pins?

Not Invested at All ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very Invested
1 2 3 4 5 6 7

Item A2.

Post-Decision Survey, Part 1

Debrief Questions

Q1. Which pin did you select? _____

Q2. Briefly describe how you felt about your decision-making process and your final selection.

_____
_____
_____
_____

Q3. When given a menu of sixteen items, is this the model in which you usually make decisions?
☐ Yes ☐ No

Q4. If given the opportunity to choose again, would you follow the same decision-making model?
☐ Yes ☐ No

Q5. On a scale of 1 to 7, 1 being very dissatisfied and 7 being very satisfied, how **satisfied** are you with your final decision?

Very Dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very Satisfied
1 2 3 4 5 6 7

Q6. On a scale of 1 to 7, 1 being not confident at all and 7 being very confident, how **confident** are you with your final decision?

Not Confident at All ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very Confident
1 2 3 4 5 6 7

Q7. On a scale of 1 to 7, 1 being not regretful at all and 7 being very regretful, how **regretful** are you with your final decision?

Not Regretful at All ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very Regretful
1 2 3 4 5 6 7

Q8. On a scale of 1 to 7, 1 being not overwhelmed at all and 7 being very overwhelmed, how

overwhelmed were you with the number of options?

Not Overwhelmed at All ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very Overwhelmed
1 2 3 4 5 6 7

Q9. On a scale of 1 to 7, 1 being not thoroughly at all and 7 being very thoroughly, how **thoroughly** did you review each option?

Not Thoroughly at All ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very Thoroughly
1 2 3 4 5 6 7

Q10. On a scale of 1 to 7, 1 being not important at all and 7 being very important, how **important** was this decision to you?

Not Important at All ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very Important
1 2 3 4 5 6 7

Q11. On a scale of 1 to 7, 1 being not busy at all and 7 being very busy, how **busy** were you when you made this decision?

Not Busy at All ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very Busy
1 2 3 4 5 6 7

Q12. On a scale of 1 to 7, 1 being not likely at all and 7 being very likely, what is the **likelihood** of you choosing the same item if you were to repeat this experiment?

Not Very Likely ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very Likely
1 2 3 4 5 6 7

Figure A1.

Example of Tournament-Styled Decision-Making Under Sequential Binary Choice Group.

