

Choice Overload and the Senior Population; Guidelines for a Designer.

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Abstract

Much research has been conducted and published regarding choice behavior and the concept that less is more. Too many choices can cause cognitive overload for users, lead to choice paralysis, and negative emotions. Past research has also studied and published regarding choices and the older adult population in specific. The research has established that older users prefer fewer options than their younger counterparts. Choice overload's application to UX is not as well known. Therefore, a further area to study is whether there is a difference between the older and younger generations regarding the preferred amount of options given on an interface. This study conducted two rounds of testing. The purpose of the first round of testing was to confirm that the elderly favor fewer options on an interface. The purpose of the second round of testing was to help determine guidelines for designers concerning specific choice set sizes. The results of the testing supported prior research regarding the senior population's preferences; however, guidelines for choice set size were not able to be determined. The findings of the study added support to other user-experience elements such as filtering, navigation systems, and aesthetics.

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Chapter 1: Introduction

Choice Overload

For a while, our society believed that the more options given to a consumer, the happier our consumers will be. However, Iyengar and Lepper (2000) conducted the famous jam study which contradicted this popular belief. Twice they set up a display of jams in a grocery store. The first time the table had a set of jams with six different flavors and the next time the jam set had 24 flavors. Of the consumers who passed by the table, 60% stopped at the larger set of jams, and 40% stopped at the smaller set of jams. There was not a significant difference in the amount of jams users sampled between the two different choice sets. Of these consumers who sampled jams, from the first set of six jams, 30% later purchased a bottle of jam. While from the consumers who tested from the set of 24, only 3% of them purchased a jar of jam (Iyengar & Lepper, 2000).

Since e-commerce is so common today, users are faced with an infinite amount of options for their purchasing desires. Besides for e-commerce, technology in general offers a plethora of options to users. There are multiple applications that serve the same function, and within a particular interface, users are bombarded with multiple alternatives. One objective in this study was to learn how the concept of choice overload applies to website use. Will users react to alternatives on a site the way they do to multiple flavors of jam in a grocery?

Considering the astonishing results of the jam study, many decided to research this trend. The results of Iyengar and Lepper's (2000) study point to the fact that users at first find many options enticing, however, later it inhibits them from making a purchase. For example, my mother is known to be a great shopper. She received this title since she is notorious for walking into a store with various options and being able to find and purchase something of value. Most people express how they do not have patience to shop in the same stores as she does. Yet, life for an individual in the twenty-first century requires making decisions numerous times a day. In our democratic government, people

have the liberty to make majority of the choices that effect their lives. It is debatable whether people want all these choices and if all these choices are beneficial. Barry Schwartz explains the paradox of less is more in his book *The Paradox of Choice*. He says, “As the number of choices we face increases, freedom of choice eventually becomes a tyranny of choice” (Schwartz, 2016). With the increase of choices, comes an increase in regret. Individuals with tendencies to strive for the best, may feel disappointed in their past decisions and therefore feel overwhelmed when encountered with new decisions. In 1992, Tversky and Shafir observed that as options increase, the reluctance to make decisions increases as well (Mather 2006). A human's inaccurate perception of events, aversion to trade-offs, and the effects of comparisons, anchors, and framing all cause decision making to be a complicated task (Schwartz, 2016). Choices may seem alluring, but in actuality, the decision-making process is far more difficult and complicated than it seems. An abundance of alternatives leads to choice overload, resulting in negative emotions.

Previous studies have found that the senior population, of 65 and older, has more of an aversion to large choice sets than their younger counterparts. Various studies have compared the behavior between older and younger adult populations to verify this phenomenon. Most studies found this trend to be accurate. Therefore, other studies proceeded to explore why the senior population prefers fewer choices than younger adults. There have been many proven reasons which include cognitive limitations that occur with age, physiological changes in the brain that occur with age, and attitude changes that occur with age. This study will aim to answer if the senior population will have different behavior towards choice during website use in comparison to their younger counterparts. In specific, will the older adults dislike the many options presented to them?

Designers can take information and utilize it to solve problems. User experience designers take information about human behaviors and relate it to interface use, generating more positive experiences for users. Implementing the data about choice overload, some have started testing choice set sizes to try to develop guidelines for

designers. In this way, the information learned can become useful and applicable. Bech, Kjaer, & Lauridsen (2011) studied choice set sizes of five and nine, and Reuskaja and Hogarth tested choice set sizes of five, ten, 15 and 30. Additionally, Bech, Kjaer, and Lauridsen (2011) tested choice sets of five, nine and 17, and Frey, Mata, and Hertwig (2015) tested with choice set sizes of two, four and eight. Many studies talk about the various other elements that affect user behavior for decision making, but I did not find any studies that yielded conclusive data regarding choice set size for the senior population. Therefore, my study will consist of trying to develop guidelines for designers when creating interfaces that are geared towards the senior population. These guidelines would provide concrete information regarding the ideal amount of alternatives to present to a user, improving the experience of seniors on the web.

Chapter 2: Literature Review

Choice Overload

Various research studied user behavior regarding making choices and why it proves to be difficult. These studies concluded that psychological tendencies, trade-offs, comparisons, anchoring and framing all contribute to the difficulty of making decisions. One of the reasons why humans struggle with making decisions is because of human psychological tendencies. For example, during the evaluation process, a person decides based upon the emotion she will feel when she pursues that choice. However, a person's prediction of how a choice will make her feel in the future tends to be inaccurate since humans recall the peak emotions of experiences, the most positive and the most negative memories, and the end of an experience. Therefore, our memories of past experiences are inaccurate, so when emotions influence decision making many times people are left disappointed with their decision (Schwartz, 2016).

Another reason why humans struggle to make decisions is that humans do not like to make tradeoffs. Trade-offs require one to evaluate the "opportunity costs" which are the opportunities passed upon when you go with a different option. When a person encounters more options, it leads to higher stress levels from passing up opportunities. A person may think that after they have finally made their decision, they will find a better alternative; this is called anticipated regret and stops people from making decisions too. In one study, the likelihood of a consumer making a purchase decreased when they were presented with a second option (Schwartz, 2016). These phenomena are apparent in the results of a survey about cancer patients. 65% of the respondents stated that they would want to choose their cancer treatments if they were diagnosed with cancer in the future. Twelve percent of people who get cancer state that they want to choose their treatment (Gawande, 1999). We tend to think that we like many choices, but when it comes to deciding, we struggle. Often, we develop into pickers, decision makers who

pick an option and hope for the best, instead of choosers, a decision maker who thinks before confidently choosing an option.

