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The "Visual Preference Heuristic": The Influence of Visual versus Verbal Depiction on Assortment Processing, Perceived Variety, and Choice Overload

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The "visual preference heuristic" suggests that consumers prefer visual to verbal depiction of information in a product assortment. Images produce greater perceptions of variety than text, which is appealing in assortment selection, but can result in choice complexity and overload when choice sets are large and preferences are unknown, suggesting a moderator for Iyengar and Lepper's results. Eye-tracking results reveal that the natural gestalt processing of individual visual stimuli, as compared to the piecemeal processing of individual textual stimuli, affects the processing of the assortment as a whole with visual (compared to verbal) presentation facilitating a faster, though more haphazard, scanning of the assortment. While the less systematic processing that results from visual presentation feels easier, it is not ideal for larger assortments resulting in higher complexity ratings and choice overload than with text depiction. These findings reveal that, like many heuristics, preference for visual depiction may be overapplied.

As online access becomes increasingly common, consumers are becoming multichannel shoppers, as likely to view product assortments online as offline. The online environment allows the number of options offered to be quite large as there are not the constraints that exist in brick and mortar environments. Instinctively, consumers prefer more variety, yielding a greater chance that their preferences will be matched (Kahn and Lehmann 1991). Yet we also know there is a downside to too much variety; it can be overwhelming and lead to choice overload. Product assortments that are large and complex can cause consumers to feel overwhelmed and dissatisfied or to opt not to make a choice at all (Huffman and Kahn 1998; Iyengar and Lepper 2000; Jacoby, Speller, and Berning 1974). Also, consumers dissatisfied with the shopping process because of large product assortment are less likely to revisit the store or repurchase (Fitzsimons, Greenleaf, and Lehmann 1997). So while greater variety is generally preferred when choosing among assortments, when consumers are faced with actual option selection, variety can make the process more difficult and complex.

The actual variety of an assortment, as in the number of stock-keeping units (SKUs) within a category, is usually referred to in the retailing industry as the assortment depth (Mantrala et al. 2009). Further, *perceptions* of variety can differ even when actual variety is held constant. In fact, the likelihood that consumers will purchase from a retail site is positively related to the perceived variety that they think the assortment offers, rather than the actual variety (Broniarczyk, Hoyer, and McAlister 1998). Huffman and Kahn (1998) showed that when actual variety in choice sets was large and overwhelming, perceived variety and hence consumer satisfaction could be controlled through both the way information about the options was presented and consumer input in the product examination process. Others found that

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perceived variety varied as a function of the organization of the assortment (Hoch, Bradlow, and Wansink 1999; Kahn and Wansink 2004), the relative symmetry in the frequencies of the items in the assortments (Young and Wasserman 2001), and individual differences (Morales et al. 2005).

Here we consider how perceived variety of an assortment online varies as a function of whether the options are presented using words or images. While assortments can be presented using a combination of the two, in many cases one information mode dominates in initial scanning, particularly when viewing a retailer's offering on a small screen. For example, many applications for shopping on a tablet or smartphone (e.g., those from Zappos, Gilt, or Amazon) prioritize one mode on the initial screen (e.g., visual) and then the other mode on subsequent screens (e.g., more detailed verbal description).

Holding constant the number of options, assortment organization, and amount of information offered about each option, we show how presentation format, whether presented visually or verbally, influences perceptions of variety and complexity. We find that when selecting an assortment of options, greater perceived variety is preferred. However, in the choice stage, when considering individual options, too much perceived variety can increase complexity and cause consumers to delay or opt out of choice. We predict that visual depiction, which increases perceived variety, is generally preferred to verbal depiction in the first stage, the assortment decision. However, subsequently, when individual options are considered, visual depiction is not always optimal as, with larger choice sets, it can increase perceived complexity and thus lead to greater choice deferral. We focus on conditions when preferences are unknown, in line with most of the choice overload literature (Scheibehenne, Greifeneder, and Todd 2010).

Past research examining the differences in processing of images versus words provides an explanation for these findings. Images are processed in a gestalt manner that is faster, less deliberate, and thus feels easier than the piecemeal processing that is associated with verbal stimuli. Additionally, since gestalt processing allows for parallel rather than sequential recognition of attributes, it is easier to identify attribute interactions (Holbrook and Moore 1981; Veryzer and Hutchinson 1998), which increases the perceived variety of the assortment. Together these aspects of gestalt processing result in a preference for visually presented assortment choice sets. Thus we predict the existence of a "visual preference heuristic," whereby consumers generally opt for visual presentation over verbal.

However, in large choice sets, the increased perceptions of variety are accompanied by increased perceptions of complexity, which can result in choice overload. When consumers are forced to examine many options for choice, the faster, easier, and less deliberate gestalt processing that naturally occurs with images is less desirable (Hoch and Deighton 1989; Meyer 1986, 1987). In addition, we propose that the mode of processing used to examine individual images carries over to the manner in which the entire assortment is considered, resulting in a faster and less systematic approach for visual as opposed to verbal assortments. Compared to gestalt processing, the slower, more deliberate piecemeal processing of words, while making verbal assortments less preferred, is a more effective form of processing of large choice sets both for the individual items as well as the full assortment. It follows in cases when preferences are not known and further scrutiny of the large choice set is required, the preference for visual depiction may not always be optimal. As such this research offers three key contributions:

1. We identify and find evidence of a "visual preference heuristic": consumers choose visual over verbal depiction of choice sets, regardless of choice set size.
2. We observe the influence of presentation format on choice behavior revealing visual presentation to be suboptimal for large choice sets when preferences are unknown.
3. We show that the manner in which individual options are processed has a carryover effect to the examination of the entire assortment.

THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

Distinctive Processing of Images and Words

Studies using brain-imaging techniques show that, while there is a common neural network activated by both verbal and visual processing, there are also specific areas of brain activation for each form: the left inferior parietal lobule for the processing of words versus the right middle occipital gyrus for processing pictures. In considering higher level processing such as memory, expectation, and attention, researchers examine event-related potentials (ERPs), neural signs that reflect brain activity. Studies comparing ERPs of words and pictures find consistent differences between the two (see Khateb et al. [2002] for review). Paivio's dual coding theory (1971, 1986) describes two distinct but interconnected systems—one visual and one verbal.

In addition to these differences in brain activation, images are also processed more quickly and automatically, and the connection between an image and its meaning is more direct than it is for words (Luna and Peracchio 2003; Paivio 1971; Unnava and Burnkrant 1991). Carr et al. (1982) investigated the use of primes and found that images offer faster and more automatic access to their meanings than to their names, while words have faster and more automatic access to their names than their meanings. Images also trigger more emotional processing than do words (Hsee and Rottenstreich 2004; Lee, Amir, and Ariely 2009; Lieberman et al. 2002).

Additional evidence for the automatic and even unconscious nature of image processing can be found by observing how aspects of aesthetics, such as symmetry or certain proportions (e.g., the golden ratio), can influence perceptions of attractiveness without explicit awareness (Arnheim 1974;

Birkhoff 1933). Studies using images of facial expressions show that the meanings of facial expressions are automatically processed (e.g., Stenberg, Wiking, and Dahl 1998). Because it is faster and more automatic, the processing of images rather than words likely feels easier.

Gestalt versus Piecemeal Processing. In addition to these more automatic reactions, there are also differences in the manner in which information is interpreted. Words and numbers must be processed sequentially or in a piecemeal manner, whereas an image can be processed all at once (Hart 1997). Similarly, Paivio (1986) describes the imagery system as able to work in parallel, while the verbal system works sequentially. However, Sharps and Nunes (2002) suggest that it is inappropriate to think of these two modes of depiction as two rigidly separated processes operating in isolation, but that it is better to think of these processing styles as lining up along a continuum. While they show that consistent with the prior thinking, images tend to be processed in a more gestalt fashion and verbal material in a more piecemeal fashion, they find that within the visual modality alone, one can illustrate stimuli in a piecemeal as well as a gestalt manner; however, the latter is more realistic and prevalent. The visual stimuli we use in this research will be of the more common format that can be processed in a gestalt manner.

Preference for Choice Sets. Because of the natural gestalt processing that occurs with images versus the slower and more deliberate piecemeal processing that occurs with words, an assortment presented in visual format seems faster and easier to process (Holbrook and Moore 1981; Veryzer and Hutchinson 1998). We predict that consumers are likely to choose the assortment that they perceive will allow them to engage in a fast and easy decision process and therefore hypothesize the following:

H1: Consumers will generally prefer visual over verbal depictions of choice options.

We refer to this as the visual preference heuristic and next consider a boundary condition for this prediction. If this preference is driven, at least in part, by the perception that viewing images allows for an easier choice process, then in situations when this seems not to be the case, we would expect the preference to go away. While our prediction of the visual preference heuristic is based on the processing of images versus words, consumers likely only recognize a general choice process and not individual parts (processing, evaluation, etc.). Therefore, making the choice process seem more difficult with images than with words ought to attenuate the visual preference. We test this by manipulating how easy it is to discern differences in attribute levels in visual versus verbal presentation. We predict the following:

H2: When visual attribute discernment is more difficult and therefore choice from visual presentation seems more difficult than from verbal presentation, the preference for visual depiction will be attenuated.

To determine whether preference for visual presentation is optimal, we consider how assortment presentation might influence assortment processing, the resulting assortment perceptions, and subsequently choice behavior.

Processing of the Assortment as a Whole. We predict that the differences in processing of images versus words influence, not only the processing of the individual items within the choice sets, but also how the choice sets are examined as a whole. We proffer that the piecemeal processing required for each verbal stimulus motivates a more systematic processing of the choice options as a set, yielding a more methodical evaluation, more time spent, and a lower likelihood of skipping or bypassing information about individual choice options. When options are presented verbally and consumers process in a piecemeal fashion, they read the information about each option in a more structured systematic manner—sequentially horizontally or vertically. In contrast, the gestalt processing that naturally occurs with each visual stimulus likely encourages a faster, less systematic processing of a visual choice set where options are evaluated more randomly.

The result is that with gestalt processing, less time is spent considering each option, the examination path between options is more haphazard, and there is a greater likelihood that options may be overlooked. However, the impact of a less systematic style of processing on such factors should depend on the number of options in the choice set. For example, the likelihood that any option will be skipped increases as the number of options in the set increases. Similarly, with larger choice sets there are more degrees of freedom in terms of movement paths. We therefore hypothesize the following:

H3: In larger choice sets, visually depicted assortments will be processed in a less systematic manner than verbally depicted assortments.

