Multi-Stage Decision Processes: The Impact of Attribute-Order on How Consumers Mentally Represent Their Choice

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ABSTRACT

With the ever-increasing number of options from which consumers can choose, many decisions are done in stages. Whether using decision tools to sort, screen, and eliminate options, or intuitively trying to reduce the complexity of a choice, consumers often reach a decision by making sequential, attribute-level choices. The current article explores how the order in which attribute-level choices are made in such multi-stage decisions affects how consumers mentally represent and categorize their chosen option. The authors find that attribute choices made in the initial stage play a dominant role in how the ultimately chosen option is mentally represented, while later attribute choices serve only to update and refine the representation of that option.

Across thirteen studies (six of which are reported in the supplemental online materials), the authors find that merely changing the order of attribute choices in multi-stage decision processes alters how consumers (i) describe the chosen option, (ii) perceive its similarity to other available options, (iii) categorize it, (iv) intend to use it, and (v) replace it. Thus, while the extant decision-making literature has mainly explored how mental representations and categorization impact choice, the current article demonstrates the reverse: the choice process itself can impact mental representations.

*Keywords: multi-stage decisions, mental representations, categorization, decision tree, phased decisions, replacement choice*
Multi-stage decision processes are those in which the final choice is reached by making a series of lower-level (often, attribute-level) choices. With the ever-growing number of options available to consumers, such multi-stage decision processes are increasingly prevalent. For example, many decision aids help simplify decisions by guiding the consumer through the decision attribute-by-attribute. Websites commonly allow consumers to build and customize their preferred option or sort and screen the available options in an attribute-by-attribute process (e.g., Nike.com, bestbuy.com, and most car manufacturers’ websites). Likewise, numerous restaurant chains, such as Chipotle and Domino’s, allow consumers to create their meal ingredient-by-ingredient. Even without the explicit use of such decision aids, in some contexts, the decision context is multifaceted and individuals naturally break down the decision into a series of lower-level, attribute-based decisions (e.g., Bettman and Park 1980; Billings and Marcus 1983; Olshavsky 1979; Tversky and Sattath 1979; Wright and Barbour 1977). Such piecemeal decision processes help consumers simplify their decisions and reduce the cognitive load associated with considering all possible alternatives.

It is often the case, that when making such multi-stage decisions, the specific order in which attribute choices are made is arbitrary and can be easily changed (e.g., Kahn, Moore, and Glazer 1987; Levav, Reinholtz, and Lin 2012). The current article explores how a change in the order of attribute choices in multi-stage decisions—despite not influencing what will ultimately be chosen—impacts how consumers mentally represent and categorize the chosen option. We argue and demonstrate that such shifts in mental representations affect (i) the way consumers describe the chosen option, (ii) the degree to which consumers perceive the chosen option to be similar to other available options, (iii) how consumers categorize the chosen option, (iv) how consumers intend to use the chosen option, and (v) what consumers choose to replace the chosen
option with, if necessary. Thus, we show the same product may be mentally represented and categorized by consumers differently depending on the order in which attribute choices were made.

This article offers several unique contributions. First, from a theoretical perspective, while existing literature mainly focused on how and why mental representations impact choice, this article is the first (as far as we know) to explore instances in which the choice process itself impacts mental representations and categorization. Thus, this article examines a novel interplay between decision making and mental categorization: even when the same option is ultimately chosen its meaning and the consumers’ subsequent behavior substantially change, due to the unique path leading to this choice.

Further, the literature concerning multi-stage decision processes has mainly focused on decision structures in which earlier choices in the sequence determine the availability of options later in the sequence (i.e., path-dependent choice processes). In contrast, because the current article focuses on how multi-stage processes impact mental representations (and not the choice), we study path-independent multi-stage decision processes (i.e., the availability of options is not contingent on earlier choices in the sequence), allowing us to isolate and study pure order effects. Thus, we also add to the literature concerning multi-stage decision processes by focusing on a relatively understudied type of hierarchical decision process.

Second, from an applied perspective, this research demonstrates that firms and policy makers can impact how consumers mentally represent their offerings in the marketplace by simply changing the order of attribute choices in multi-stage decision processes (which are often employed in sorting and configuration tools). As we demonstrate, such shifts in mental representations impact several important aspects of consumer behavior.
Third, from a methodological perspective, our experimental designs and findings suggest that researchers studying topics related to mental categorization and its impact on consumer behavior could use this simple change in attribute-choice order to manipulate how participants mentally represent and categorize target stimuli.