Besides human emotions, designers and marketers influence user behavior through comparisons, anchoring, and framing. There are four ways that a person compares items: comparing to what she hoped it would be, comparing to what she expected it to be, comparing to other experiences in the past, and comparing to experiences others have had (Schwartz, 2016). When marketers claim that an item will make a user feel a certain way and it proves to be untrue, users feel disappointed. Also, social media makes it too easy for people to compare their decisions. Anchoring is when a person relies on one specific piece of information. For example, if a store anchors a toaster for \$30 next to a toaster for \$60, customers will think that the \$30 toaster is a bargain. Framing is a cognitive bias formed as a result of the way an item is presented. In his book, Schwartz brings an example of framing through two gas stations. One station discounts for cash, and the other station charges more for credit. In reality, it is the same charge, but a different way of framing it (Schwartz, 2016). Consequently, comparisons, anchoring, and framing make it hard for people to make decisions.

Older Adults and Choice Behavior

Although making decisions is a struggle for all of humanity, there is a population that is affected by it more than others. According to research performed by Reed, Ikels, and Simon in 2008, there is evidence that shows that as people get older, they do not want large choice sets (Reed, Mikels, & Löckenhoff, 2013). When surveyed, older adults wanted half the amount of choices that young adults wanted (Mikels, Reed, & Simon, 2009). Rosin et al. 2006 took this even further to prove that this preference is even true across different nationalities (Reed, Mikels, & Löckenhoff, 2013). In 2006, the Medicare Part D program gave seniors fifty-five choices in health coverage options; however, only twenty-two million adults out of forty-three chose a coverage option (Reed, Mikels, & Simon, 2014). This effect differs from the attitudes of young adults, who are willing to pay for more choices. In 2006, Mather showed a trend about how older adults avoid

making decisions (Mather, 2006). Reed, Mikels and Lockenhoff give explanations based on testing to prove that there is a linear trajectory correlation between choice set size and age. Meaning, that as age increases, the desire for choices decreases (Reed, Mikels, & Löckenhoff, 2013). These studies confirm that when designing specifically for the elderly, there will be a different preference relating to the amount of options.

There were many studies conducted that observed the difference in behavior between the elderly and the young that propose some explanations. The first explanation as to why this occurs is that older adults are more likely to satisfice. Satisficing is the behavior of choosing something that is good enough. On the contrary, young adults are more likely to maximize. Maximizing is the behavior of choosing what is best. Two studies prove that people who satisfice prefer fewer choices (Schwartz et al., 2002, and Tanuis et al., 2009) A different study observed that older adults search less for better options (von Helverson & Mata, 2012). Indeed, Reed, Mikels, and Lockenhoff also observed that older adults viewed fewer options (Reed, Mikels, & Löckenhoff, 2013). This pattern was already observed back in 1990 when Johnson said that older adults seek less information than younger adults. Another survey performed by Reed, Mikels, and Simon asked participants to answer how many options they would prefer. Once again, the results showed that older adults preferred fewer options, and this preference increased with age (Reed, Mikels, & Simon, 2014). In a study done by Rydzewska et al., they observed that older adults went so far as to alter their behaviors during a task to avoid searching through many options (Rydzewska et al., 2018). So since older adults are satisfied with choosing an option that is good enough, they do not desire numerous options.

Cacioppo explains the next reason given by Reed, Mikels, and Lockenhoff, Petty, Feinstein, and Jarvis in 1996, which is that due to age-related limitations, seniors have more difficulty making decisions because of cognitive limitations. To illustrate, seniors have negative associations with maximizing, self-efficacy, future time perspective, neuroticism, short-term memory, and numeracy. All these attributes affect one's decision

making capabilities and result in the desire for fewer alternatives. For example, maximizers tend to look for what is best, and therefore prefer more options, and future time perspective is linked to the motivation of seeking more information. In 2004, Salthouse expounded upon the notion that since working memory declines with age and working memory is a requirement for effective decision making, older adults prefer fewer choices (Reed, Mikels, & Löckenhoff, 2013). Decision quality is higher when an individual's numeracy level is higher. Numeracy is the ability to understand probability and numerical concepts (Szrek & Bundorf, 2013). Choice overload can be a result of exceeding one's cognitive capabilities, and since the elderly's cognitive capabilities decline, they are more likely to reach a state of cognitive overload (Mikels, Reed, & Simon, 2009). A designer always wants to make sure that their user does not have cognitive overload, or else they will abandon a site or not revisit it.

There are four steps included in the decision-making process, understanding the information, integrating the information in an internally consistent manner, identifying the relevance of information in a decision process, and inhibiting impulsive responding. These steps rely on three cognitive functions, crystallized and fluid intelligence, memory capacity, and speed of processing (Finucane & Gullion, 2010). Besides for working memory that declines with age as mentioned previously, processing speed also decreases as humans get older (Rydzewska et al., 2018). In-depth processing of information helps a person to see past irrelevant differences to make a better decision (Bruin de Bruin et al. 2007). Bodner and Schiffer observed that when information needed to be retrieved from memory, age differences emerged (Mata & Nunes, 2010). The reason for this is because it is harder for older adults to keep multiple pieces of information in their mind to be able to make comparisons (Mather, 2006). In conclusion, cognitive impairments cause older adults to have a difficult time making decisions and to seek less information. As a result, it is imperative that interfaces designed specifically for the senior population avoid giving too many options.

Mather explains the cognitive decline in the older population from physical symptoms displayed by the elderly. In 2000, Raz stated that the volume of the brain declines at a two percent rate per decade. The prefrontal cortex is the region which is affected by this decline the most. There are two regions in the prefrontal cortex that specifically affect decision making which thereby means that the elderly's decision making is affected. First, the orbitofrontal cortex is involved in both decision making and emotion processing, and then the dorsolateral prefrontal cortex which is involved in the ability to maintain and manipulate information into working memory. MacPherson et al. in 2002 also found that the dorsolateral is affected by age (Mather, 2006). So even though Iyengar argues that the younger generations grew up in a world full of choice and consequently prefer choices more than their older counterparts (Reed, Mikels, & Löckenhoff, 2013), there is a physiological explanation that validates the behaviors of older adults.

Besides for the physiological brain, the attitude of humans changes as they get older. Cartensen, Fung, and Charles (2005) developed the socioemotional selectivity theory, SST. This theory states that young adults pursue knowledge-related goals and seek out information, while older adults pursue emotionally meaningful goals and engage in emotion regulation by not focusing on making complex decisions (Reed, Mikels, & Simon, 2014). Johnson carried out a study that had two types of participants, college students and retirement age adults, and the given theoretical task was to buy a car using the information provided. The results proved that college-aged participants utilized more of the provided information, spending less time on each piece of information, and were also more likely to review the information, compared to their older counterparts (Johnson, 1990). So, there is no need to give an abundance of options to the elderly, because they will not spend the time viewing and evaluating them. Emotions play a significant role in making decisions. Since the elderly understand that their time is limited, their goals switch, and they begin to focus on more positive matters, avoiding encountering negativity. Luce (1998) discovered that people who decide not to make a

decision have fewer negative feelings, so avoiding decision making helps to regulate emotions (Mather 2006). This regulation of emotions would explain why so many older adults did not choose a Medicare plan.