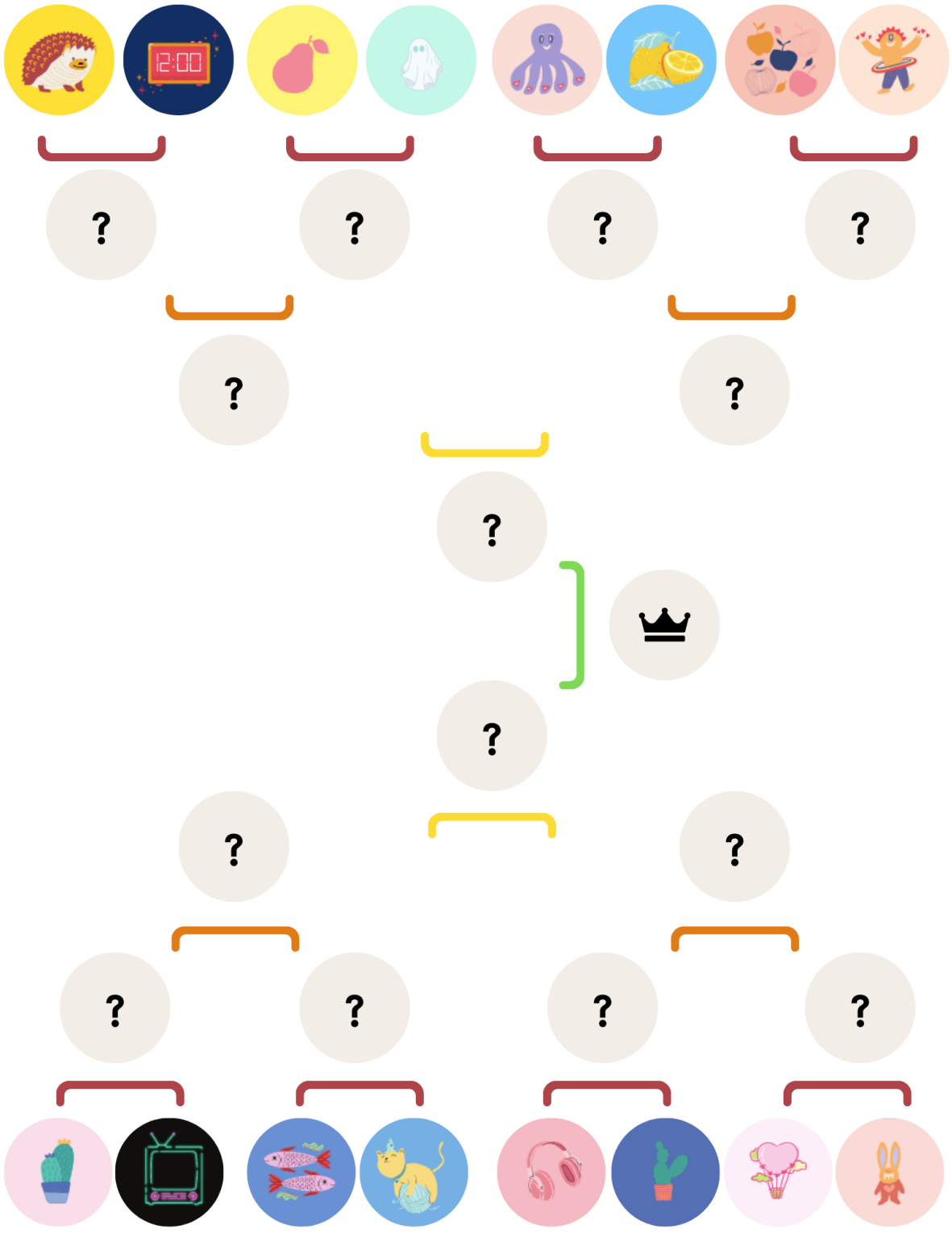

Figure A2.

Example of Tournament-Styled Decision-Making Under Sequential Quaternary Choice Group.

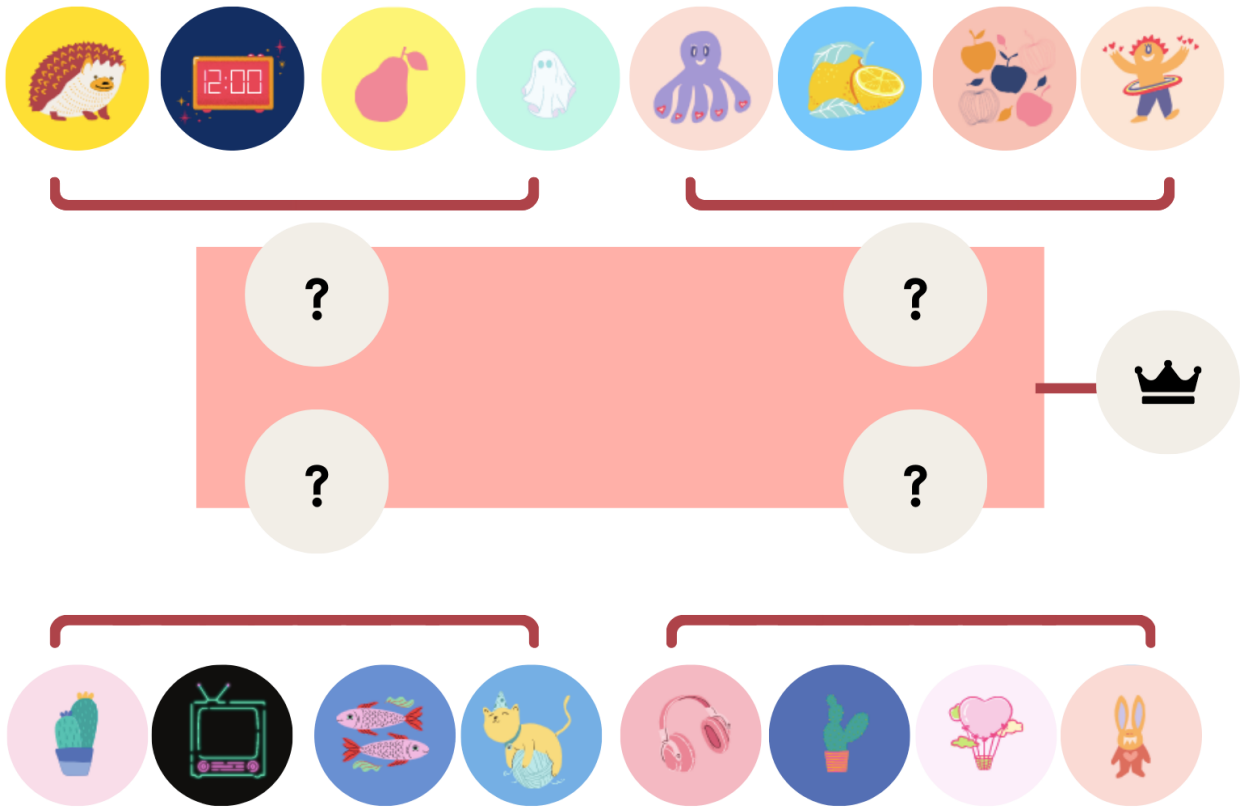

Table A1.