Additionally, we predict that this more systematic processing that occurs with verbal rather than visual depiction in larger choice sets—both at the individual item level as well as across the assortment—will result in a more comprehensive, less idiosyncratic processing of the items in the set. Moreover, there ought to be measurable behavioral differences in response to the different types of processing. Specifically, the more comprehensive and less idiosyncratic processing is likely more effective, resulting in better recognition and retention of items in the assortment. However, we also expect this behavioral response will depend on the size of the choice set. In smaller choice sets, where a cursory examination of options is likely adequate, we do not expect to see differences in processing as a function of depiction. However, in larger choice sets where the more systematic processing that is motivated by verbal depiction would be beneficial, we would expect to see a difference across depiction modes. We therefore predict the following:

H4: In larger choice sets, the systematic processing that naturally occurs with verbally depicted items

(as opposed to visually depicted items) will result in better recognition and retention of more items in the assortment. In smaller choice sets, this will not be the case.

Hypotheses 3 and 4 suggests that the preference for visual depiction of choice sets is not always optimal and may differ as the stage of choice process (and hence the consumer goal) changes. To support this intuition, we next discuss how these processing differences generated by format can influence perceptions of variety and complexity of the choice set. We begin with an overview of the literature that shows why those assortment perceptions matter.

Variations on variety and complexity perceptions by stage of choice.—To attract consumers to an assortment, managers try to increase perceptions of variety, the positive and attractive aspect of assortment, while minimizing perceptions of complexity, the negative aspect of assortment, that can occur during the choice stage and cause choice overload. Scheibehenne et al. (2010) provided a meta-analysis of the research investigating choice overload. This meta-analysis found a mean effect size of zero for choice overload but found considerable variance between studies. As Chernev, Böckenholt, and Goodman (2010) suggest, the interesting question is not whether choice overload occurs but *when* it occurs, and thus the key is to identify the conditions that can minimize or maximize choice overload. The meta-analysis argues that one necessary precondition for overload is a lack of familiarity with, or prior preferences for, items in the choice set. Another precondition is that there is no dominant option in the set. In our studies we only examine choice sets where preferences are unknown and there are no dominant options.

Existing research offers some prescriptions for maintaining the same amount of actual variety but mitigating the negative effects of perceived complexity. For example, Hoch et al. (1999), Kahn and Wansink (2004), and Young and Wasserman (2001) suggest the organization of the options can be varied so that the same assortment can be offered in a manner that minimizes perceived complexity. More recently, Mogilner, Rudnick, and Iyengar (2008) demonstrated the "mere categorization effect," that the number and content of category labels can affect perceptions of variety at the assortment stage and customer satisfaction at the choice stage. This complements the work by Morales et al. (2005), which showed that matching external structure in the store with internal personal categorization of the category can also minimize the complexity of large assortments. All of this suggests that while perceptions of variety and complexity may be highly correlated, there are ways in which the two can be disentangled. Specifically, perceived variety is relevant when consumers are at the first stage of the choice process, and their goal is to choose an assortment. Perceived complexity is relevant when consumers are at the second stage of the choice process and their goal is to choose an option from within the assortment. We propose that visual/verbal presentation format is another important moderator for understanding how perceptions of variety and complexity may vary at different stages of the choice process.

Variety perceptions.—With respect to perceived variety, we predict a main effect. We predict that the natural gestalt processing of images versus piecemeal processing of words will influence perceptions of variety of the assortment. When choice options are described in words, each attribute of the option is processed individually, making consideration of the interactions among the various attributes difficult. In contrast, when choice options are presented in images, all attributes are processed simultaneously. The recognition of attribute interactions as well as main effects increases the number of permutations, and thus perceptions of variety increase. Hence, we hypothesize the following:

H5: Perceived variety will be higher for visually versus verbally depicted choice sets.

Complexity perceptions.—Perceived complexity occurs when the consumer goal is to choose among options within the assortment, and at this stage the size of the choice set becomes relevant. When choice sets are at least moderately complex and unfamiliar, processing in a gestalt or alternative-based manner is difficult (Hoch and Deighton 1989; Meyer 1986, 1987). When information can be processed in smaller chunks, for example, in a piecemeal fashion, the information is easier for nonexperts to process (Alba and Hutchinson 1987; Chase and Simon 1973). Huffman and Kahn (1998) found that for large choice sets, presenting information in an attribute-based setting, rather than in an alternative-based setting (which requires more gestalt processing) reduced perceived complexity. It follows then that when considering a large choice set with unfamiliar stimuli, there may be advantages to verbal presentation over visual. Per hypothesis 3, when options are presented verbally and consumers process in a piecemeal fashion, they consider the information both within and across options in a structured systematic manner. Taken together, we therefore predict the following:

H6: In larger choice sets, respondents who see options described verbally will perceive less complexity in the choice options than respondents who see options described visually.

There is evidence to suggest that the relative importance and preference for variety and complexity varies by stage of the choice process as consumers' goals change. For example, Novemsky and Ratner (2003) showed that consumers believe in the positive effect of contrast (which can be obtained by adding more variety), in anticipation of consumption, but during the actual consumption there are no positive advantages of the variety or contrast experienced. Construal theory (Trope and Liberman 2010) also predicts that psychological distance from the choice alters preferences. For example, consumers prefer desirable over feasible alternatives in thinking about the future and prefer more feasible alternatives when thinking about the present.

These two theories suggest that at the first stage, before

any actual choices are made, consumers likely prefer assortments with more perceived variety. Therefore if, as we predict, visual presentation increases perception of variety (hypothesis 5), this may further reinforce hypothesis 1 and the preference for visual depiction. However, as construal theory predicts, when the consumer then gets closer to the actual choice decision, the concrete trade-offs of each item become salient and perceived complexity is more relevant. Here feasibility becomes more important than desirability (Hamilton and Thompson 2007). This is consistent with Scheibehenne et al. (2010), who conclude that when consumers are focusing on the assortment, attractiveness tends to correlate positively with size of the assortment; however, when consumers are focusing on determining the appeal of a specific option, choice overload comes into play and consumers are overwhelmed with large choice sets. In order to make this final choice from the assortment, consumers have to process not just the entire assortment but also the individual options, and therefore the combination of the two influences perceptions of complexity. These complexity perceptions then influence what will ultimately be chosen or whether the consumer will opt out of making a choice.

It follows then when making a choice from a large choice set with unfamiliar stimuli, there may be advantages to verbal presentation over visual. The more systematic (hypothesis 3) and comprehensive (hypothesis 4) processing that occurs with verbal depiction likely makes the choice set less overwhelming, decreasing complexity (hypothesis 6) and thus decreasing choice overload. Support for this hypothesis exists in other empirical evaluations of choice. Bawa et al. (1989) found that consumers were more promotion-sensitive (which requires a systematic evaluation of numeric information) when presented with larger assortments than with smaller assortments. Thus, we hypothesize the following:

H7A: In a larger choice set, respondents who see options described verbally will be less likely to opt out of making a choice than respondents who see options described visually. In a smaller choice set, presentation format will not influence propensity to opt out of making a choice.

H7B: The perception of complexity will mediate the influence of presentation format on choice overload (propensity to opt out of making a choice).

So we are proposing perceptions of assortment complexity as another reason for choice deferral, in addition to the more traditional reasons already identified in the literature that focus on choice options themselves, such as choice difficulty resulting from the stress of trading off attributes of options or preference uncertainty resulting from the difficulty in finding the most attractive option among similar alternatives (Dhar 1997).

Taken together, these seven hypotheses suggest that there is a general preference for visual presentation of assortments, which we identify as the visual preference heuristic. Moreover, our theory predicts that like other choice heuristics, this visual preference is overapplied; while visual presentation may be sufficient or even optimal for smaller choice sets, with larger choice sets images result in inferior processing of the entire assortment, higher perceptions of assortment complexity, and choice overload.

Experiments

In five studies we offer support for these hypotheses. In study 1 we show that there is a general preference for visual presentation and that this preference exists regardless of choice set size and also in two product categories that differ on key dimensions related to the efficacy of visual/verbal depiction. In study 2, we use a product category and set of stimuli where differentiation on a key attribute is easier with verbal depiction than visual and show that the preference for visual depiction decreases. In study 3, using eye-tracking technology we show that with images consumers use a faster, more haphazard, and less systematic manner of examining the options than with verbal text presentation. The next two studies examine the consequences of this. In study 4 we consider performance on a matching task to examine how visual versus verbal presentation format influences processing effectiveness. Then in study 5 we show that in large choice sets visual depiction is not optimal and leads to higher perceptions of complexity and greater likelihood to opt out of choice.

In all of our experiments, we are careful to ensure that the information content of the presentation formats is held constant. We present respondents with a key that describes the product options both visually and verbally, thus insuring equivalent information for all conditions and controlling for any variation in interpretation of the meaning of the text or images. Also, as illustrated in the common phrase "a picture is worth a thousand words," images often contain more information than their verbal equivalent. To ensure that any differences we observe are not driven by additional information that might be intuited from realistic visual depictions, we use cartoon illustrations.

STUDY 1: PREFERENCE FOR VISUAL PRESENTATION FORMAT

In study 1, we test hypothesis 1 that there is a preference for visually presented assortments with two different sizes of choice sets. Since we believe this preference is based on the differences in processing styles of visual versus verbal depiction, we predict that choice set size should *not* affect the general preference for visual depiction.

We also use two product categories: mutual funds and crackers. Different product categories intrinsically lend themselves to presentation in one format or another. For example, at one extreme, products such as art or fashion that derive utility from aesthetics should have an inherent advantage with visual presentation and would be a weak test of our hypothesis, so we do not include such a product category. On the other extreme are products that are much more suited to textual rather than image depiction, products with attributes that offer no obvious visual depiction and

that consumers are used to seeing in text form. Mutual funds is an example of such a product category. In the middle of this spectrum would be a product like crackers, which can be presented both visually and verbally and where attribute interactions are not of obvious importance (e.g., flavor and shape do not likely interact). If such interactions did matter, this would offer an advantage to image depiction and therefore be a weak test of our hypothesis. We believe the results from crackers can be extrapolated to many categories, ones whose attributes can be expressed either verbally or visually, for example, many consumer package goods products, furniture (e.g., sofas, tables), or clothing (e.g., sports shoes). In fact, many of the product categories that are suggested for consumer-based customization, like Nike sports shoes, have this characteristic. Because our hypothesis is based on the differences in processing styles of visual versus verbal depiction, we predict that as long as the category can be expressed somehow visually, the preference for visual over verbal depiction should exist.

Finally, we also ask participants about their motivation for choice set selection. Because we believe the preference for visual over verbal is driven by the faster, easier, and seemingly more enjoyable processing of images, we expect these to be the motivations that participants who select images will state. Additionally, because we suspect that consumers identify and appreciate the greater variety that seems to come with visual depiction, we also predict a difference in application of this motive as well.

Method

Two hundred ninety participants (40% male, $M_{age} = 33$) who were recruited using Amazon's Mechanical Turk participated in the experiment online for compensation. Respondents were randomly assigned to one of two conditions that varied by product category—crackers or mutual funds. Additionally, we randomized between subjects the order of two questions—preference for presentation form (visual vs. verbal) and preference for number of options (8 vs. 27).