Developing Smaller Choice Sets

These research studies have established the need for smaller choice sets. Yet, developing smaller choice sets is not a simple matter, since many factors need to go into consideration, such as variation. According to Scheibehenne et al 2010, item similarity contributes to choice overload (Willemsen, Graus, & Knijnenburg, 2016). The more similar items presented in a choice set, the more cognitive effort it requires to decide. However, too many diverse items can lead to user's having to make a more difficult trade-off. Therefore, the ideal choice set is small and has diversity, meaning all options are as different as they can be.

Another factor to be aware of is framing, which has a powerful effect on how a user interprets a situation. Typical information architecture is categorized by benefit or attribute. According to one study, it is better to distinguish alternatives in a set by attribute since organizing by benefits can weaken a user's preference for one item out of a set. This is because benefit-based organization leads to abstract processing which emphasizes to a user the similarities between the items, which makes it harder for a user to decide between items (Lamberton & Diehl, 2013). In addition, based off of Bateman's study, the more familiar a person is with the issue at hand, the more alternatives that person can manage (Bech, Kjaer, & Lauridsen, 2011).

Another study discovered that users form different inclinations based on how many choices they encounter, since respondents of the study who made decisions from choice sets of 9 reported to choosing more randomly than the respondents with a choice set of 5 (Bech, Kjaer, & Lauridsen, 2011). Moreover, the first choice set in the sequence is the most influential one, meaning that designers should be conscious of keeping the first choice set of an interface small. In reality, choice sets are generally not presented in isolation; usually, users are following through a sequence of making several decisions

(Levay, Reinholtz, & Lin, 2011). This information is useful for guiding designers since it explains that designers need to look at the larger picture and sequence of events a user will go through to determine appropriate choice set size. All these tips help designers to create ideal choice sets.

Some research states that choice satisfaction and its relation to consumer satisfaction is a “U” slope. Meaning that at first, when choices increase, there is more satisfaction, but then as choice increases further, satisfaction declines. This is proven from research done by Reuskaja and Hogarth with choice sets of 5, ten, fifteen, and thirty. Consumers reported highest levels of decision satisfaction when they had the choice set of ten or fifteen (Moser, Phelan, Resnick, Schoenebeck, & Reinecke, 2017). Perhaps users may feel more satisfaction, however, when a user decides from a large choice set, it is unlikely that he will change his decision. Sticking with a decision that was not the most beneficial will lead to negative feelings in the long run. Also, in a very small choice set, when a user guesses, the likelihood that the user will guess an option that is beneficial is higher (Barnes, Hanoch, Wood, Liu, & Rice, 2012). Therefore, it is hopeful that a model can be determined from this study which will guide designers in creating choice sets that hit the perfect balance of user satisfaction.

It is apparent from previous research that older and younger adults have different preferences in choice set size for various reasons. Other research studied the concept of choice set size in general, but the research lacks specific guidelines for designers. This may be because when there are numerous factors that play into a choice set size, it is too difficult to determine specific guidelines. However, it may be possible to determine guidelines for a more specific target user, such as older adults. A study done after the new Medicare Part D plan was released studied choice set size concerning the elderly population. The sixty-five-year-olds chose a plan that cost them ten dollars less than an eighty-five-year-olds. Which means, that the multitude of insurance choices caused the older adults to choose an option that wasn't the best decision. Moreover, participants of the study with 9 options, the max in the study, spent \$50 more on the plan they selected

than participants with less options (Hanoch, Wood, Barnes, Liu, & Rice, 2011). The results of this study are applicable since it proves that age and choice set size matters. However, the study's relevance is limited since the max choice set size was only 9 options.

Few studies tested the ideal amount of choices for the older adult population. The usual amount of choice sets is between 8 and sixteen within health economics (Bech, Kjaer, & Lauridsen, 2011). Bech, Kjaer, and Lauridsen compared choice sets of five, nine, and 17, each with two alternatives and an opt-out option. They found that age is a more significant factor of decision making than choice set size since there was not a significant difference in perceived difficulty and the user's satisfaction when encountering large choice sets. The takeaway from this study proves that more research is needed in this area, since the results did not support research nor provide concrete advice for designers. Another study, performed by Frey, Mata, and Hertwig, tested participants with choice set sizes of 2, 4 and 8. The choice set size order given to participants was varied to minimize the few-to-many effect defined by Hills, which is when a user is first presented with smaller choice sets, they are better able to make decisions on larger choice sets later. Yet, in this particular study, the older adults were still affected by this phenomenon more than younger adults (Frey, Mata, & Hertwig, 2015). This information is relevant since it proves that it is important for the older population to be given small choice sets first.

In 1956, George Miller stated that there is a magical number seven plus or minus two. The reasoning behind this number is that humans' cognitive capacity for processing information cannot handle more than nine chunks of information at a time (Miller, 1956). Designers apply Miller's Law often, for example, in trying to limit the options in a menu to nine. Likewise, perhaps the maximum ideal amount of choice presented to a user at once is nine. However, other studies disagree, stating that if a user can see the text of the options and therefore only needs to recall the information, they can handle more than

nine chunks of information. These studies also state that many designers misunderstood what Miller researched back in 1956 (Nielsen, 2009).

In conclusion, choice architecture and developing ideal choice set size is daunting since the ideal set is dependent on the particular user. Whether the user is mindful of the task at hand or does not care much about it, a user's capabilities, motivations, biases, attention, cognitive capacities, and understanding all affect their choice behavior (Münscher, Vetter, & Scheuerle, 2015). Since there is a gap in the research of specific choice set size guidelines to assist designers, I will try to begin developing guidelines by focusing on a specific user group. Through understanding the target user thoroughly, in this case the older adult population of over 65, guidelines can be determined that will create positive experiences for the target user.

Chapter 3: Methods

Methods

In this study, I performed two rounds of testing. I tested to see if the senior population preferred fewer choices than the middle-aged and younger adults, and if they will have a more positive experience deciding when the choice sets they are given are smaller. I observed participants of all age categories using websites which were designed specifically for older adults so that I could study decision-making behavior during site use. For comparative purposes, I also watched participants using interfaces created for all age ranges. Even though the purpose of this study targeted the senior population, I also observed both younger and middle-aged adults to compare their behavior with the senior population.