Descriptive Statistics for Demographic Information and Observed Variables.

Measure	*M*	*SD*
Age	20.45	1.93
Decision Satisfaction (1-7)	6.25	0.82
Decision Confidence (1-7)	6.04	1.01
Decision Regret (1-7)	1.94	1.43
Decision Utility (3-21)	18.35	2.48
Menu Overwhelm (1-7)	3.56	1.81
Decision Thoroughness (1-7)	4.19	1.45
Decision Importance (1-7)	3.32	1.76
Likelihood of Repetition (1-7)	5.67	1.15
Impulsivity (5-65)	31.69	8.39
Arousal Anxiety (5-35)	25.06	5.06
Busyness (1-7)	2.67	1.71
Product Category Involvement (1-7)	2.92	1.78

Item A3.

Participant Free Responses Across Treatments.

Free Response: Briefly describe how you felt about your decision-making process and your final selection.

Simultaneous Choice Group (SC)

1. *All of the pins were very cute, but I chose the pin with a cat because it gave me the most comfort by looking at it.*
2. *At first glance, I felt really unsure about which one I wanted, since there were so many pins. But I went through each one of the pins, one by one, and ended up choosing 4 because I liked it the most.*
3. *I chose the porcupine. I like that it's small and cute, which fits my personality! Also, I love animals. I chose against the octopus because the porcupine looked more accurate*
4. *I chose this pin because I have a cat and it'd be cool to have a pin about something that resembles your cat*
5. *I chose this pin because it wasn't as girly as other pins. I like the color and porcupines are cute.*
6. *I decided based on personal interest relative to the other pins. I prefer horror movies and all things spooky, so it was relatively easy.*
7. *I don't think I've ever voluntarily worn a pin, so I felt a bit on the spot and nervous when making my decision.*
8. *I felt confident about it since the choice was simply based on my preference. I also liked the many options that I had.*
9. *I felt confident and assured of my decision*
10. *I felt conflicted between pins 2 and 13 because they both fit my vibe.*
11. *I felt good about choosing that pin because it reminds me of happiness and love. I decided on that because it appealed to me the most.*
12. *I felt like I was looking for the pin that fit my personality most which is why I chose the pin I did. Making the decision was slightly difficult because there were so many options.*
13. *I felt that were a lot of great options and that a lot of the pins were pretty similar. I made my final preference off my favorite one.*
14. *I have never been extremely interested in pins, however, I chose the one with the ghost on it because I was using Snapchat just before this study*
15. *I like cats and the color blue so this pin was perfect for me!*
16. *I liked a lot of the pins, but I chose the cat because I love cats.*
17. *I liked the fact that the pin was black. And the neon colors were also cute*
18. *I looked at all of the pins first and then picked the one I thought looked the cutest.*

19. *I looked for objects that I liked or found nice to look at. The headphones remind me of something I like to use often as well as music itself.*
20. *I really liked how funky and unique this pin was. I think of the pins available this pin spoke to me the most.*
21. *I thought the duller colour was nice along with the simple ghost design that wasnt too big or too small*
22. *I thought the lemons looked the nicest, and did not experience any choice paralysis*
23. *I was attracted by the color and my love for lemons. None of the other options caught my attention so I decided to choose the pin with the lemon design on it.*
24. *I wasn't sure if there was a time limit for choosing, but I tried to make a decision quickly anyway. I was motivated largely by the base color of the badge and less by the figure/icon.*
25. *I'm pretty indecisive so I was worried I was taking too long to decide, but I ended up choosing the one that I thought was cutest/found myself being most drawn to.*
26. *It was overwhelming. I went with my gut*
27. *It was very difficult. I love the cat one because i love cats but also I was very drawn to the pink and the cute little bunny monster.*
28. *It's super cute and makes something kind of scary (like a ghost) a friendly-looking figure. Also, I love the colors too!*
29. *Like a kid in a toy store choosing a stuffed animal*
30. *Love is flying on the sky and it created a good connection with cloud as well. It symbolizes the universality of love.*
31. *Several of those pins caught my attention Bc I thought my friends would like it but I picked the one with the rainbow and heart Bc I related to it the most*
32. *Sort of unsure—they all looked nice to me, but I ended up picking 14 because I liked the background color and the cactus.*
33. *The decision making process was extremely low stakes. I simply chose what was most aesthetically pleasing to me*
34. *The first thing I looked for was the main image of the pin. I really liked the ghost because it looked really cute and I also loved the color of the pin.*
35. *Took a while to look at all of them, the one I chose stood out to me. Not sure if it was my favorite but I didn't want to take a long time*