Respondents in the cracker conditions were told to imagine they were shopping for a party using an online grocery store and they had one item left on their shopping list to purchase, crackers. They were told the website offers a variety of crackers and then were shown three example crackers. This was a key that offered the information visually and verbally together (see app. A, fig. A1). The visual representation question explained that the website offers two presentation forms. Respondents were asked to select whether they wanted the options presented as "written descriptions of the crackers as expressed in words" or "visual images of the crackers as shown in pictures." After their choice, they were then shown three examples of cracker options in the form they chose. They were then told that the website offers two varieties of cracker options, either 8 crackers or 27 crackers. They were then asked to select from which variety of crackers they would like to choose. For respondents who were first asked about the number of options they would like to see, they were shown either 8 or 27 large Xs to demonstrate their choice before being asked about depiction style.

For both conditions, respondents were then shown the choice assortment they had selected: 8 or 27 options presented visually or verbally. Respondents were asked to rate the assortment on three 9-point scales measuring perceived variety ("This assortment of crackers offers a lot of variety," "This assortment of crackers gives me at least one option I like," and "How much variety do you think there is in this assortment?"). They were shown the assortment again and asked questions related to making a choice. These were our measures of perceived complexity ("This assortment of crackers in too complex to consider," "It is difficult to keep track of all the various options in this cracker assortment," and "There are too many options in this assortment of crackers"). These measures of variety and complexity are adapted from Kahn and Wansink (2004). Respondents were then asked to identify their motives for selecting the format and set size that they chose. They were given a list of 10 motives and asked to select up to three that best describes their reasons.

Respondents in the mutual funds conditions followed a similar procedure. However, they were told to imagine they had just received a $500 bonus from their job and that they were considering investing it in a mutual fund. They were then given a description of three attributes on which these mutual funds differed: fees, mean and standard deviation of annual return, and region of investment. They were then shown a key illustrating the various ways in which the mutual funds varied, and again the key displayed the information both in pictures and in words (see app. A, fig. A2). The rest of the survey was the same as for the crackers with appropriate product class edits.

All participants then filled out the 22-item visual versus verbal information processing scale (Childers, Houston, and Heckler 1985), basic demographic questions, and were asked to rate their concern with giving the correct response in the study on a 7-point scale.

Results

Twenty-seven participants (9.3%) who indicated that they had minimal concern with giving correct answers in the study (1 on 7-point scale) were excluded from this analysis, leaving a final sample of 263. (In future studies we excluded respondents based on the same criteria and report the initial sample based on the final number of participants.)

Assortment Presentation Preference. The majority (64.6%, $t(262) = 4.97$, $p < .001$) of respondents opted for options presented visually rather than verbally. This supports hypothesis 1. Looking only at respondents who were first asked about the number of options in the choice set, this did not influence preference for information representation with 60% (8 options) and 69% (27 options) selecting images ($\chi^2(1, N = 136) = 1.11$, $p = .29$). Additionally, respondents who saw crackers were not significantly more likely to opt for visual presentation than those who saw mutual funds (crackers: 67.2%, mutual funds: 61.9%; $\chi^2(1, N =$

263) = .79, p = .37), suggesting that the visual preference is very strong. Additionally, there is no effect of category type on choice of number of options (8 options = 66.2%; 27 options = 33.8%; $\chi^2(1, N = 263) = .03$, p = .87). Going forward, we report the results across product categories except where there were significant differences.

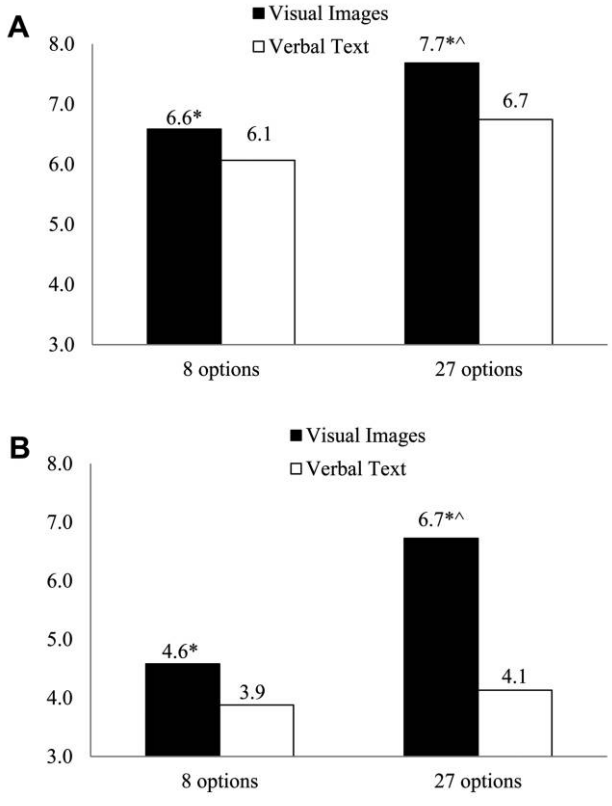
Individual differences in processing as measured by the Childers et al. scale (1985) influence the choice of presentation format ($B = -.06$, Wald $\chi^2 = 10.34$, p = .001), whereby those who are more verbal processors and less visual processors are less likely to have selected the visual presentation format. There is no effect of this individual difference variable on choice of number of options ($B = -.009$, Wald $\chi^2 = .28$, p = .59).

Assortment Perceptions. In terms of perceptions of variety ($\alpha(3) = .81$) there is a main effect of number of options in the obvious direction (large > small; $M_{27\text{ options}} = 7.4$, $M_{8\text{ options}} = 6.4$; $F(1, 262) = 22.59$, $p < .001$). This is also the case for ratings of complexity ($\alpha(3) = .87$; $M_{27\text{ options}} = 5.9$, $M_{8\text{ options}} = 4.3$; $F(1, 262) = 36.88$, $p < .001$). As hypothesized, selected presentation format also affects both of these ratings with visual presentation leading to higher ratings of variety ($M_{\text{visual}} = 7.0$, $M_{\text{verbal}} = 6.3$; $F(1, 262) = 28.10$, p = .001) and complexity ($M_{\text{visual}} = 5.3$, $M_{\text{verbal}} = 4.0$, $F(1, 262) = 29.33$, $p < .001$), supporting hypotheses 5 and 6. An analysis of means reveals that the difference in both variety and complexity ratings between 8 and 27 options is driven by the visual image conditions (variety: $F(1, 169) = 28.8$, $p < .001$; complexity: $F(1, 169) = 62.7$, $p < .001$) and not the verbal text conditions (variety: $F(1, 92) = 2.5$, p = .12; complexity: $F(1, 169) = .48$, $p < .49$). Additionally there is an interaction effect of number of options and presentation format on complexity ($F(1, 262) = 15.07$, $p < .001$) but not on variety ($F(1, 262) = .98$, p = .32). This offers support for hypothesis 6. An analysis of means reveals that the effect of presentation format on measures of complexity is greater among 27 options ($M_{\text{visual}} = 6.7$, $M_{\text{verbal}} = 4.1$; $F(1, 88) = 39.7$, $p < .001$) than among 8 options ($M_{\text{visual}} = 4.6$, $M_{\text{verbal}} = 3.9$; $F(1, 173) = 6.5$, p = .01) though both are significant. (See fig. 1*A* and *B* for means by condition. For product category differences, see table 1.) Processing style is not a significant covariate in predicting either variety ($F(1, 262) = .04$, p = .90) or complexity ratings ($F(1, 262) = 2.67$, p = .36), which is to be expected given processing style influenced assortment choice.

Assortment Choice Motives. Participants who selected visual presentation were more likely to say this was driven by the motive to make the task easier, quicker, more enjoyable, and to see the most variety (all $\chi^2(1, N = 263) > 4.5$, $p < .05$). Meanwhile, those who selected verbal presentation were more likely to say they did this in order to see the most information ($\chi^2(1, N = 263) = 17.9$, $p < .001$) and allow for a more precise examination ($\chi^2(1, N = 263) = 22.5$, $p < .001$). Participants who selected the smaller choice set were more likely to claim they were motivated by wanting to make the task easier ($\chi^2(1, N = 263) = 44.8$, $p <$ .001), quicker ($\chi^2(1, N = 263) = 14.9$, $p < .001$), and because they knew they would need to spend a great deal of time ($\chi^2(1, N = 263) = 18.2$, $p < .001$). In contrast, those who selected 27 options were, not surprisingly, more likely to say that their choice was motivated by a desire to view more variety ($\chi^2(1, N = 263) = 124.8$, $p < .001$) but also to get the most information ($\chi^2(1, N = 263) = 20.1$, $p < .001$) and to make the best choice ($\chi^2(1, N = 263) = 33.2$, $p < .001$; see table 2).

FIGURE 1

STUDY 1: VARIETY AND COMPLEXITY RATINGS



NOTE.—Variety ratings (*A*) and complexity ratings (*B*). The asterisk (*) indicates significantly larger within 8/27 options at $p < .05$. The arrow (^) indicates significantly larger within visual images/verbal text at $p < .05$.

Discussion

We find support for hypothesis 1; there is a general preference for visual presentation over verbal when options are unfamiliar, and this preference exists across choice set sizes and product categories. Moreover, while the individual difference measure of visual versus verbal processing does influence presentation choice, the effect is not strong (B =

TABLE 1

STUDY 1: RATINGS OF VARIETY AND COMPLEXITY BY PRODUCT TYPE

	Chose 8 items		Chose 27 items	
	Chose verbal words	Chose visual images	Chose verbal words	Chose visual images
Crackers:				
N	35	56	10	36
Variety	5.6*	6.6*	7.4	7.5
Complexity	3.9*	5.2*	3.9*	6.9*
Mutual funds:				
N	28	56	20	22
Variety	3.8	4.0	4.2*	6.5*
Complexity	6.6	6.6	5.4*	8.0*

*Indicates significantly different at $p < .05$.

−.06), again illustrating the widespread nature of the preference. Ratings of variety and complexity provided initial support for hypotheses 5 and 6, though without random assignment. Moreover, because respondents were able to select their own choice set, these results are particularly noteworthy in that prior research suggests that participants would be confident in their choices and report high perceptions of the choice sets to confirm their decisions (Lichtenstein, Fischhoff, and Phillips 1982; Ronis and Yates 1987). Our findings on these two measures appear to be universal with no significant effects of individual differences in processing style. The results suggest that visual presentation of choice sets consistently leads to higher perceptions of both variety and complexity but that a greater number of options *only* leads to greater perceptions of variety and complexity when the options are presented visually in images and not when presented verbally in text. In other words, presentation format has a greater influence on these assortment perceptions than does increasing the actual amount of assortment while maintaining verbal presentation.