Participants

I tested 33 users in total, 19 female participants, and 14 male participants. 12 participants were young adults from the age range of 18-44, 11 participants were from the middle-aged range of 45-64 years of age, and ten participants were from the senior population of 65 and older.

All 33 of the users tested were Caucasian.

One user had ADHD and a different user had Parkinson's.

Measure

Survey

To acquire qualitative data, users were asked to fill out a pre and post survey. Before the test I asked users questions regarding their demographics, their comfort level with technology, and their perception of their decision-making behaviors. After the testing, I asked users questions regarding their emotions while performing the assigned tasks. I also asked open ended questions, such as their preferred amount of choice.

Time Measures

The time to complete the assigned tasks was recorded so I could acquire quantitative data. The data was analyzed for two different measures. First, to compare the rate of completion times between the different age categories. And second, to compare the rate of completion between the different sites in the study.

Instruments

During the second round of testing, I screen recorded some user testing sessions. Since the task was short and simple, many behavioral trends displayed by users were similar. In addition, I gained the most important data from the time to complete task and follow up questions. Therefore, after the beginning tasks I did not feel it was necessary to continue recording the user sessions.

Materials

First Round of Testing:

Nia.nih.gov, acl.gov, seniorliving.org, amazon.com, ebay.com, youtube.com, wsj.com, and webMD.com.

Second Round of Testing:

Figure 1a. Actual NIA site

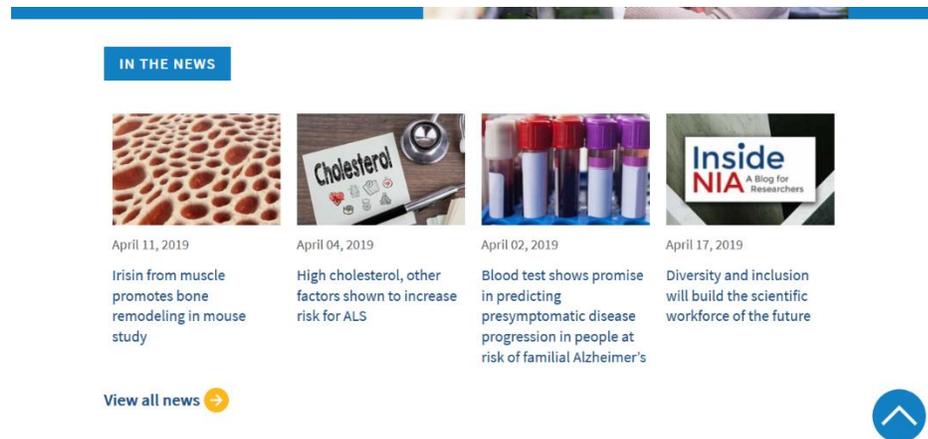


Figure 1b. NIA 8 options mockup

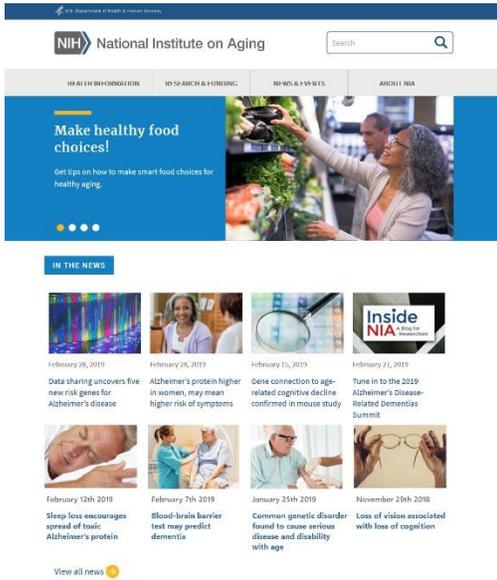


Figure 1c. NIA 12 options mockup



Figure 2a.
WSJ more options mockup



Figure 2b.
WSJ less options

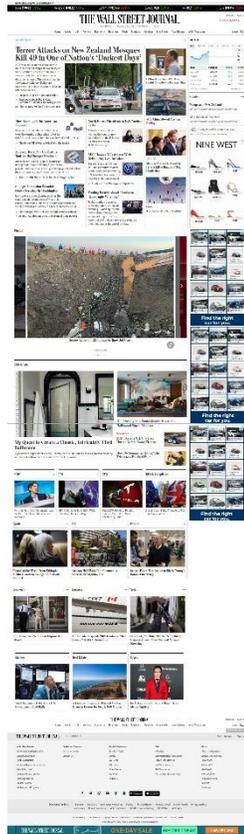


Figure 2c.
WSJ website



Procedure

I conducted two rounds of testing. The purpose of the first round was to gather information to support my hypothesis that the senior population will appreciate fewer choices on an interface. The purpose of the second round was to try to determine a solution or guidelines for designers.

In the first round of testing, I observed users using three different sites on the internet and varied the sites to analyze a total of eight sites during the study. These sites consisted of two groups, the first group of websites was geared towards the elderly population, and I expected that they would be more user-friendly to older adults. These websites were Seniorliving.org, ACL.org (Administration for Community Living), and NIA.NIH.gov (National Institute on Aging). The second group of websites were general websites that target all age categories. The sites included in this study were Amazon, YouTube, The Wall Street Journal, eBay, and WebMD. Users were given the task to either select an article to read, select a video to watch, or to purchase an item worth five dollars. Each user tested three different sites, two general sites and one site for the elderly population. A total of 12 users were tested, with ages ranging from 24-79.

In the second round of testing, I tested two of the sites that were used in the previous study, and I made two mockup versions for each site. One was a general public site-The Wall Street Journal (WSJ) and the other website's target audience was for the senior population-National Institute on Aging (NIA). In the mock-up sites I created, I manipulated the choice sets to give me data and insight. For the WSJ site which had many options, I created a mock-up site that had fewer options and a mockup site that had more options. The NIA site had very few options, so I created two mock-up sites with more options, but a different amount. The choice set sizes for NIA site were fixed at four, eight and 12 so that I could see if choice sets should try to follow the magical number seven plus or minus two (also known as Miller's Law). On all six sites, the task was the same, users were asked to select an article from the landing page. In this way, I could try to determine an ideal number for a choice set size to guide designers.

Chapter 4: Results

Results

I performed two rounds of testing, and the results from both tests provided me with various data to analyze. During the first round of testing, I acquired data regarding choice behavior in general, and during the second round of testing, I was able to acquire more specific data regarding preference for choice set size. Also, during the second round of testing, I was also able to acquire data regarding the preferences for the older and younger age populations. The testing results from both data sets gave me information to then be able to draw some conclusions as a takeaway and contribution to the design world.