Sequential Binary Choice Group (BC)

1. *A lot of my decisions were based on either colors or cutesy pictures. I found it a lot easier to make decisions between the pins than I tend to find making decisions in my daily life.*
2. *For each pair, I just decided which one I'd like to wear more/feel more comfortable showing to others. For some pairs, I didn't like either so I didn't really focus on the choice because I new I would need to compare it with another pair later. The final selection was definitely the hardest because 1 and 12 were both good.*
3. *I am satisfied with my decision, it ensured the best option.*
4. *I am very happy with my decision, but enjoyed most of the pins in general.*

5. *I attempted to choose my favorite pin off of initial gut reactions. It was fun and I am curious what this entails about my decision making. I loved my final pin but there were many pins I did not like.*
6. *I chose the cat because I have a cat at home that I miss. This will remind me of her. The decision making process was easy at first but got harder as I had to choose which pin I wanted out of pins that I liked.*
7. *I felt a little overwhelmed with having to continuously make decisions but getting to decide between only two at a time made it way easier*
8. *I felt burdened by my first pick (1) and I felt like I should stick with it throughout the decision making process. I was happy with my final selection in the end.*
9. *I felt happy with it and satisfied with my choice.*
10. *I felt happy with my decision. I was pretty set on selecting the ghost (pin 4) from the very start and it ended up being the best even after all the pins were shown to me.*
11. *I felt indecisive because I liked many of them and there were so many options.*
12. *I felt slightly overwhelmed*
13. *I felt that my decision making was purely based on what I thought looked better.*
14. *I found the decision making process to be fairly straightforward, but for some of the preferences I felt much more strongly than other preferences. I also found myself doubting some of my preferences after I had made a decision.*
15. *I kept questioning if it was going to go back to the first choice and was sad that I didn't get my very first option which was the ghost pin. Also I was wondering if I was following a pattern myself of always choosing the first vs second one, but I do think it's more based on my aesthetic preferences rather than sticking with the first/second choice.*
16. *I narrowed down a few options but the 12:00 design resonated with me because of relatability.*
17. *I personally preferred the any animal kind designs. It was not based on reasonable logic which dictated the final selection. I simply picked the one with preferred design*
18. *I simply went on instinct for which pin spoke out more to me*
19. *I tend to be very indecisive so I picked the pin that caught my attention the most. Towards the end I really liked 9 and would tend to choose similar.*
20. *I thought the decision making process was pretty stress free. Occasionally I didn't really have a preference between the two so I chose one randomly but the final selection was easy.*
21. *I thought the decision process was easy because it was done in pairs of 2. It allowed me to compare each pin without feeling overwhelmed*
22. *I wanted to pick lemons because they are my favorite fruit and the colors were vibrant and drew me towards them.*
23. *I was mostly indifferent between the pins, but when I saw the cat pin (12) I knew at once that was my favorite.*
24. *I was really influenced by the color of the pin and for some choices, found it hard to decide*
25. *I was scared to let a choice I liked go. I would've wanted to ended up choosing between the octopus and hedgehog but I had to let one choice go*
26. *I went for the cutest one and the one that appealed sense more. I love cute cats.*

27. *I'm very happy with my decision, it wasn't that hard to decide which pin I liked the most.*
28. *It became harder as I went because I really liked a lot of them. I ended up having to put some meaning behind the pin in order to make a decision, i.e. what would I tell someone who asks me what the pin means to me. I love pins and collect them.*
29. *It got a bit more challenging to decide between pins during the last few rounds but I based my decision ultimately on aesthetics.*
30. *It is difficult to make the choosing between the pins, as it gets harder and harder afterwards between good designs. In the last and most challenging decision, I have to go through the details and look for flaws to persuade myself why to choose one over another.*
31. *It was easy selecting between 2 pins initially and was more difficult when narrowing it down at the end (probably because I get to keep the final one). I ended up picking #12 as opposed to #4 because I just really love cats, but it took the longest to decide this.*
32. *It was simple.*
33. *It was very fast because i love cats*
34. *It's easy to make decisions out of two unknown items, but it was hard to choose between two items that were already favorites in other categories. Hard to pick between two favorites basically. And this process is interesting because I don't know if this is the pin I would've pick had i been shown all 16 pins at once*
35. *Most of the choices were easy but this ones light blue design really won me over compared to the light pink designs of most of the others.*
36. *The decision process got easier as I went along, and I am happy with my final selection.*
37. *The porcupine design was very nice and adorable. Definitely caught my attention first when I saw it and I liked it since.*
38. *There were more options than I expected. For some reason I tried to anticipate the "right" answer.*