Next, we develop our theoretical framework and hypotheses. We then report seven studies (six additional studies are reported in the supplemental online materials), including studies that employ incentive compatible designs with consequential outcomes. We conclude with discussions on the theoretical, methodological, and applied contributions of this research, as well as the limitations and future directions.

**MULTI-STAGE DECISION PROCESSES AND MENTAL REPRESENTATIONS**

Multi-stage decisions, sometimes referred to as phased decisions (e.g., Wright and Barbour 1977) or decision-trees (e.g., Tversky and Sattath 1979), are those in which the ultimate choice is reached by making a series of lower-level (often, attribute-level) choices. Unlike choices that are made in a single stage by selecting a single option from a given assortment, in multi-stage decisions consumers reach their ultimate choice in a sequential, piecemeal (attribute-level) process (e.g., choosing the product’s design first, then its color, etc.). As mentioned above, many decision aids guide the consumer through the decision in stages, often in an attribute-by-attribute process. In other instances, the decision context is naturally multifaceted, and innately involves making a series of lower-level decisions. For example, choosing a vacation typically entails a choice of a destination, hotel, room type, flights, car rental, and so on. In such cases, the ultimate choice is reached by making a series of lower-level decisions.
Whether the choice involves an exogenously provided decision aid (e.g., Diehl, Kornish, and Lynch 2003) or is innately comprised of a series of lower-level decisions, in many cases the order of attribute choices is malleable and can be easily manipulated. For example, most websites allow consumers to screen or configure products based on different attributes and the order of attribute choices can be easily altered. Other types of decisions that are made offline naturally offer flexibility in terms of attribute ordering. Dining plans, for instance, may be established by first choosing a location (e.g., dine in vs. take out) then a food type (e.g., pizza vs. Chinese), or vice versa. Equivalently, it is equally reasonable to first choose a movie theater then a specific movie to view, or vice versa (at least in major metropolitan areas). Given the prevalence of multi-stage decision processes and the ease with which businesses can manipulate the order by which consumers choose attributes, it is important to study and understand the effect of altering the attribute-choice order.

Existing research on multi-stage decisions focused on, among other things, how such hierarchical choices impact consumers’ preferences and choices. For example, several papers demonstrated that choices that are made after a screening process substantially differ from choices made without an initial screening stage. Specifically, decision makers were found to deemphasize the importance of screening attributes in later stages of the process (Chakravarti, Janiszewski, and Ülkümen 2006) and less likely to revisit information they used for screening (Wright and Barbour 1977). Closely related to the current research question, Kahn, Moore, and Glazer (1987) examined how extrinsic factors that influence the order of attribute consideration (a situation termed constrained choice) impact which option consumers end up choosing. It is important to note that because the focus of existing research was on how multi-stage decisions impact the ultimate choice, existing research studied path-dependent hierarchical processes. That
is, screening options on one attribute determined the subset of available levels of subsequent attributes (i.e., attribute levels across the different stages are correlated). For example, a consumer that screens options based on quality would face specific price levels in later stages of the decision process.

One of the key aspects that distinguishes the current article from prior work on multi-stage decisions is that we examine the impact of such decision processes even when the ultimate choice remains the same. That is, we argue and demonstrate that the order by which consumers consider and choose attribute levels has important implications even when the option that is chosen remains the same. To test pure order effects in such multi-stage decisions, and to distinguish it from other mechanisms, we examine path-independent multi-stage processes throughout the article. That is, decision processes in which the attribute levels available in later stages are *not* contingent on the choices made in earlier stages.

To clearly emphasize the importance of the distinction between path-dependent and path-independent decision processes, and to demonstrate how the order of attribute choices in multi-stage decisions could impact consumers, consider the following simple example. Imagine a consumer choosing a coat based on two attributes: material (wool vs. leather) and design (stylish vs. casual). Further, assume that all four possible combinations of coats are available for purchase (i.e., wool-stylish, wool-casual, leather-stylish, and leather-casual). Because all four options are available for purchase, it is evident that which coat is eventually chosen should not be influenced by whether the consumer first chooses material then design or first design then material. The consumer in this case can freely choose any design regardless of the chosen material or freely choose any material regardless of the chosen design. Consequently, the consumer’s ultimate choice will typically *not* depend on the order in which attribute choices are
made (assuming attributes do not interact to influence preferences—we limit our discussion and empirical examinations to contexts with no such interactions).