The results from the motives questions suggest that, in line with prior work on gestalt versus piecemeal processing, consumers perceive visual presentation to be an easier, faster, and more enjoyable format and that verbal presentation is better suited for a precise examination. If this is the case, then when visual presentation does not seem as if it will offer the easier, faster, and more enjoyable choice experience, the preference should decrease. We explore this in the next study.

STUDY 2: ATTENUATING THE PREFERENCE FOR VISUAL PRESENTATION

To test hypothesis 2 in study 2 we manipulate the ease of the choice process. We examine this both holding information constant and also with verbal presentation not only offering greater discernment but also more information than visual as a stronger manipulation of this same construct. We expect that when choice with visual presentation is manipulated to seem less easy, the preference for visual presentation will decrease.

Method

One hundred seventy-one participants (43% male, M_{age} = 35) who were recruited using Amazon's Mechanical Turk participated in the experiment online for compensation. Respondents were randomly assigned to one of six conditions in a 3 (perceptual similarity of the nail polish colors: control/not similar, similar, versus similar-explained) by 2 (choice set size: 8 vs. 27 options) between-subjects design.

Respondents were told to imagine they had decided to purchase nail polish as a small present for a female friend and were shopping at an online beauty supply store. They were told the website offers a variety of nail polishes and that the options vary on the shape of the bottle, the color, and the type of glitter. Respondents were shown a key that presented the information both verbally in words and visually in pictures. For the control color condition there were three easily distinguishable colors—a blue, a red, and a pink. In both the similar color and similar-explained color conditions the three colors were all shades of pink, which were different from each other but were more difficult to discriminate. In the control and similar color conditions the verbal description of the names offered basic color information (busy blue, ballet pink, and ruby red in the control and bold pink, perfect pink, and softest pink in the similar color conditions). We chose names in the verbal condition that, while different, did not offer much information about the differences in the hues to hold information about the relative "pinkness" of the color constant. In contrast, in the similar-explained color condition, the names were 001 most pale pink, 002 light pink, and 003 medium pink, offering information on the shade of pink (see app. B, fig. B1). After viewing the key, participants were then told that they would be shown either 8 or 27 options, depending on the condition. They were then told "when making your nail polish selection, please indicate how you would prefer to be presented with the nail polish options" either in "written descriptions of the nail polishes as expressed in words" or "visual images

TABLE 2

STUDY 1: PERCENT OF RESPONDENTS SELECTING MOTIVES FOR CHOICE OF PRESENTATION FORMAT AND NUMBER OF OPTIONS

Reason for selection	Chose verbal words	Chose visual images	Chose 8 options	Chose 27 options
N	93	170	48	78
Most information about options	49.5*	23.5*	9.2*	31.5*
Allow for more precise examination	47.3*	18.2*	31.0	39.3
Task easier	31.2*	46.5*	50.6*	9.0*
To make the best choice	31.2	29.4	17.8*	52.8*
Knowing I would spend a great deal of time	21.5	15.9	37.4*	12.4*
Make task less complex	21.5	26.5	44.8*	3.4*
To make the choice quickly	15.1*	34.1*	33.3*	11.2*
Due to difficulty	9.7	9.4	6.9	4.5
Task more enjoyable	7.5*	29.4*	15.5	16.9
To view most variety of options	9.7*	20.6*	5.2*	70.8*

*Indicates significantly different within presentation format or number of options comparison at $p < .05$.

of the nail polishes as shown in pictures" and were shown three examples of each. They were then shown the choice assortment they had selected—8 (27) options presented visually (verbally) and were asked the same follow-up questions as in study 1. Finally, participants were reminded that they were purchasing nail polish for a friend and were asked to make a selection. They were given the option to select one option, multiple options, or "none of the above." They then rated the relative importance of the three product attributes in a constant sum question.

Pretest on Ease. One hundred fifty-two participants (64% male, $M_{age} = 28$) who were taken from the same population as the main study were randomly assigned to one of five conditions in a 2 (presentation form: image vs. text) by 3 (perceptual similarity of the nail polish colors: control/not similar, similar, vs. similar-explained) design. Participants were given the same purchase context, shown the condition-consistent 8-option assortment, and asked to rate it on two difficult/easy 7-point scales: ability to discern the differences between the products and ability make a choice from this choice set. Averaging the two ease measures ($\alpha(2) = .89$) among participants in the control conditions, the visual image condition is rated as easier than the text condition ($M_{\text{visual images}} = 4.82$, $M_{\text{verbal text}} = 3.73$, $t(57) = 2.94$, $p = .005$). In both the similar and similar-explained conditions this is not the case, with no difference on either measure (similar colors: $M_{\text{visual images}} = 3.57$, $M_{\text{verbal text}} = 3.20$; $t(61) = .98$, $p = .33$; similar-explained colors: $M_{\text{visual images}} = 3.57$, $M_{\text{verbal text}} = 3.44$; $t(58) = .26$, $p = .77$).

Results

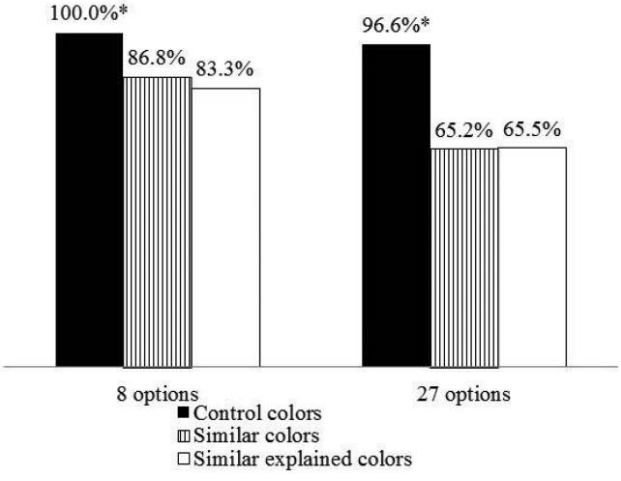
Results of the constant sum question reveal a significant difference in importance weights ($F(2, 512) = 155.83$, $p < .001$), whereby color ($M = 53.3$) is considered more important than both glitter ($M = 25.9$; $t(170) = 11.39$, $p < .001$) and bottle shape ($M = 20.87$; $t(170) = 11.97$, $p < .001$). This did not vary across color conditions ($F(2, 170) = .16$, $p = .89$), choice of presentation format ($F(1, 170) = .02$, $p = .90$) nor their interaction ($F(2, 170) = .73$, $p = .48$). This confirms that the manipulation of color conditions, indeed, varied ability to discriminate on an attribute that influences the choice decision. Also, across measures there were no significant differences between the similar colors and similar-explained colors conditions. Thus, we collapse across these two conditions when reporting (referring to both as similar colors$_2$).

Assortment Presentation Preference. The majority (83.6%, $t(170) = 11.84$, $p < .001$) of respondents chose options presented visually rather than verbally. Examining the percentage selecting visual presentation format, there was a main effect of color (control colors = 98.2%, similar colors$_2$ = 76.3%, $\chi^2(1, N = 171) = 13.3$, $p = .001$), a main effect of number of options (8 items = 90.0%, 27 items = 76.5%, $\chi^2(1, N = 171) = 5.6$, $p = .02$), and an interaction of these two ($\chi^2(1, N = 171 = 18.2$, $p < .001$). An analysis of means reveals that the effect is stronger within 27 items (control colors = 96.6%, similar colors$_2$ = 65.3%, $\chi^2(1, N = 81) = 10.1$, $p = .002$), than within 8 items (control colors = 100.0%, similar colors$_2$ = 85.4%, $\chi^2(1, N = 90) = 4.5$, $p = .03$; see fig. 2). Individual differences in processing as measured by Childers et al. (1985) influence the choice of presentation format ($B = -1.4$, Wald $\chi^2 = 54.52$, $p = .001$) whereby those who are more verbal processors and less visual processors are less likely to have selected the visual presentation format. There was no effect of gender on choice of presentation form (visual choice: male = 86.4%, female = 80.4%, $\chi^2(1, N = 171) = 1.1$, $p = .29$).

Assortment Perceptions. As in study 1 we examine the perceptions of both variety and complexity and how these differ across the resulting choice sets. Because the number of participants selecting verbal is so low, once we cross this by color condition and number of options, the verbal text conditions range in size from $N = 0$ to $N = 10$. Therefore, finding any significant differences between groups would be noteworthy not only (as in study 1) be-

FIGURE 2

STUDY 2: CHOICE OF VISUAL REPRESENTATION DECREASES WHEN VERBAL REPRESENTATION DOES NOT OFFER GREATER EASE



* Indicates significantly larger within 8/27 at $p < .05$.

cause the presentation form is their choice but also because we are considering very small sample sizes. When examining perceptions of variety ($\alpha(3) = .78$) there are no main effects (all $F > .10$). When examining perceptions of complexity ($\alpha(3) = .89$), the results replicate the findings from study 1 whereby image presentation leads to higher ratings of complexity ($M_{\text{visual images}} = 5.0$, $M_{\text{verbal text}} = 3.1$; $F(1, 170) = 10.4$, $p = .002$), particularly among 27 options (marginal interaction term: $F(1, 170) = 3.1$, $p < .10$; see table 3 for full results and descriptions of main effects).

Assortment Choice Motives

Across color conditions, participants who selected visual presentation were more likely to say this was driven by the motive to make the task easier ($\chi^2(1, N = 171) = 5.5$, $p = .02$), more enjoyable ($\chi^2(1, N = 171) = 16.3$, $p < .001$), more variety ($\chi^2(1, N = 171) = 4.0$, $p < .04$), less complex ($\chi^2(1, N = 171) = 4.3$, $p = .04$), and (marginally) quicker ($\chi^2(1, N = 171) = 3.2$, $p = .08$). Meanwhile, those who selected verbal presentation were more likely to say they did this in order to see the most information ($\chi^2(1, N = 171) = 45.0$, $p < .001$) and allow for a more precise examination ($\chi^2(1, N = 171) = 4.4$, $p = .04$). These results replicate those from study 1 and support our theory. There were no significant differences in motives selected across color conditions (all $p > .10$; see table 4 for full results).

Choice Overload

A binary logistic regression with color conditions, number of options, visual preference, and all of their interactions as covariates reveals there is a marginal effect of number of options (Wald $\chi^2 = 3.51$, $p < .10$) whereby participants who saw 8 options were less likely to opt out of choice (3.3%) than those who saw 27 options (14.81%, $\chi^2(1) = 7.02$, $p = .01$). Analysis of values across cells reveals that across the three color conditions there is a trend whereby participants who saw 27 options and selected visual presentation were most likely to opt out of choice. While this pattern is directional, it is not significant, likely due to the small sample sizes for some cells. It is evident that this result is driven by the visual image conditions and not the verbal text conditions providing initial support for hypothesis 7A (see table 3).