Sequential Quaternary Choice Group (QC)

1. *All of the pins looked so aesthetically pleasing, so it was definitely hard to pick my favorite pin. I based my decisions off of which I thought would look the nicest on a backpack or accessory and also which I thought was the most relevant to my style.*
2. *Felt good to make choices between fewer option then choose a final answer*
3. *Fine, strongest inclination*
4. *I chose the ones I would be likely to buy when I see then on stores and the ones that I would like to put on my items. When I made the final decision, I chose the one with my favorite color.*
5. *I feel really happy about my decision. I was a little hesitant that it was the right choice but I like it a lot*
6. *I felt confident until I found my answers determined which pin I recieved.*
7. *I had some hesitation when I saw them in sets but in the end I picked the one that stood out in colors to me the most*
8. *I know people who are really into decorative pins, they usually put them on backpacks. I personally have some interest because I like decorating things and expressing my personality &*

preferences through that. It wasn't hard for me to choose pins because I know what graphics/colors/visual styles I like and the pins were very cute!

9. *I like the pin I selected, but i always have trouble deciding on things when I have to make a snap judgement. I feel some anxiety when I have to make choices without time to consider my options.*
10. *I like the porcupine/hedgehog on the pin, and he had a nice smile. The other ones did not catch my attention as much.*
11. *I liked the color contrast and the simplicity. Also like the happy mood expression of the animals*
12. *I liked the color scheme and design of the pin the most out of all.*
13. *I liked the dark backgrounds, but I also enjoyed nature and wanted something to do with a plant or an animal.*
14. *I made the decision based on color aesthetics*
15. *I picked pins with images and color schemes that resonated with my style/preference. For the final choice, I went with my favorite color, and I also liked the simplicity of the design.*
16. *I really liked my final choice. Choosing my favorite one was a lot easier after going through that process. I usually have a difficult time deciding between pins.*
17. *I spent a surprising amount of time on this decision for someone who does not care at all about pins. I'm satisfied with my decision, and even if I weren't I would probably lose the pin within days.*
18. *I think my decision making process was largely determined by color. I went with the pins that caught my attention the most*
19. *I think the nature of the study inclined me to make decisions without thinking too much, but the decision-making wasn't very stressful.*
20. *I tried to choose whichever pin I felt most drawn to, specifically in terms of the design and color scheme. The final selection between the last four pins took a little bit longer, but ultimately I chose the one whose colors I liked the most.*
21. *I was happy with it! I really liked the first I saw and felt content.*
22. *I was mildly conflicted between two pins for some of the choices but for most of them the choice was quite obvious for me. I also had a bit of a trend where I would only choose the animals available until the last pin, where i didn't choose an animal instead opting for a cactus. That outlier from my trend was my final choice.*
23. *I was originally confused on how the pin selection could be stressful but after the first group was shown I understand. I tried to make my decision with little thinking and to solely pick the one that caught my eye.*
24. *I was quite happy with my final selection, however with my initial selections i was a bit confused and even regretted the first two choices i made.*
25. *It was actually really hard to decide because I felt that the pins were similar style. I also really like pins (i have some on my backpack) so i would've liked a lot of them*
26. *It was an interesting variety that made the selection process slightly more difficult. The colors/style of art influenced my decision, especially in terms of how I might view myself wearing one.*

27. *It was difficult because I like a lot of them but I am indecisive.*
28. *It was easy to pick my favorite out of a small selection of pins. Although it was more difficult to choose my final decision, it was a low-stakes decision, so it was easy to pick one even if I wasn't sure.*
29. *It was pretty difficult when there were no images I was able to relate to, but for most rows I had a clear preference*
30. *It was pretty easy since I love plants and cacti and I also like the background of the pin which is pastel pink which blends pretty well with green*
31. *Simplicity. Little background noise and the white-blue juxtaposition drew me to it.*
32. *The two pins I liked the best were in the first row, so it was most difficult to make that decision (although I ultimately chose my first row pin). I am happy with my final selection, probably because it reminds me of pins that I already own. My only doubts are about if I would have liked a more unique pin.*
33. *They were all so cute, but I eventually chose the rainbow dancing character because it reminded me of LGBTQ+ pride which is a part of my identity.*
34. *Unstressed, actually got a rush of happiness from the cute designs. The outcome did not concern me.*
35. *Which ever pin initially caught my eye, because of either color or subject of the design.*