The above case is a stylized example of path-independent decision structures, which are the focus of the current article. We speculate that previous research did not focus on such path-independent structures (where all combinations of attribute levels are available) because changes in attribute-choice order in such cases typically do not lead to shifts in choice shares. However, we argue that these path-independent structures are in fact important to study from both theoretical and applied perspectives. Even though the same coat will be selected regardless of which attribute choice is made first, we argue that, from the consumer’s perspective, this coat will be mentally represented differently based on the order of those choices. Specifically, if the consumer is first asked to select the material (and selects wool over leather) and is then asked to choose the design (and selects stylish over casual), this consumer will mentally represent the chosen coat as a wool coat that has a stylish design. That is, the coat will be primarily mentally represented and categorized on the basis of its material—wool—and differentiated from other wool coats on the basis of its design—stylish. However, the same coat will be mentally represented by the consumer very differently if the coat’s design was selected first and then its material. In this case the coat will be represented and categorized as a stylish coat made of wool. We argue that this seemingly meaningless difference is in fact meaningful and has important consequences for how consumers describe, use, and replace their chosen options.
HOW MULTI-STAGE DECISION PROCESSES INFLUENCE MENTAL REPRESENTATIONS

Mental representations are generally defined as an “encoding of information, which an individual can construct, retain in memory, access, and use in various ways” (Smith 1998). A mental representation is an internal cognitive symbol that represents external reality and can be drawn upon to describe, evaluate, or make decisions with respect to certain stimuli (e.g., objects, experiences, people). The mental representation of stimuli typically occurs rapidly, spontaneously, unconsciously, and as information is encountered (e.g., Lakoff 1987; Sato, Schafer, and Bergen 2013). Accordingly, research has demonstrated that mental representations, and the process by which mental categories are formed, are influenced by context (e.g., Anderson and Ortony 1975; Barsalou 1982; Roth and Shoben 1983).

The importance of mental representations to human perception and, consequently, numerous marketing-relevant variables, has been repeatedly demonstrated within the marketing literature. To wit, consumers’ mental representations have been shown to influence information search, inference, memory, and choice (e.g., Alba and Hutchison 1987; Cohen and Basu 1987; Henderson and Peterson 1992; Huber and McCann 1982; Loken and Ward 1990; Moreau, Markman, and Lehmann 2001; Parker and Lehmann 2014; Reinholtz, Bartels, and Parker 2015; Sujan and Deklava 1987; Weiss and Johar 2013; Yates, Jagacinski, and Faber 1978).

Given the influence of mental representations on such a broad spectrum of consumption-related behaviors, it is unsurprising that researchers have also examined factors influencing mental representations such as language structure (Schmitt and Zhang 1998; Yorkston and De Mello 2005), self-construal (Jain, Desai, and Mao 2007), numerical list structure (Isaac and
Schindler 2014), and goal salience (Barsalou 1983). However, while existing literature in judgment and decision making mainly focused on how mental representations influence choice, the current article examines if and how the choice process itself impacts mental representations.

As mentioned, context plays a role in the formation of mental representations. Directly related to the current research question, previous research suggests that the order in which information about a stimulus is encountered can impact how this stimulus is mentally represented, with earlier information playing a greater role (Markman 1987, 1989; Moreau, Markman, and Lehmann 2001). For example, Moreau, Markman, and Lehmann (2001) showed that participants relied more heavily on ads and labels that are encountered earlier when asked to categorize a new product they had never seen before. Thus, earlier information will likely dominate how a stimulus is mentally represented, with later information serving to refine the individual’s mental representation of the stimulus. This may be especially relevant in the context of multi-stage decision processes, where options are gradually “constructed” or “formed” in an attribute-by-attribute choice process.