Discussion

Using the visual category of nail polish, it is not surprising that we saw an even stronger preference for visual presentation than in study 1. Yet, within this category, we were able to attenuate this preference by decreasing the ease with discernment on the most important attribute could occur with visual presentation. This supports hypothesis 2. While the greater ease of processing that accompanies image depiction produces a general sense of an easier choice process (as evidenced in the choice motives results), other factors, such as ease of attribute level differentiation, can overcome this causing image depiction to lose its preferred status. Nevertheless, even in the close color conditions, the majority of respondents opted for visual presentation. We also included two text conditions, one in which color discernment was greater in text than in visual and one where the text also offered additional informative cues in the form of numerical ratings and useful names. Unexpectedly, there were no differences between these two conditions.

We asked respondents to evaluate their selected choice set and, as in study 1, a larger choice set leads to greater perceptions of complexity only when options are presented visually. This suggests that visual representation, while more popular, may not be optimal with large choice. The choice overload results seem to corroborate this idea. Although not significant due to uneven cell sizes, the results within the visual presentation format suggest that, as the number of options increases, participants are actually less likely to select an option and more likely to opt out of choice. These findings are particularly noteworthy when considered in the context of prior work on choice set size and choice overload. For example, Iyengar and Lepper (2000) found that increasing the choice set size from 6 to 24 in the context of jam, a largely visual stimulus set, led to significantly fewer people making a purchase. We find a similar result within our visual presentation format conditions in study 2. Additionally, considering the complexity ratings, we find among those who elected visual representation, greater ratings on complexity when the choice set size increases from 8 to 27 options. However, among respondents who selected the options dis-

TABLE 3

STUDY 2: RATINGS OF VARIETY AND COMPLEXITY AND PARTICIPANTS OPTING OUT OF CHOICE

	8 options		27 options	
	Chose visual images	Chose verbal text	Chose visual images	Chose verbal text
Total across conditions:				
N	81	9	62	19
Variety rating	6.3	6.2	6.9	6.7
Complexity rating	3.9	3.4	6.2**	3.8
Percent opting out of choice	3.70	0	19.4**	0
Control condition:				
N	28	0	28	1
Variety rating	6.8	. . .	7.1	8.7
Complexity rating	3.5	. . .	6.2**	2.0
Percent opting out of choice	0.0%	. . .	21.4%	0.0%
Similar colors:				
N	33	5	15	8
Variety rating	5.9	6.3	6.0	6.6
Complexity rating	4.0	3.6	6.1**	3.4
Percent opting out of choice	9.1	0.0	13.3	0.0
Similar-explained colors:				
N	20	4	19	10
Variety rating	6.3	6.0	7.2	6.6
Complexity rating	4.4	3.1	6.2**	4.4
Percent opting out of choice	3.7	0.0	19.4	0.0

NOTE.—No main effects on variety rating: color condition ($M_{\text{control colors}} = 7.5$, $M_{\text{similar colors2}} = 6.4$; $F(1, 170) = 2.7$, $p = .11$), number of options ($M_{8\text{ options}} = 6.3$, $M_{27\text{ options}} = 7.3$; $F(1, 170) = 1.6$, $p = .20$), visual preference ($M_{\text{visual images}} = 6.7$, $M_{\text{verbal text}} = 7.2$; $F(1, 170) = .83$, $p = .36$). Main effect on complexity rating: no effect of color conditions ($M_{\text{control colors}} = 3.9$, $M_{\text{similar colors2}} = 4.4$; $F(1, 170) = 2.0$, $p = .16$), main effect of number of options ($M_{8\text{ options}} = 3.7$, $M_{27\text{ options}} = 4.6$; $F(1, 170) = 24.8$, $p < .001$), main effect visual preference ($M_{\text{visual images}} = 5.0$, $M_{\text{verbal text}} = 3.1$; $F(1, 170) = 10.4$, $p = .002$), marginally significant interaction of number of options and visual preference ($F(1, 170) = 3.1$, $p < .10$).

**Indicates significantly different within number of options at $p < .05$.

played verbally, we find no evidence of the Iyengar and Lepper overload and the pattern of results suggests that with a larger sample size we might see no difference or even the reverse whereby perceived complexity *decreases* with an increase from 8 to 27 options.

When asked to indicate their motives for selecting visual or verbal presentation format, again the results replicate those from study 1. Consumers perceive visual presentation to be an easier, faster, and more enjoyable format and verbal presentation to be better suited for a precise examination. We hypothesize that the ease, speed, and enjoyment that comes with gestalt processing may not be ideal with larger choice sets and that this type of processing that occurs with images may be causing the greater perceptions of complexity when considering 27 options. In the next study we use eye-tracking devices to specifically examine the processing that naturally occurs with visual versus verbal stimuli.

STUDY 3: EXAMINING DIFFERENCES IN EYE MOVEMENTS ACROSS CHOICE SETS

In study 3 we use eye-tracking technology to examine the effect of processing directly and test hypothesis 3. By using eye-tracking devices, we are able to measure the amount of time spent evaluating each option, whether each option is examined, and the pattern of the fixations. With respect to these three variables, we predict that regardless of choice set size, participants will spend longer evaluating each option when presented with verbal depictions than when presented with visual depictions. With respect to the visual movement path and number of options skipped, in small choice sets (where there are fewer degrees of freedom in terms of visual movement paths), we predict there will be no differences between visual and verbal depictions in either the number of options examined or in movement patterns. However, in larger choice sets, we expect respondents will view verbal depictions in more systematic/reading-like movement patterns and will examine a greater percentage of the options within the choice set.

In this (and the next two studies) we use crackers as the product category. The set-up of study 3 is similar to the cracker condition of study 1. However, one fundamental difference is that, whereas in the prior studies participants chose their choice set, to ensure against self-selection confounds, going forward we randomly assign respondents to conditions.

Method

Forty students ($M_{\text{age}} = 21$; 70% female) at University of Technology, Sydney, participated in the experiment online

TABLE 4

STUDY 2: PERCENT OF RESPONDENTS SELECTING MOTIVES FOR CHOICE OF PRESENTATION FORMAT ACROSS COLOR CONDITIONS

	Total		Control		Similar colors		Similar-explained colors	
Reason for selection	Chose verbal words	Chose visual images	Chose verbal words	Chose visual images	Chose verbal words	Chose visual images	Chose verbal words	Chose visual images
N	28	143	1	56	13	48	14	39
Most information about options	71.4*	14.7*	0.0	17.9	76.9*	10.4*	71.4*	15.4*
Allow for more precise examination	60.7*	41.3*	100.0	48.2	53.8	33.3	64.3	41.0
To make the best choice	42.9	32.2	0.0	30.4	38.5	27.1	50.0	41.0
Task easier	25.0*	47.6*	0.0	60.7	23.1	39.6	28.6	38.5
To make the choice quickly	31.4**	37.8**	0.0	35.7	30.8	43.8	14.3	33.3
Knowing I would spend a great deal of time	21.4	14.0	0.0	14.3	23.1	16.7	21.4	10.3
To view most variety of options	10.7*	28.7*	0.0	21.4	15.4**	41.7**	7.1	23.1
Make task less complex	10.7*	28.7*	0.0	30.4	15.4	27.1	7.1	28.2
Task more enjoyable	3.6*	42.7*	0.0	35.7	0.0*	56.3*	7.1*	35.9*
Due to difficulty	0.0	1.4	0.0	0.0	0.0	4.2	0.0	0.0

*Indicates significantly different within color condition at $p < .05$.
**Indicates significantly different within color condition at $p < .10$.

for payment. The design was a 2 (number of choice options: 4 vs. 14) by 2 (presentation form: image vs. text) between-subjects design.

Throughout the studies participants were seated one at a time in front of a computer equipped with Tobii Studio 2.2 technology. Participants were presented with the crackers choice set commensurate with their condition twice: first time to look over the choice set and then to select one option, more than one option, or "none of the above."

Commensurate with the necessities of an eye-tracking study, there were several differences between this study and prior and subsequent studies. First, a lab assistant needed to calibrate the participants one by one, so the eye movements could be tracked by the software. Second, the lab assistant continued to monitor the participants one on one, as they proceeded through the experiment. Finally, while in the other studies the presentation of the particular (cracker) options within each choice set was randomized between subjects, in this study they were not. This allowed for recording of which specific option was being examined at any point in time. The choice set for all four versions were delineated into specific areas of interest (AOIs), and each AOI was associated with a single cracker stimulus. The results are analyzed such that all points within the AOI are considered a fixation on that specific cracker option. Using the Tobii fixation filter (Tobii 2010), we compare pattern and durations of fixations across the experimental conditions.

In line with previous research we distinguish between systematic examination (defined as similar to reading) and nonsystematic examination (Hogeboom and van Leeuwen 1997). To do this we calculated the number of movements between crackers, whereby the participant's eye fixations moved from one cracker AOI to a neighboring cracker AOI (either right, left, up, or down but not diagonally) and also included movement from the end of one row to the beginning of another. From this we calculated a systematic-movement percentage, taking into account the total number of crackers examined; if participants did not look at a cracker at all, it was not included in this calculation.

Results

Initial Presentation. We examine the manner in which participants processed the options when initially presented with the choice set. Looking at amount of time taken to view each option, in both the large ($F(1, 278) = 7.65$, $p < .006$) and small ($F(1, 78) = 13.5$, $p < .001$) choice sets, respondents take longer with verbal than visual stimuli. On our other measures overall we see a general pattern, whereby there are no differences within the small choice sets, but in the larger choice sets examination of the options is less systematic with visual than with verbal presentation (see table 5).

Choice. Respondents were then presented again with the choice set in order to make a choice. All respondents except one (39 of 40) made at least one choice from the selection ($F(3, 36) = 1.00$, $p = .40$); thus we do not replicate study 2 results nor find support for hypothesis 7A. We attribute this to the experimental setting necessary for eye tracking; each participant is alone in the lab with the lab assistant, and probably demand effects motivate the participant to make a choice and not select "none of the above." With respect to the manner in which participants processed the options, as with the initial view we see no differences within the smaller choice sets in terms of systematicity ($M_{verbal} = 100\%$, $M_{visual} = 100\%$; $p > .10$) or number of options skipped ($M_{verbal} = .20$, $M_{visual} = .80$; $F(1, 19) = 2.46$, $p = .14$). In contrast, in the larger choice sets participants who

TABLE 5

STUDY 3: EYE-TRACKING PROCESS MEASURES IN INITIAL CHOICE SET VIEWING, CHOICE, AND MATCHING

	8 options		27 options	
	Verbal text	Visual images	Verbal text	Visual images
Initial view:				
Time taken on each option viewed	5.21*	2.47	1.91*	1.46
Percent systematic movements	100.0	100.0	77.9	68.6
Number of options skipped	0	0	0.5	0.3
Choice:				
Time taken on each option viewed	8.63**	4.31	18.69	13.86
Percent systematic movements	100.0	100.0	69.5	34.8
Number of options skipped	0.2	0.8	1.3	9.7*

NOTE.—Time statistics given in seconds.
*Indicates significantly larger within 8/27 options at $p < .05$.
**Indicates significantly larger within 8/27 options at $p < .10$.

saw verbal descriptions are more methodical and careful in their examination of the options (percent systematic: 69.5%; $M_{\text{options skipped}} = 1.3$) than participants who saw visual descriptions (percent systematic: 34.8%; $F(1, 19) = 18.1$, $p < .001$; $M_{\text{options skipped}} = 9.7$; $F(1, 19) = 20.3$, $p < .001$). We also find that respondents take longer with text than images though marginal in the smaller choice sets ($M_{\text{verbal}} = 8.5$, $M_{\text{visual}} = 4.3$; $F(1, 19) = 3.63$, $p = .07$) and only directional in the larger choice sets ($M_{\text{verbal}} = 18.7$, $M_{\text{visual}} = 13.9$; $F(1, 19) = 1.15$, $p = .30$; see table 5). These results are all consistent with hypothesis 3.