First Round of Testing

I was able to acquire some insights into user's decision-making behaviors by observing them going about the task in the first round of testing. Some trends I noticed were that users generally selected an item from the options presented in the beginning. In fact, most users did not click past the first page. The first task assigned to users was to choose an article on a website designed for the elderly, and only a quarter of the users went to page two. Of those three users, two of them were over 65, and one was 42. That was interesting to note since they were middle-aged and older adult users, contradicting my research which stated that the younger adult population seeks out more information. What is interesting, is that the two older users who went to the next page did so on the Seniorliving and NIA sites, which are geared for the elderly. This supports Bateman's study, which is that the more familiar a person is with the issue at hand, the more alternatives that person can manage (Bech, Kjaer, & Lauridsen, 2011). So, the behavior of looking further and more extensively can be interpreted as relevancy of options distracting users from the number of options provided. Meaning, when a user finds the given information to be relevant and therefore interesting, she does not care or pay attention to the amount of options presented.

After telling a 79-year-old participant to pick an item to purchase on Amazon, she responded that she has her kids shop on Amazon for her since "there are too many pictures and things to choose from."

Besides for observing user behavior and putting together user trends, post-survey questions helped acquire information. When participants finished the assigned tasks, they were asked to fill out a post-test survey. I acquired valuable insights and data from three of the questions asked which were: if and why users regretted their decision, how technology can help, and how many options users prefer.

One of the questions users had to answer was whether they regretted their decision. Users who regretted their choice gave reasons such as, being stressed for time, or having issues with the small budget I gave them. One user who was 67 stated that she probably could have made a better decision, but it would have taken too long to look further. Another user was having issues using the laptop on my mousepad and therefore felt that he could have made a better decision. His struggles taught me that if an interface is hard to use in any way, it affects a user's satisfaction in their decision. The takeaway from these answers is that time, financial state, and physical constraints all affect user satisfaction in their choice.

I also gained some valuable data from asking users how technology can help solve their decision-making issues. One user stated that she wished she could see all her options at once. Users preference to view all options at once may be a reason why the infinite scroll navigation is prevalent today. Other users suggested filtering, sorting, or any narrowing tools. Another user stated that when using the search box, the information given should be accurate. This feedback means that perhaps users would prefer precision over recall for search results. In conclusion, the takeaway from this post survey question is the importance of the infinite scroll, filtering systems, and search engine precision.

Lastly, I also asked users how many options they would prefer on a page. This question was broad and vague; however, some users provided me with valuable insights. One user stated that layout is more important than the number of options. In specific, the

user was comparing the ACL website to the WSJ website, noting that the WSJ website layout should be more spread out. Another user suggested that as many options as possible should be shown on a page, this statement supports the infinite scroll navigation for sites. Another user stated that on a landing page in specific there should be no more than four options. Another user stated that landing pages should be less cluttered and more user-friendly. My takeaway from this question and the previous questions, lead me to a different track of thinking about choice set size. It led me to realize that there are many other essential factors that designers can implement that will alter a user's decision-making process, other than just the choice set size.

Second Round of Testing

Based off the results from the first round of testing, I realized that I needed to make some revisions as to how I was planning on doing the second round of testing. In specific, I realized that what I was testing was too broad. Many different categories of choice sets are presented to users, for example, the navigation bar and the actual content displayed. Within the various ways that choice sets are presented to users, I learned that there are differences which affect user preference for choice volume. For example, users may prefer a different amount of options on a shopping site or on a news site. Based off the feedback and data, for the second round of testing, I decided to focus on the content of a landing page. In specific, I decided to test the number of articles displayed on the page. This way, I was hoping I could develop more concrete guidelines for designers.

Much of the qualitative data I collected from the second round of testing, matched what I observed from my previous round of testing. I received similar answers to how technology can improve user experiences, such as placing all options on the same page and providing filters. I was also able to analyze more specific ways that designers can help users make choices more easily. In addition, since all users tested the same pages during my second round of testing, I was able to get more concrete answers regarding choice set size. This time, many users expressed their dislike of high choice sets. For example, one user said that she only struggles with choosing the best option when there

are a high variety of options. Another user expressed “it is tough because there are a lot of interesting ones... but I got to just pick one.” A different user stated that it was difficult to choose an article since many were similar in topic. Similarly, another user expressed how it felt like there were fewer options since she did not like anything. One user stated that if there are too many options, then a user can forget what they came to look for in the first place. I acquired the most useful data from the answers users gave me in response to asking them which site they preferred and felt the most satisfied with their choice for the WSJ and NIA site, after they were presented with three different versions of each.

WSJ Results

The WSJ had numerous options to choose from on their landing page. So it was interesting to note different users perspective regarding the large choice set size presented. When asked the follow-up question of which site they preferred, one user expressed, “I hated the one with a ton of options” about the actual WSJ site. Another user stated that he liked the first site- which had the least amount of options since it was easiest to see what he liked best. He also mentioned that he liked the colorful picture, which implies that graphics affect the user’s decision-making process. One of the older users selected the most prominent articles on the page, explaining that since it was bigger than the other articles on the page, it caught his eye. Moreover, since it was of interest of him, he did not bother to scroll further. He went on to say that he would need to strain his eyes to read the other article descriptions. Another older user stated that she did not notice a difference in the article amount; however, the articles with larger text caught her attention. There was also another older user who stated that he usually is attracted to larger fonts and he looks for grabbing headlines. His usual behavior implies that aesthetics, specifically font size, affects the decision-making process too.

One user expressed that she did not feel like there were too many options. A different user also stated that he did not notice the difference in options. Another user also stated that she did not notice the number of options since she was looking for what

interested her, however, on the last site (which had the most options) she felt like there was the least since she did not find anything that interested her. The next user stated that on the WSJ there was too much of the same thing. Again, this points to the fact that more important than choice set size is the variety of choices. A different user stated that she appreciated the WSJ page with fewer options since the other sites were a little overwhelming.

There was another user who preferred the actual WSJ site since he felt that my mockups looked cluttered. The next user also said that my landing pages looked cluttered but went on to say that the actual WSJ also was a jumble. One user stated that it is simpler with fewer options because then you do not need to scroll through the whole page. In fact, many users did not scroll and selected an article from what was displayed above the fold. A lot of other users just scrolled slightly and then selected an article. So my observations and feedback from the WSJ testing, proved further to me what I had learned from my first round of testing, which is that the amount of options presented is not the most critical factor in a user's decision-making process.

NIA Results

Just like on the WSJ sites, after users selected an article on the three NIA pages, I asked them which site they felt the most pleased with the article they selected, and on which site they had the most pleasant experience. On the NIA website I was able to get more concrete answers since users were given sites with a fixed amount of options of four, eight, and 12. I asked all users whether they preferred, the four, eight, or 12 options. Thirty-eight percent, eight out of 21 users, stated that they would prefer four options. Thirty-eight percent, eight out of 21 users, said that they would prefer eight options. And 24% percent, five out of 21 participants, said that they would prefer 12 options.