Our main hypothesis is that because multi-stage decisions are made in a sequential, piecemeal (attribute-level) process, and because mental representations are formed spontaneously as information is encountered, attribute choices that are made earlier will likely be the primary basis by which the soon-to-be-selected option will be mentally represented. Returning to the coat example, once consumers select the material (e.g., wool), they will use this information to attach meaning to, and thus mentally represent, the soon-to-be-selected coat. That is, even prior to finalizing the entire multi-stage decision process, consumers will already use the chosen material to mentally represent their impending choice as a wool coat. Then, after choosing the coat’s style (e.g., stylish), consumers will add this information to (i.e., refine) their
mental representation of the wool coat, such that it is now a wool coat that has a stylish design. As illustrated by this example, the mental representation of the chosen option will therefore be sensitive to the order in which attribute choices are made. Reversing the attribute-choice order should lead consumers to represent the same coat as a stylish coat that is made of wool. This shift, we argue and demonstrate, impacts several important aspects of consumer behavior.

In the first empirical section (studies 1a-1b and studies 1c-1e in appendix A), we directly test our main hypothesis—attribute-choice order in a multi-stage path-independent decision process alters how consumers mentally represent the chosen option—using four distinct and validated markers for shifts in mental representation. Specifically, we test how the attribute-choice order alters how consumers (i) describe the chosen option (studies 1a and 1c), (ii) perceive the similarity of the chosen option to other available options (study 1b), (iii) categorize their chosen option (study 1d), and (iv) intend to use the chosen option (study 1e). Due to space constraints we only report empirical evidence for the first two markers for mental representation (i.e., description in study 1a and similarity in study 1b) in the main article. Evidence for the additional markers of shifts in mental representations (i.e., categorization and intended usage) are mentioned in the main text but fully reported in appendix A (studies 1c-1e).

In the second empirical section (studies 2-5) we test and demonstrate that the order of attribute choices in the multi-stage decision process alters how consumers replace the chosen option, if necessary. Studies 3a and 3b extend our understanding of the underlying mechanism by exploring the roles of choice and agency in the documented effect. Consistent with the mental representation account, study 3a demonstrates that the focal order effect does not occur when consumers merely view the attribute information sequentially without choosing levels from those attributes (i.e., outside the context of an impending decision, and therefore without an impending
choice to mentally represent). Consistent with our proposed account, and ruling out several rival accounts, study 3b demonstrates that the effect persists even without consumer agency (i.e., when observing a third party choosing in a multi-stage decision process).

Next, studies 4 and 5 further demonstrate the robustness of the effect and explore important boundary conditions. Study 4 demonstrates that the effect occurs spontaneously, even when the order of attributes is clearly determined randomly and when the attributes themselves offer no meaningful information about the alternatives, effectively ruling out inference-based accounts. Study 5 demonstrates that the effect is further attenuated when consumers already have pre-established mental representation of the stimulus class.

Figure 1 summarizes the dependent measures employed in the studies and the predicted results (using the aforementioned, stylized coat example). Six additional studies reported in appendix A further demonstrate the robustness of the effect across domains, rule out choice-based accounts, and address additional methodological concerns.

FIGURE 1. HYPOTHESED IMPACT OF ATTRIBUTE-CHOICE ORDER ACROSS
**STUDIES**

<table>
<thead>
<tr>
<th>Order of Attribute Choices in the Multi-stage Decision Process</th>
<th>Study 1a: Description (Studies 1a &amp; 1c*)</th>
<th>Study 1d*: Categorization (Study 1d*)</th>
<th>Study 1e*: Intended Usage (Study 1e*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leather</td>
<td>Wool</td>
<td>Casual</td>
<td>Leather</td>
</tr>
<tr>
<td>More likely to describe coat as: “Stylish coat made out of wool”</td>
<td>More likely to describe coat as: “Wool coat with a stylish design”</td>
<td>More likely to categorize with other wool coats</td>
<td>More likely to use when context requires a wool coat</td>
</tr>
<tr>
<td>More similar to other stylish coats</td>
<td>Similarity Judgment (Studies 1b)</td>
<td>More likely to categorize with other stylish coats</td>
<td>More likely to replace with a coat that is made out of wool</td>
</tr>
<tr>
<td>More likely to categorize with other stylish coats</td>
<td>Categorization (Study 1d*)</td>
<td>More likely to categorize with other wool coats</td>
<td></td>
</tr>
<tr>
<td>More likely to use when context requires a stylish coat</td>
<td>Intended Usage (Study 1e*)</td>
<td>More likely to use when context requires a wool coat</td>
<td></td>
</tr>
<tr>
<td>More likely to replace with a coat that has a stylish design</td>
<td>Replacement (Studies 2-5)</td>
<td></td>
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</tbody>
</table>