Discussion

Participants are generally systematic in their examination of options in the small choice sets regardless of depiction style, but for large choice sets, they are more systematic and thorough when options are verbally displayed compared to the visual display. We observe that for large assortments the piecemeal processing of individual verbal options carries over to produce a slower and more systematic processing of the overall choice set while the natural gestalt processing of individual visual stimuli leads to a faster and more haphazard processing of the assortment. In the next two studies we examine the perceptual and behavioral consequences of these differences in processing. In study 4 we consider whether the more systematic processing that occurs in large choice sets with text as opposed to images is more effective.

STUDY 4: VISUAL VERSUS VERBAL PRESENTATION IN A MATCHING TASK

Study 4 is designed to test the effectiveness of processing that naturally occurs during choice from either a visually or verbally depicted assortment. One way to measure processing is through performance on a matching task (Adams 1967; Roediger and Guynn 1996). Therefore, we use a surprise matching task after a choice task to measure recognition and retention of items as an indication of the processing that has occurred. Per hypothesis 4 we expect that with a large choice set performance on the matching task (number of options correctly recalled and recognized) will be better when the options were presented verbally than when they were presented visually. We expect no such effect with a smaller choice set. However, previous research identifying the picture superiority effect predicts that with single items, performance on a matching task will be better with visual presentation than verbal (Childers and Houston 1984; Nelson, Reed, and Walling 1976). We therefore expect visual depiction to result in better performance in a smaller choice set. Therefore, we are predicting a crossover interaction. After the matching task we also ask participants how sure they were of their responses and whether they would have performed better or worse if they had done the task with the alternate presentation format. Our theory suggests a main effect here regardless of choice set size: participants who saw images versus words will feel more certain since the task will feel easier. Similarly, all participants will prefer the task with images, regardless of which they saw.

Method

Two hundred and two students ($M_{\text{age}} = 22.3$; 60% female) at the Wharton School, University of Pennsylvania, participated in the experiment online for payment. The design was a 2 (number of options: 4 from 8 vs. 14 from 27) by 2 (presentation form: image vs. text) between-subjects design. In this and the next study, the full 8- and 27-item assortments were full factorial designs for three attributes (shape, flavor, or topping) and varied in the number of attribute levels (two or three).

Participants were first shown an information key (see app. A, fig. A1) and asked to imagine they were shopping for crackers for a party. They were then shown the assortment of crackers commensurate with the condition (either 4 or 14, presented either in images or text). After making a choice, respondents were shown the complete set, all 8 or 27, and were asked to select the 4/14 that were shown previously. Respondents were then asked how sure they were of their response using a 100-point sliding scale and to rate

on a 7-point scale if they had seen written descriptions/visual images (instead of visual/written) would they have performed worse or better. Participants then gave their gender and age and were thanked.

Results

Performance on Matching Task. Considering number of correct options selected, we find no main effect of presentation format ($M_{verbal} = 5.1$, $M_{visual} = 5.2$; $F(1, 201) = .09$, $p = .76$), a main effect of number of options ($M_{8\ options} = 2.4$, $M_{27\ options} = 7.8$; $F(1, 201) = 1{,}251.91$, $p < .001$), and a significant interaction of these two variables ($F(1, 201) = 57.82$, $p < .001$). Among 8 options, respondents who saw images perform better than those who saw verbal descriptions ($M_{verbal} = 1.9$, $M_{visual} = 2.9$; $F(1, 97) = 46.59$, $p < .001$). However, among 27 options, respondents who saw images performed worse than those who saw verbal descriptions ($M_{verbal} = 8.1$, $M_{visual} = 7.5$; $F(1, 102) = 6.14$, $p = .02$; see fig. 3). This supports hypothesis 4.

Perceptions of Matching Task. On both measures the results are as expected; participants who saw images were more sure of their response than those who saw text ($M_{verbal} = 33.0$, $M_{visual} = 47.7$; $F(1, 201) = 13.42$, $p < .001$), and this is driven by participants who saw 8 options ($F(1, 97) = 21.54$, $p < .001$) rather than 27 ($F(1, 102) = .75$, $p = .39$). Examining responses to whether their performance would be better with the alternate presentation format respondents who saw images are less likely to say that they would do better if they had seen words than vice versa ($M_{verbal} = 5.7$, $M_{visual} = 4.3$; $F(1, 201) = 45.74$, $p < .001$; see table 6 for full results and all main effects).

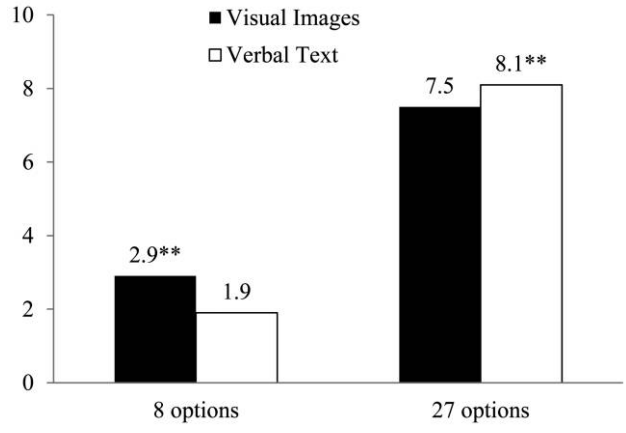
Discussion

In line with prior work on the picture superiority effect (Nelson et al. 1976), when the choice set is small, images produce greater performance than text. Counter to past research, however, we find that with a larger choice set the opposite is true. The results of study 4 corroborate the implications from study 3 that for smaller choice sets images lead to better processing but that for larger choice sets verbal descriptions are better. Despite this, regardless of choice set size, respondents presented with verbal descriptions were more likely than those who saw images to say the matching task would have been easier had they been presented with information in the alternate format. This speaks to the strength and overuse of the visual preference heuristic—apparent even after a task where verbal presentation led to superior performance.

The matching task could be considered a model of how consumers might search if they had strong preexisting preferences and know what they are seeking. In such a case like small choice sets, visual presentation could be considered optimal. As such, this study offers a potential moderator beyond the categorical ones suggested in studies 1 and 2, when visual presentation is optimal.

FIGURE 3

STUDY 4: NUMBER OF OPTIONS CORRECTLY IDENTIFIED IN SURPRISE MATCHING TASK



** Indicates significantly larger than visual images/verbal words within 8/27 options at $p < .05$.

In the next and final study we consider further consequences of the differences in processing observed in study 3; study 5 examines the perceptual differences (variety and complexity), as well as behavioral differences (choice overload) hinted at in the first two studies.

STUDY 5: VISUAL VERSUS VERBAL PRESENTATION FORMAT, CHOICE SET PERCEPTIONS, AND CHOICE OVERLOAD

In study 5 we test hypothesis 7A on choice overload. We also examine hypotheses 5 and 6 on perceptions of variety and complexity and consider how the latter may influence choice behavior per hypothesis 7B. We predict that the faster and more haphazard examination of the assortment with visual depiction that we observed in study 3 and seems less effective per study 4 is insufficient in larger choice sets; consumers thus perceive the choice set to be highly complex and will be more likely to opt out of choice all together. However, the more systematic approach with verbal versus visual presentation allows participants to more carefully process the options, which can mitigate perceptions of complexity; thus in the verbal condition, the choice deferral should not be as great.

Additionally, we include two new scales, the 13-item maximizer/satisficer scale (Schwartz et al. 2002) that identifies whether someone tends to seek out the first option that crosses the threshold of being acceptable (satisficer) or must find the best available option and thus will be more negatively influenced by large choice sets (maximizer) and the 11-item centrality of visual product aesthetics (CVPA) scale

TABLE 6

STUDY 4: RESPONSE TO MEMORY TASK

	8 options		27 options	
	Verbal text	Visual images	Verbal text	Visual images
Number of options identified correctly	1.9	2.9**	8.1**	7.5
Sure of response to memory task	41.6	66.7**	25.3	29.0
Other presentation format would be better	5.7**	4.3	5.7**	4.2

NOTE.—Sure of response to memory task: main effect of presentation format ($M_{verbal} = 33.0$, $M_{visual} = 47.7$; $F(1, 201) = 13.42$, $p < .001$), main effect of number of options ($M_{8\ options} = 54.6$, $M_{27\ options} = 27.1$; $F(1, 200) = 56.77$, $p < .001$), interaction effect ($F(1, 201) = 11.25$, $p = .001$). Other presentation format better: main effect of presentation format ($M_{verbal} = 5.7$, $M_{visual} = 4.3$; $F(1, 201) = 45.74$, $p < .001$), no main effect of number of options ($F(1, 201) = .00$, $p = .99$).

**Indicates significantly larger within 8/27 options at $p < .05$.

(Bloch, Brunel, and Arnold 2003) that measures how important the look of a product is to a consumer.

Method

Two hundred thirty-six undergraduate business students ($M_{age} = 18.6$; 61% female) at the University of Miami participated in the experiment online for course credit. The design was a 2 (number of choice options: 8 vs. 27) by 2 (presentation form: image vs. text) between-subjects design.

Participants were first shown an information key (see app. A, fig. A1) and asked to imagine they were shopping for crackers for a party. They were then shown the assortment of crackers commensurate with the condition. Respondents rated the assortment on the variety and complexity as in studies 1 and 2. They were then shown the assortment again and asked to make a selection where they were allowed to choose one option, more than one option, or "none of the above." Participants then filled out the individual difference scales, gender and age.

Results

Assortment Perceptions. We find a main effect of number of options on perceptions of variety ($\alpha(3) = .83$; $F(1, 234) = 27.5$, $p < .001$) and complexity ($\alpha(3) = .83$; $F(1, 234) = 37.7$, $p < .001$). As expected, respondents perceived greater variety and complexity for the 27-option than for the 8-option assortment. There is also a main effect of presentation form with higher scores for images than text on measures of variety ($F(1, 234) = 10.8$, $p = .001$) and complexity ($F(1, 234) = 3.99$, $p = .047$). There is also a significant interaction for both variety ($F(1, 234) = 27.48$, $p < .001$) and complexity ($F(1, 234) = 36.42$, $p < .001$).