The users who stated that they would prefer four options gave reasons such as preferring fewer options, eight is too much information, it is easier to see what they liked, and they do not need to spend extra time deciding. Another user stated that all he needs to see is what is most popular or recent, which can be represented in four articles.

Another user expounded on her reasoning for choosing four, expressing that she does not need 12 choices since she is interested in everything, and will find something that she will like. She said that she does not need so many choices and that perhaps it is an age issue. (This user is 68). She is used to making do with what she has, while in her opinion, “the younger generation needs more choices”. Her statement supports Iyengar’s view that the younger generation appreciate more choices since that is what they are used to.

The reasons which were given by the participants who stated that they would prefer eight options included: eight being not too much and not too little, just in the middle, you do not necessarily need 12, four is too few, and 12 can get confusing. One user commented on how he appreciated that when there were eight options, he did not need to scroll. Another user stated that you still have choices but are not overwhelmed or frustrated by too many. In conclusion to this feedback from this user group, four is too few options, but they dislike the vastness of 12 options. Thus, Miller’s magical number seven would apply to this user group's preferences.

Lastly, the users who preferred 12 options gave reasons such as, the probability of finding what I like is higher, or appreciating more options. Another user stated that more options mean that there is more of a variation, which makes it more interesting. He also stated that if he only had four options, then he would think the site was trying to lead him somewhere, and they had an agenda.

It seems that users’ preference for choice set size is indeed a matter of opinion. However, since 76% of users did not prefer the option with the highest volume of choices, my research was supported.

The Older Vs. Younger Adult Population’s Behavior

Table 1 provided below gives a thorough analysis of the differences and similarities between the behaviors of the different age categories. Except for the NIA site where users only had four options, the young adults on average always took longer to complete the task. This trend proves that indeed young adults look at and prefer more options. What is perhaps most interesting to note, is the difference in the behavior for all

age categories when presented with the task of choosing an article from the WSJ vs. the NIA site. There were many options on the WSJ, and therefore the task took all participants longer. The age category that had the most substantial difference in time from the WSJ tasks to the NIA tasks was the young adult population. All aged participants spent the most similar amount of time to complete the task for the NIA 12 options.

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Figure 1. Time to Complete Tasks

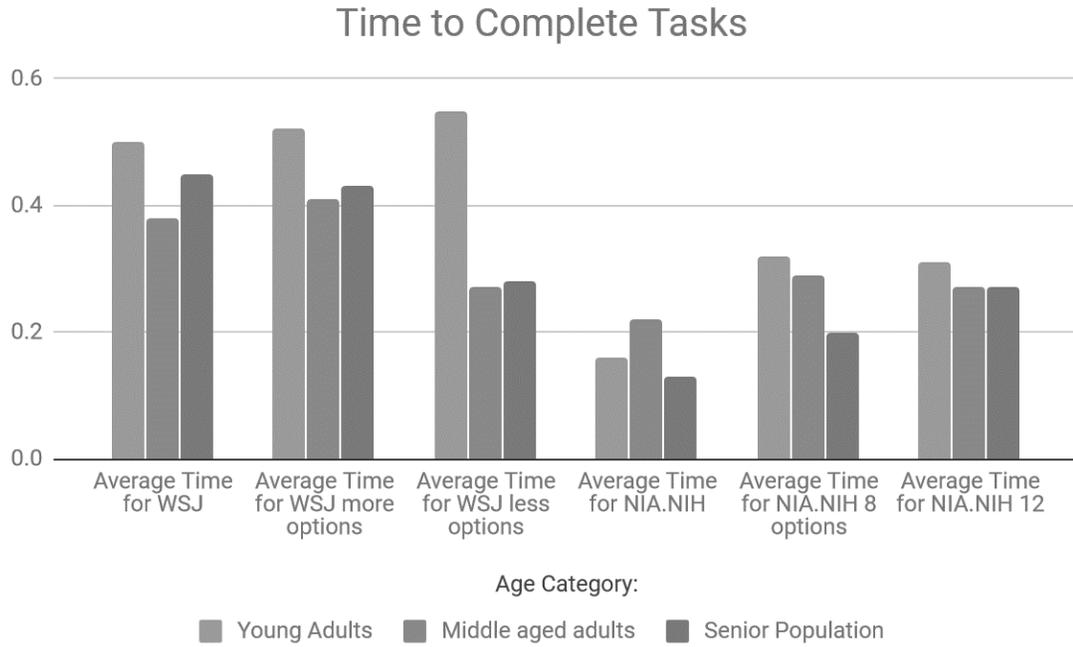


Table 1

Second Round of Testing Results

User Number:	Gender:	Age:	Time for WSJ	Time for WSJ more options	Time for WSJ less options	Time for NIA.NIH	Time for NIA.NIH 8 options	Time for NIA.NIH 12	prefers:
15	female	20	0.073	0.1098	0.2948	0.0313	0.0263	0.2276	4
3	female	22	0.4685	0.5237	0.767	0.0859	0.4819	0.4153	8
4	male	24	0.6055	0.7323	0.3949	0.0498	0.3307	0.2359	4
7	female	26	1.3336	0.757	0.387	0.0269	0.5277	0.2515	12
8	male	29	0.1619	0.3833	0.3817	0.2838	0.2664	0.309	12
9	male	29	0.355	0.6357	1.0957	0.4935	0.2965	0.3969	12
12	female	38	0.3336	0.5033	0.1933	0.1256	0.3436	0.3575	8
Average Time		7	0.4995833333	0.5236333333	0.5535166667	0.1618666667	0.3247285714	0.3060333333	

Optimal amount of options for the senior population; Guidelines for a Designer.