* Studies 1c-1e are fully reported in appendix A

**STUDIES 1A-1B: THE IMPACT OF MULTI-STAGE DECISIONS ON HOW CONSUMERS MENTALLY REPRESENT THEIR CHOICE**

Study 1a: Descriptions of the Chosen Option

Previous research has repeatedly demonstrated the strong link between mental representations and language (Lakoff 1987; Sato, Schafer, and Bergen 2013; Schmitt and Zhang 1998; Yorkston and De Mello 2005). Indeed, much of the seminal work in psychology relating to mental representations and categorization focused on text comprehension (e.g., Roth and Shoben
Further, emphasizing the link between mental representations and language in a cross cultural study, Schmitt and Zhang (1998) showed that speakers of a specific language, with its unique linguistic labels that classify the world into categories, perceive and categorize external stimuli differently than speakers of a different language. Building on this strong link between representations and language, we expect that if the order of attribute choices in multi-stage decisions influences how decision-makers mentally represent and categorize their chosen option, then attribute-choice order should influence the way they later describe it. Thus, we predicted that individuals would be more likely to use the attribute in the initial stage as the primary descriptor of the chosen option, and the attribute in the subsequent stage as a secondary descriptor.

**Method.** Eighty-four paid participants (58% male, median age 33) recruited from the online panel, Amazon Mechanical Turk (hereafter, AMT), were asked to imagine that they were planning to purchase a sofa set. Participants were told that the sofa set with their preferred design was available in three colors (white, brown, or black) and three fabric materials (linen, cotton, or wool). Participants were then told that the order in which they would make the attribute choices would be randomly determined by the computer (we elaborate on this randomization procedure and its purpose in the discussion section of studies 1a-1b). Participants were then randomly assigned to one of two conditions. In the *material-first condition* participants first chose their preferred material then their preferred color. Participants in the *color-first condition* made these attribute choices in the reverse order. After making their choice of color and material, or material and color, participants were asked to imagine that a friend called them and asked which sofa they decided to purchase. Participants were then asked to write, in an open-end format, how they would describe the sofa to their friend over the phone. These responses were coded by two
Results and Discussion. The frequency of choosing any specific material-color combination did not differ significantly by the attribute-choice order manipulation ($\chi^2 (8) = 5.2, p > .74$). Thus, the following results cannot be attributed to shifts in choices across conditions. Note that in all subsequent studies reported in the article and SOM, the choice shares of the option that was initially chosen did not differ significantly across the attribute-choice order conditions. For brevity, we do not repeat this analysis in the main text for each of the studies but rather summarize these chi-square analyses as well as multinomial logistic regressions testing for order effects on choice shares in appendix B.

Two research assistants coded participants’ responses. For each response, the coders were instructed to indicate which, if any, of the two attributes (color or material) was used as the main descriptor for the sofa. The level of agreement between the two coders was high (88.1%) and the coders resolved disagreements on the remaining ten responses through discussion. Overall, seven responses were coded by both coders as not clearly indicating the use of one attribute over the other as the main descriptor. Analyzing the data with and without these seven responses does not substantially changes the pattern of results.

As predicted, the majority of participants (58.5%) assigned to the color-first condition used color as the main descriptor of the sofa. In contrast, only 18.6% of participants assigned to the material-first condition used color as the main descriptor. A binary logistic regression confirmed that this difference between conditions was significant ($\beta = 1.82, Wald-\chi^2 (1) = 13.0, p < .001$). Supporting our hypothesis that attribute-choice order in multi-stage decisions influences the mental representation of the chosen options, the manner in which participants described their chosen options varied systematically with the order in which they had made their attribute
choices. An additional study reported in appendix A (study 1c) replicated these results using a different response mode that rules out issues related to sentence structure.

Study 1b: Similarity Judgments

A fundamental aspect of how individuals mentally represent and categorize stimuli is how those cognitive processes influence similarity judgments. Stimuli are perceived as more similar when they are considered members of the same category (Goldstone, Lippa, and Shiffrin 2001; Harnad 1987; Levin and Beale 2000; Livingston, Andrews, and Harnad 1998). Accordingly, if multi-stage decisions influence how consumers mentally represent their chosen option, then this should be revealed in their perceptions of similarity. That is, if consumers use the first attribute in the sequence as the primary attribute when forming their representations, then options that share the same level of that attribute should be perceived as more similar (compared to options that share levels of attributes chosen later in the sequence).