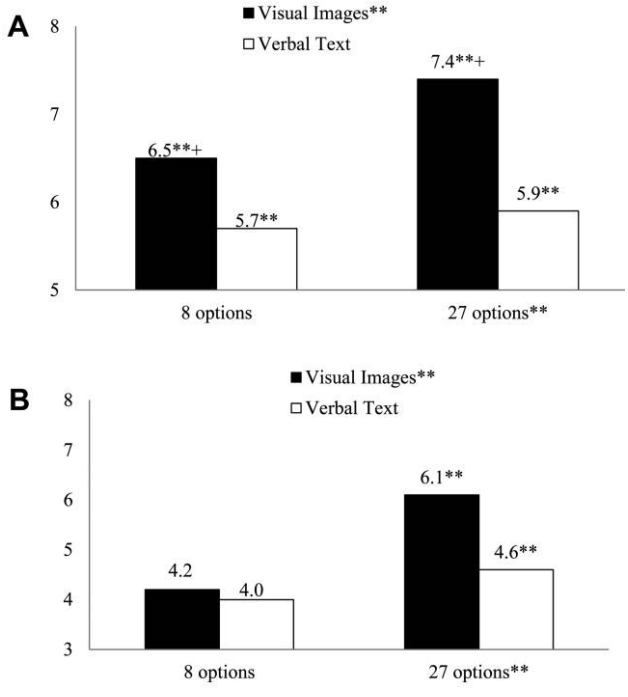
Supporting hypothesis 5, participants who saw visual images perceive greater variety than those who saw verbal text descriptions for both 8 options ($M_{visual} = 6.5$, $M_{verbal} = 5.7$; $F(1, 115) = 6.88$, $p = .01$) as well as 27 options ($M_{visual} = 7.4$, $M_{verbal} = 5.9$; $F(1, 117) = 21.22$, $p < .001$), although the difference is greater for 27. There is no difference in perceptions of variety within verbal text for 8 and 27 options ($F(1, 127) = .41$, $p = .52$), but there is for visual images ($F(1, 105) = 17.03$, $p < .001$). The differences in perceived complexity between presentation formats are driven by differences when respondents are presented with 27 options ($M_{visual} = 6.1$, $M_{verbal} = 4.6$; $F(1, 117) = 16.04$, $p < .001$). This supports hypothesis 6. There was no significant difference when respondents were presented with 8 options ($M_{visual} = 4.2$, $M_{verbal} = 4.0$; $F(1, 115) = .375$, $p = .54$; see fig. 4*A* and *B*).

Choice Overload. We find no main effect on likelihood to opt out of choice for the number of options (8 options = 9%, 27 options = 8%, $\chi^2(1) = .002$, $p = .97$) nor for presentation format (visual = 10%, verbal = 7%, $\chi^2(1) = .82$, $p = .36$). There is, however, a significant interaction effect ($\chi^2(1) = 4.36$, $p = .04$). There is no difference in the number opting to select none of the above among 8 options (visual = 5%, verbal = 11%, $\chi^2(1) = 1.30$, $p = .24$), while there is a difference in the opposite direction among 27 options (visual = 16%, verbal = 3%, $\chi^2(1) = 6.15$, $p = .01$) with more respondents opting out of choice who saw images than saw text (fig. 5). This supports hypothesis 7A. Looking only at the results for respondents who saw the options displayed visually, we replicate the results of Iyengar and Lepper (2000). We find that there is greater overload when the choice set size increases from 8 to 27 options consistent with greater ratings on complexity ($F(1, 105) = 34.71$, $p < .001$), as well as a marginal increase in choice of "none of the above" ($\chi^2(1) = 3.09$, $p = .08$). However, when we examine the results for respondents who saw the options displayed verbally, this is not the case; there is no significant difference in ratings of complexity ($F(1, 127) = 2.81$, $p = .10$). Moreover, the percent selecting "none of the above" actually decreases marginally ($\chi^2(1) = 3.61$, $p = .06$). Neither of the individual difference measures (maximizing vs. satisficing and CVPA) revealed significant main effects nor interaction effects when we included them in the regression (all Wald's < 1.3, all $p > .10$).

Mediation Analyses. We used a bootstrapping approach to test for mediation (Preacher and Hayes 2004; Zhao, Lynch, and Chen 2010). First we examined the interaction effect of presentation format and number of items on choice

FIGURE 4

STUDY 5: PERCEIVED VARIETY AND COMPLEXITY



NOTE.—Perceived variety (*A*) and perceived complexity (*B*). Asterisks (**) indicate significant differences between 8 and 27 options (main effect), visual and verbal (main effect) as well as within 8 options between visual and verbal and within 27 options between visual and verbal at $p < .05$. The plus sign (+) indicates a significant difference within visual for 8 and 27 options at $p < .05$.

of "none of the above" and tested for complexity (average of three measures) as a mediator. We found that the mean indirect effect from the bootstrap analysis is positive and significant (2.7), with a 95% confidence interval excluding zero (.72 to 10.3). The direct effect (1.4) is not significant ($p = .16$), indicating indirect-only mediation. This supports hypothesis 7B that it is high perceptions of complexity that drive consumers to opt out of making a choice. We also tested variety (average of three measures) as a potential mediator, and in line with our characterization of variety it does not mediate the effect; the 95% confidence interval for the indirect effect includes zero (−.74 to 1.33).

Discussion

We find support for hypotheses 5, 6, 7A, and 7B. Despite respondents showing a strong preference for visual rather than verbal descriptions (studies 1 and 2), in larger choice sets visual presentation format causes greater perceptions of complexity and thus greater choice overload. Study 5 therefore identifies a moderator for the choice overload effect that Iyengar and Lepper identified. It is due to the visual nature of the stimuli, which facilitated a more gestalt-like processing of the options, whereas the more piecemeal-like processing style that results from verbal depiction allows for less choice deferral.

GENERAL DISCUSSION

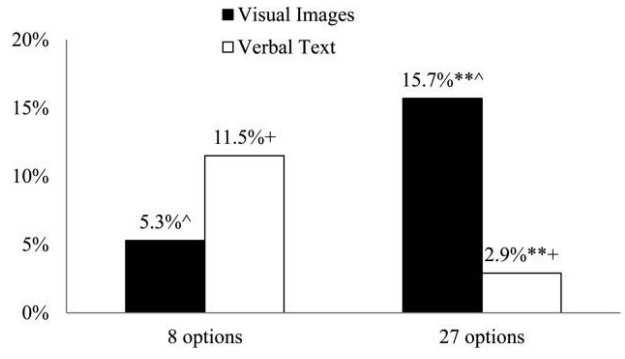
In this research, we find evidence of a visual preference heuristic such that consumers prefer visual rather than verbal depiction of stimuli in an assortment, regardless of choice set size. This occurs even with product categories not typically depicted visually and for which there is no natural visual representation (mutual funds in study 1) and even when verbal depiction allows for greater differentiation (close color conditions in study 2). However, we find that this preference for visual can lead to suboptimality. When choice sets are small, visual presentation results in more efficient processing of stimuli, increased perceived variety, and faster processing times. However, when choice sets are large, visual presentation motivates a facile approach and when preferences are unknown consumers may do better with verbal depiction that induces a slower, more systematic processing style. We provide evidence for our conclusions through five studies.

In study 1 we showed that consumers defer to a general visual preference heuristic; they opt for visual rather than verbal depiction regardless of choice set size. We did not find a significant difference in this preference as a function of product class, although we predicted we would. In study 2, we varied the ability to differentiate among attribute levels using diverse or similar colors of nail polish. Again the preference for visual depiction still existed, but we find a significant decrease in this preference when attribute differentiation was difficult, suggesting perceptions of ease as a driver of the heuristic. In study 3 we used eye-tracking technology to examine the actual process with which options are examined. Across conditions participants spent longer examining each option with verbal presentation than visual, indicative of piecemeal versus gestalt processing. We also observed how this difference in processing the individual items influenced processing of the entire choice set. In small choice sets where gestalt processing is adequate we found no differences in assortment processing between presentation formats. However in larger choices sets the piecemeal processing of verbal options caused respondents to more systematically process the entire choice set, scanning in a pattern similar to reading and skipping fewer options than when presented with visual depiction. Study 3 therefore provided evidence of the two differences in processing, both at the individual item level and at the assortment level. We suggest that these natural differences in processing of images versus words results in both the "visual preference heuristic," as well as the negative impact of visual depiction on the choice process in larger choice sets.

The next two studies looked more specifically at this negative impact. In study 4 we used a surprise matching task as a measure of processing effectiveness. We found that for

FIGURE 5

STUDY 5: PARTICIPANTS OPTING OUT OF CHOICE—SELECTING "NONE OF THE ABOVE"



NOTE.—Asterisks (**) indicate significant difference between visual and verbal within 27 options (main effect) at $p < .05$. The plus sign (+) indicates significant difference between 8 and 27 options within visual at $p < .10$. The arrow (^) indicates significant difference between 8 and 27 options within verbal at $p < .10$.

small choice sets, visual depiction was better for a matching task than verbal depiction. However, these results reverse for large choice sets where verbal depiction yielded better results. Study 5 revealed that visual presentation led to positive perceptions of more variety for small choice sets and a greater likelihood to choose. In large choice sets, however, this increased perception of variety was accompanied by negative perceptions of complexity resulting in a decreased likelihood to choose. Thus, studies 4 and 5 suggest that the visual preference heuristic is overapplied; in studies 1 and 2 participants opted for visual presentation even with large choice sets while studies 4 and 5 revealed this not to be optimal. However, the choice sets we used in all our studies represented situations where the options were all new and thus preferences unknown. In situations where the choice sets are familiar or where satisficing is acceptable the efficient, fast gazing strategy applied to visual assortments might not only suffice but be preferable.

We limited our exploration to the use of words or images exclusively and did not consider when a combination of the two might be used. Future research might tackle these questions. Additionally, while prior work on choice overload has considered the organization of the stimuli (e.g., Kahn and Wansink 2004), and the trade-off of number of attributes versus attributes levels (e.g., Lee and Lee 2004; Malhotra 1982) we did not. The options were always presented in a randomized fashion. Had they been presented in a more orderly manner it is possible that the less systematic order of processing the visual stimuli in the large choice set (study 3) may have dissipated. However, it seems unlikely that the time spent processing the options would have also increased and, thus, our results likely still hold even with a more organized option presentation.