Standard Devaition			0.4179893767	0.2243013502	0.3162540374	0.1729977401	0.1630698901	0.07801658859	
17	male	47	0.204	0.02	0.0615	0.1898	0.224	0.3086	4
13	female	48	0.269	0.7305	0.1163	0.0983	0.4685	0.3809	8
1	female	49	0.8668	0.9342	0.787	0.3185	0.5295	0.3735	4
10	female	50	0.144	0.385	0.0642	0.175	0.1663	0.0829	8
2	male	51	0.62	0.3245	0.2623	0.5297	0.2812	0.1948	12
20	male	51	0.057	0.0245	0.1188	0.1795	0.139	0.3115	4
11	female	62	0.3068	0.6859	0.3519	0.0763	0.2828	0.2112	8
Average Time		7	0.3791080789	0.4077705204	0.2747967449	0.2168071563	0.2933220513	0.2659722135	
Standard Devaition			0.2880874371	0.354591255	0.2594951344	0.1557504919	0.1479153233	0.1081981824	
21	female	74	0.3055	1.7923	0.3725	0.1492	0.3856	0.4565	8
6	female	67	1.0167	0.2136	0.1628	0.1362	0.1419	0.2272	8
18	female	68	0.2635	0.2061	0.1316	0.0891	0.116	0.1337	4
5	male	69	0.1125	0.02	0.4453	0.173	0.0929	0.3798	4
14	female	72	0.8559	0.4439	0.2488	0.0645	0.2249	0.0945	8
19	male	73	0.4173	0.02	0.3599	0.1743	0.2598	0.2768	12
16	male	75	0.173	0.284	0.2347	0.1023	0.2109	0.2923	4
Average Time		6	0.4492	0.4257	0.2793714286	0.1269428571	0.2045714286	0.2658285714	
Standard Devaition			0.349586961	0.620537568	0.1162221395	0.04259009498	0.1004307011	0.1281078935	

Table 2
Choice Preference by Age Range

	Prefers 4	Prefers 8	Prefers 12
Young Adult	2	2	3
Middle-aged	3	3	1
Senior	3	3	1

Table 1 analyzes how many options users stated they preferred per age category. It is interesting to note that the middle-aged and senior population had precisely the same preferences. This chart supports the idea that younger adults prefer more options, since three young adult participants stated that they would prefer 12, while for middle-aged and the senior population, only one participant in each age range stated that they would prefer 12 options. Across all age groups, there was no difference in preference between four or eight options.

Standard Deviation

The standard deviation for choosing an article on the NIA site was less for all age categories than the standard deviation on the WSJ site. The exception to this trend was on the NIA 12 options site, where the standard deviation was higher for the senior population than the WSJ least amount of options site. So, it seems from the standard deviation data, that the more choices available to users, the less predictable users' behaviors are.

Chapter 5: Discussion

Discussion

The goal of my user testing was to determine specific guidelines for designers when creating choice sets. At the end of my first round of testing, I knew that the scope of my second round of testing needed to be more specific. However, shortly after beginning my second round of testing, I realized that I probably would not be able to reach my goal of developing specific guidelines for a designer regarding choice set size. There are too many factors that play a role in determining a general choice set size, and it therefore needs to be designed for a specific project. For example, a shopping site will need to determine choice set size separately for navigation categories, landing page links, inventory displayed per page, and so forth. User testing to determine a specific choice set size would be ideal during the development of a site, since it is imperative to the user experience.

Users did not hesitate in answering my question of how many options would they prefer: four, eight, or 12. No users said I am not sure, or I cannot decide. All users had an opinion. Therefore, I conclude that users do have a preference in choice set size, and it does affect their experience and opinion of a site. The fact that only 24% of users stated that they would prefer the most amount of options provided (12) means that my study supported the concept of choice overload. From the middle-aged and older adult population, only 14% of the users tested said they would prefer 12 options. However, 42% of the younger population said they would prefer 12 options. This data proves that the younger population does indeed prefer more options. But, since there was no difference in preference for the middle-aged adult population and senior population, it seems that there may not be a trajectory as people get older in the number of options they prefer, which disputes the trend that Reed, Mikels, & Löckenhoff observed in 2013.

Even though I was not able to develop guidelines regarding choice set size, I believe I gleaned some applicable insights as to how designers can improve a user's

experience while making choices on an interface. There will always be users who prefer more, and always users who prefer less. From my testing, it seems that generally, it is safest to stay in the middle. However, what I did learn is how a designer can help minimize choice overload for their users. Designers can ensure that the options provided are all a variety and relevant, have good intuitive filtering in place, make use of the infinite scroll navigation, have a useful search engine feature, design a pleasant layout of the page, and ensure ease of use.

Variety & Relevance

Some users expressed that more than the number of choices, they appreciate a good variety. One user stated how choosing between similar topics was difficult. This feedback supports the research that item similarity contributes to choice overload (Willemsen, Graus, & Knijnenburg, 2016). The idea is that users want to find something they are interested in viewing. Generally, more choices ensure that a user is more likely to find what they are looking for. Many times, variety and high volume of choices overlap. Designers may feel that in order to give users a high variety of options, there needs to be many options. Such a thought process is especially applicable to sites that have large target audiences. One way to combat this issue is to provide variety, but not options within the variety. For example, on the WSJ site, there are a few articles per category on the landing page. The choices presented on the landing page can be minimized by including only one article per genre. Another insight into a variety that my testing results highlighted is that sometimes options can be very similar. For example, in medical insurance, many health insurance plans may seem to users as very similar with small differences. Sites should highlight the differences in each option to help users decide more easily and confidently. In fact, Amazon does this. They will list similar products and highlight the features of each so users can quickly scan to see what makes a product unique.

Besides variety, relevance is also significant. Hopefully, by providing an array of various options, designers will be able to provide content that is relevant to different

users. During my testing, one user had expressed that on one of the WSJ pages, she felt like there were not enough options since there were not any articles that interested her. On the NIA site that had only four options, users who felt the options were relevant and appealing did not have a hard time selecting an article. A 68-year-old participant stated “I do not need 12 choices because I am interested in everything.” Perhaps therefore the senior population had on average the quickest time for selecting an article on the NIA four options site since the articles were relevant to them. To conclude, when users are provided with an array of options in which the content is relevant to the user, then the user feels satisfied with fewer options.

Navigation

Filters

One way in which sites help users find relevant content is through filtering systems. In their feedback, many users expressed how important filters are. One participant who was 79 told me, “I do not like to shop on Amazon because there are too many pictures and things to choose from...I use Nordstrom's site because the filters are easier.” Granted, Amazon has a lot more options than Nordstrom, but this still points to the importance of filters. I observed some users trying to filter via the search bar instead of the filters. For example, another user who was part of the senior population age range, typed into the search bar: “tea for \$5.” Instead, he should have searched for tea, and then used the filtering system to filter by price to a max of \$5. He would have gotten better results that way. Most sites have filter systems in place, but maybe the filter systems are insufficient, or users do not perceive them as helpful. In the above example, perhaps if there were filtering options placed horizontally at the top of the page instead of on the side, the user would have noticed that he can filter by price. Either way, since filtering is so crucial, especially on a site that presents a user with various choices, designers should do detailed user testing on their filtering system to ensure that it is easily accessible, noticed, and easy to use.

Another way that sites help filter unnecessary content is through progressive disclosure. Progressive disclosure is the concept of only presenting the user with the necessary or requested information at a given time. To accomplish this, designers need to prioritize options according to user's needs and expectations. Another aspect to progressive disclosure is that users are only given more options when they ask for it or need it (Natolli, 2017).