This research furthers our understanding in three distinct areas: choice overload, verbal versus visual depiction and processing, and the influence of processing of individual items on that of full assortments. Specific to prior work on choice overload, these studies provide more insight to help explain the findings of Iyengar and Lepper (2000). We replicated their results of choice deferral for visual stimuli when our choice set was increased from 8 to 27 options. However, this was *only* the case when options were presented visually; when options were presented in text, this did not occur. One implication of this is that if Iyengar and Lepper's jam experiment was run with textual descriptions of the jams, the results might be different. In fact, Iyengar and Lepper included a study with text-based stimuli, essay topics, and replicated their overload results. Our results suggest that the issue of how much time was spent examining the options may have had an effect; we see that respondents spend more time with text than images. Perhaps if respondents in the essay task were forced to spend longer they would be more likely to choose. In any event, our results would not predict the choice overload findings that Iyengar and Lepper show for the essay test. However, our results on the benefit of verbal depiction for large choice sets is consistent with the results found by Ketcham et al. (2012) where they found that senior citizens under Medicare Part D Plans made better choices (i.e., were less likely to over spend on prescription drugs) when choosing from a larger rather than smaller assortment.

We based our hypotheses on prior work on the differences in the natural gestalt processing of images versus the piecemeal processing necessary with words. What our research, and study 3 in particular, reveals is that these differences in processing of the individual items carry over and affect the way entire sets are processed. It is the ease and speed with which we naturally process individual images that causes us to be less ordered and deliberative when faced with a large group of images as compared to a large group of textual stimuli. This parallels our measures of variety and complexity. While variety is generally positive, relates to preference matching, and benefits assortment choice, complexity is the negative associate of variety and relates to evaluation of the specific options within the set. As such high variety that attracts consumers to an assortment, particularly with visual depiction, can be accompanied by complexity that makes the processing overwhelming and leads to choice overload.

Our results suggest that consumers do not always know what is best. While visual depiction can be advantageous, there are some choice situations where consumers should take more time and process more deeply. The current tendency for mobile apps to favor graphics exclusively may paradoxically cause consumers to choose not to purchase, especially for unfamiliar stimuli. While the images are fun, there may be a tendency to gloss over them rather than make a purchase. In situations where marketing materials for the

outlet are separate from the actual shopping experience, for example, the homepage for an online retailer versus the product selection page, it would be beneficial to have the upfront information about the store and its products presented in a visual manner, emphasizing the ease of the decision process and amount of variety. Then, at the point of actual consideration for purchase, on the product offerings pages a more text-based interface should cause consumers to slow down, review each option more carefully, and be less likely to opt out of choice. Alternatively, if a company wishes to reap the benefits of images without suffering from the less systematic processing and all of its perceptual and behavioral consequences, then keeping the choice set seemingly small is optimal. Apple has always been a visually based company and their website does a good job of minimizing the number of images presented at a time despite their large product offering. In this manner they are able to make the choice process seem quick, fun, and easy, without seeming complex and overwhelming.

DATA COLLECTION INFORMATION

Study 1: The first author collected the data online using Amazon's Mechanical Turk to recruit the sample. The first author analyzed the data, and both authors reviewed and discussed the results. All of this took place in summer 2012.

Study 2: The first author collected the data online using Amazon's Mechanical Turk to recruit the sample. The first author analyzed the data, and both authors reviewed and discussed the results. All of this took place in winter 2013.

Study 3: The second author oversaw collection of the data by the lab manager in the Behavioural Lab at University of Technology, Sydney. The lab manager also performed preliminary creation of the variables from the raw data. The first author analyzed the data, and both authors reviewed and discussed the results. All of this took place in fall 2011.

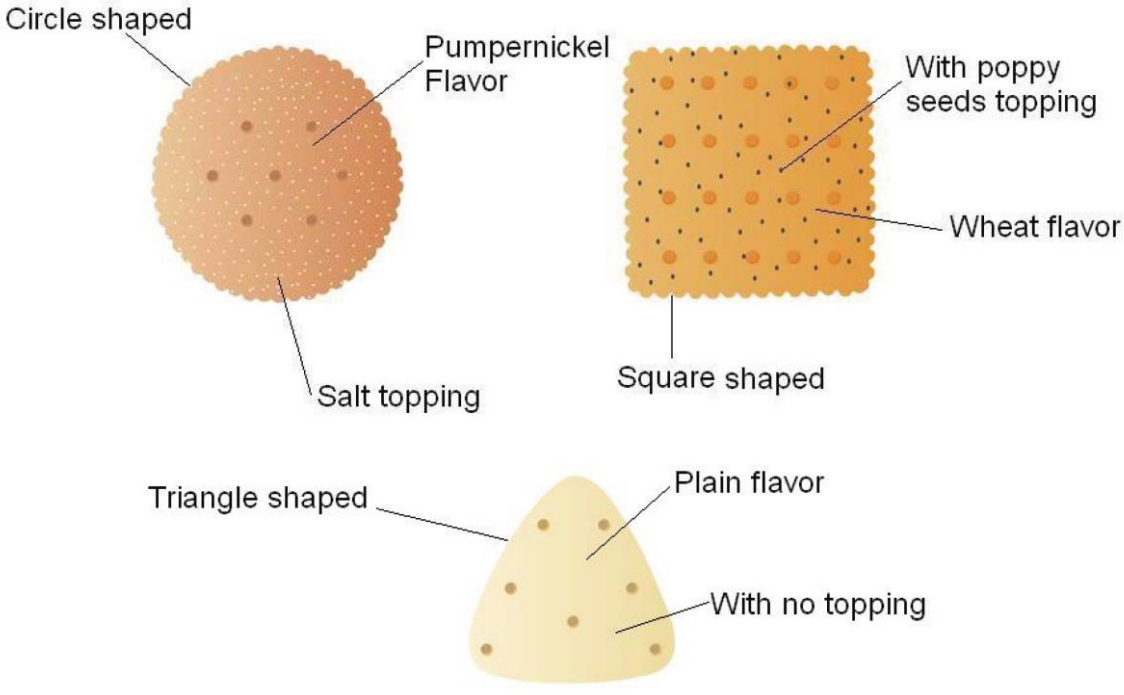
Study 4: The second author oversaw collection of the data by research assistants at the Wharton Behavioral Lab, University of Pennsylvania. The first author analyzed the data, and both authors reviewed and discussed the results This all took place in spring 2011.

Study 5: The first author oversaw collection of the data by research assistants at the Canes Behavioral Laboratory, University of Miami School of Business. The first author analyzed the data, and both authors reviewed and discussed the results. All of this took place in spring 2011.

APPENDIX A

FIGURE A1

Cracker Category 27 Item Key and Sample Stimuli Used in Studies 1, 3, 4, and 5



Example Verbal Text Stimulus

Circle shaped

Wheat flavor

With no topping

Example Visual Image Stimulus

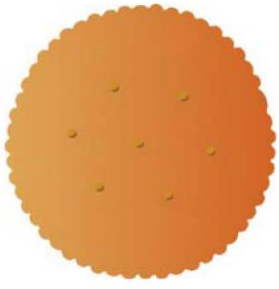
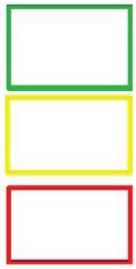


FIGURE A2

Mutual Funds Category 27 Item Key and Sample Stimuli Used in Study 1

Variable	Image depiction	Text depiction
Fees		Low Medium High
Mean and Standard Deviation of annual return		Mean: 5%, StDev: 3% Mean: 8%, StDev: 8% Mean 13%, StDev: 20%
Region of investment		North America Asia Latin America

Example Verbal Text Stimulus

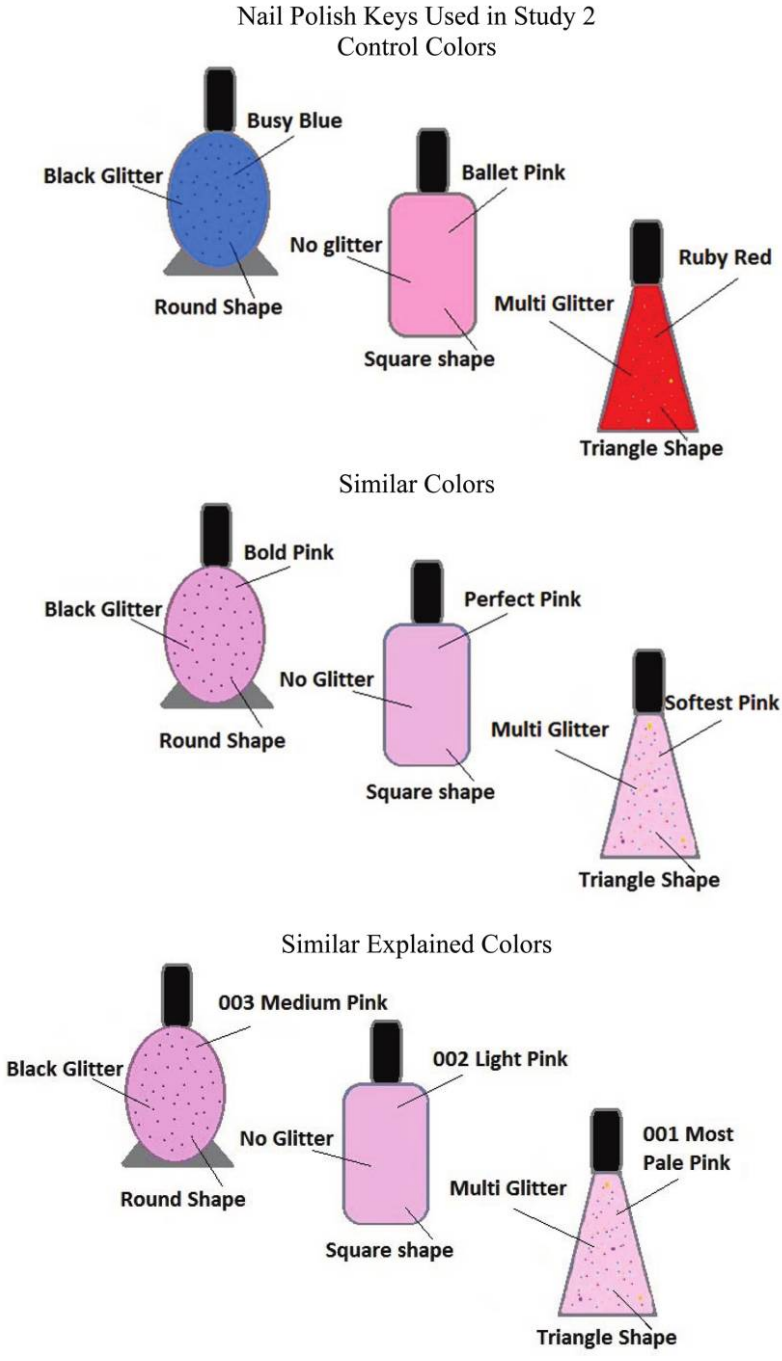
Fee: High
Mean: 5%, StDev: 3%
Latin America

Example Visual Image Stimulus

NOTE.—Image depiction of fees varies by color.

APPENDIX B

FIGURE B1



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