The Infinite Scroll

Many users referenced to the fact that they would like to see all the information presented on one page. Additionally, only a quarter of users in the first round of testing went to page two. This behavior brings support to the navigational feature of the infinite scroll, where users keep scrolling and more options load, instead of going to another page. Scrolling is especially helpful for mobile web, where scrolling is more natural than clicking small buttons to go to another page. The infinite scroll makes it easier for users to scroll through options. It does not work for all sites though. Pagination is still a better option for a site that contains much content, so that it is easier for a user to locate previous items. Also, based off research, it seems that the infinite scroll is not ideal for goal-oriented users. It works better for users who are browsing for fun (Loranger, 2014). Based off my testing, I think the infinite scroll should be taken into consideration since my users seem to appreciate that way of searching.

Ease of Navigation

User experience affects all aspects of a user interacting with a site. So, the experience a user has on a site affects the user's state of mind when making a decision. One user had expressed how he just selected an item since he was having difficulty using the touchpad on my laptop. Designers aim for their users to reach a state of flow. When an interface is easy to use and explore, users can concentrate on the task at hand and be in a state of flow.

Search Engine System

The search engine of a site deeply affects the choices presented to a user. Firstly, search engines help users avoid filtering systems and the multitude of choices. One user expressed during testing “Can we make it go faster by search?” If the search engine is efficient, users will be presented with relevant results. However, if the search engine is not optimal, users will be presented with too many options. One user stated that when they search, they wish that search results are what they wanted to see. This opinion relates to the precision vs. recall debate, which is about whether users would rather be presented with more options that are somewhat related or fewer options that are more specific to the search query. Based off my user testing and my research, I would say that users should be given precise results. Precise results will be relevant to the user and won't present as many options to the user.

Aesthetics

Aesthetics matter since they influence users' decisions. In the user experience world, aesthetics work with functionality to give users the optimal experience. Many of the older users that I tested expressed that articles with larger text attracted their attention since it was easier for them to read. This feedback supports the research that framing effects a person's decision through the formation of a cognitive bias as a result of the way an item is presented (Schwartz, 2016). Furthermore, probably users with language and vision disabilities would also be attracted to larger fonts on a site. Perhaps an issue with large choice sets is that the font size will be reduced to fit more content on the page. Designers should be conscious not to decrease font size in order to fit more options onto the page, instead make the page longer. Besides for font size, layout is also imperative in the overall experience. One user expressed how more than the number of options; the layout is important. If a designer needs to present users with many options, make sure not to squeeze it all into a small space. Instead, make the page longer. Designers manipulate users' choices by causing them to pay attention to particular content through making the text or images larger or using brighter colors. By ensuring that font and images do not get

reduced to too small, in an effort of fitting in more content, designers can manipulate users' experiences to be more positive.

Knowing your Users

Variety and relevance, filtering systems, the infinite scroll, general ease of use, search engine system, and aesthetics all play a role in a user's experience while making decisions on a site. The commonality of how to optimize these elements for decision-making lies in knowing your users. As user experience designers, one of the first questions we ask ourselves is: who are the users? If a designer knows and understand their users and their users' goals, then many of these features can be improved to help users in making decisions. For example, the designer can know the best terms for the filtering categories, what content will be relevant, and how to optimize the search engine results. If a designer knows that the target audience for an interface is young adults, then providing users with many options should not be an issue to the user base of that site. Of course, the designer should work hard to ensure that there are a variety and relevance in all the choices, but younger adults do appreciate more options. If the target audience is middle-aged and older adults, or the general population, then the designer should try to limit options where possible and make good use of all the elements discussed above. In this way, designers can ensure that the user will have a positive experience when making decisions on their site.

Limitations in Testing

A limitation of my testing was in my user group. All the users I tested were from the same ethnicity, race, and religion. Perhaps users from different races would have responded differently to my testing. Furthermore, one user had ADHD, another Parkinson's, and a different user had mental illness, but none of my other users had disabilities. It could be that users with disabilities would prefer fewer options, but that would be an area for further research. I also was not able to test the few to many effect described by Hills, which is that the sequence of choice presented effects a user decisions, since my user base was not large enough.

There also may have been accidental inaccuracy in my testing. For example, many users were not familiar with using the touchpad on a laptop and therefore had difficulty scrolling through the landing pages, or sites. This difficulty could have led to inaccurate time measurements, and less of a want to scroll further. Additionally, since users knew they were being tested and timed, they may not have performed accurately.

Chapter 6: Conclusion:

Conclusion

Various studies analyzed human's choice behavior and the notion that less is more. Choice theories application to the older population in specific has been researched in depth as well. Majority of the studies agree that the senior population prefers fewer options than their younger counterparts. However, the relationship between choice behavior, the senior population, and UX is not as well known. Therefore, this study aimed to test the difference between the elderly and the younger generations regarding the preferred amount of options given on a website. Then, the goal of the testing was to try to formulate guidelines for designers.

During my study, I was able to note a difference in the behaviors of the younger adult population to the middle-aged and senior population regarding choice behavior and preferences. The younger adults did prefer more options than older adults and did spend more time looking through the options. However, there was no significant difference noted between the middle-aged adult and senior population preferences and behavior.

I was not able to meet the second goal of my study. My study was too limited to be able to give concrete guidelines for a designer. However, I did have other user experience takeaways from my testing. One thing I discovered, is that users' preference in the number of options they appreciate depends on the task and interest level. For example, most users did not complain about the number of options on Amazon. Next, there were several takeaways I learned about website features and elements based off user feedback that are important guidelines to follow when creating sites that present users with options. These guidelines include optimizing filters systems, the system's ease of use, and search engines. It also includes ensuring that the choices presented are relevant and various. Lastly, infinite scroll navigation, graphics, font size, and layout affect how users perceive the choices they are presented with on an interface.

Further areas to study would be the infinite scroll and its relation to choice overload. Does the infinite scroll make a difference in the number of options perceived by the users? Also, disabilities and choice set size would be interesting to study. Perhaps fewer choices would make sites more accessible and user-friendly to those with disabilities.

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Optimal amount of options for the senior population; Guidelines for a Designer.

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Appendix:

Appendix A.

Pre and post survey questions:

Before:

How often do you use technology?

Do you feel comfortable with technology?

Do you consider yourself a good decision maker?

Do you usually regret a decision after you make it? Why would that be?

Do you usually make decisions on your own or ask others their opinions and advice?

After:

How did you feel while you went about completing the assigned task?

Was it hard for you to make a decision?

Why?

What in specific was hard?

Do you regret the decision you made?

Do you think you could have chosen a better option?

Why didn't you choose that better option?

Is this something you feel you struggle with often?

How would you suggest technology improve this for you?

What do you feel is the preferred amount of options?