Method. Ninety-seven paid AMT participants (70% male, median age 29) were asked to imagine that they had recently won a Starbucks workplace raffle and that they would be able to choose a free drink. The drink options varied on two attributes: type (coffee vs. green tea) and temperature (hot vs. iced). After learning about the attributes and levels, participants were randomly assigned to either first choose a drink type then temperature (the type-first condition), or vice versa (the temperature-first condition). After choosing, participants indicated which of the two other drinks in the set that shared one attribute level with the originally chosen option was most similar to their chosen drink. Specifically, participants were shown an image of the drink they had chosen, and the images of two other drinks that were available but not chosen:
either the drink of (1) the same type but different temperature or (2) a different type but the same
temperature. They were asked to choose the drink that was the most similar to that which they
had originally chosen.

Results and Discussion. As predicted, 60.4% of participants that first choose the drink’s
type (type-first condition) indicated that the drink of the same type (but different temperature)
was the most similar to their chosen drink. In contrast, only 36.7% of temperature-first
participants made the same similarity judgment. A binary logistic regression confirmed that this
difference between conditions was significant ($\beta = .97$, Wald-$\chi^2(1) = 5.34$, $p = .02$). Further
supporting shifts in mental representations, participants judged the chosen option to be more
similar to another option that shared an attribute level they chose earlier (vs. later) in the decision
process.

A direct extension of the findings in study 1b is that attribute-order in multi-stage
decisions should also impact how participants group (i.e., categorize) the options available in the
original set. That is, if changing the order of attribute choices changes how consumers mentally
represent the stimuli, then one would expect that attributes that appear earlier in the sequence
will serve as the primary dimension on which consumers group the available options in the set.
We report an additional study in appendix A (study 1d) that directly examines this proposition.
As predicted, study 1d shows that the attribute level chosen earlier in the sequence is the main
dimension on which the options are subsequently grouped. Further, study 1e (also reported in
appendix A) demonstrates how shifts in mental representations, due to the order of attribute
choices, impact how consumers intend to use their chosen option.

Discussion: Studies 1a-1e
Taken together, the results of studies 1a-1b (and studies 1c-1e in appendix A) provide consistent support for our main hypothesis. Merely changing the attribute-choice order in multi-stage decision processes significantly changes how consumers mentally represent their chosen option. Consumers rely more heavily on the first attribute that they select as they gradually form their mental representations of the complete product they end up choosing. Thus, as hypothesized, even though the order of attribute choices did not change which option participants eventually chose, it did have a significant effect on how participants described, categorized, and intended to use their chosen option, as well as how similar they judged it to be relative to other options in the set.

While these results provide direct evidence for a shift in mental representation, it is possible that consumers may directly infer the relative importance of the different attributes based on the exogenously determined order in which they appear in the sequence. Because consumers often attend first to attributes they consider—*a priori*—more important (e.g., Tversky 1972), they might also infer that attributes that appear earlier in the decision process are more important. Similar inferential processes or forms of Gricean norms (e.g., “This attribute must be more important. Otherwise, why was it presented to me first?”) could also be suggested as rival theoretical accounts. However, as mentioned in the method section of study 1a, we employed an overt randomization procedure to address this concern. Participants were informed prior to engaging in the multi-stage process that the order of attribute choices in the sequence would be determined randomly by the computer. In order to make this as salient as possible, participants were shown a screen with a loading image that lasted 2 seconds and a message stating that the computer was randomly selecting the first attribute that would appear. An attention check at the
end of the study confirmed the vast majority of participants (95.2%) recognized that the order of attribute choices was determined randomly by the computer. Analyzing the results with or without the few respondents that failed to acknowledge this randomization procedure does not substantially change the pattern of results. We employed the exact same overt randomization procedure in several other studies that we report in the article and in appendix A (i.e., studies 1d, 3a, and 4). In addition, studies 3a, and 4 further rule out this inferential account in additional ways which are discussed later.

Finally, other than supporting the proposed shifts in mental representations, the dependent variables employed in studies 1a-1e also demonstrate important and relevant behavioral consequences. Specifically, shifting how consumers describe, intend to use, and categorize chosen options is of substantive importance with practical implications. The following studies examine another conceptually and substantively important dependent variable that also taps into consumers’ mental representations of their chosen options: replacement choices.

**STUDY 2: THE IMPACT OF MULTI-STAGE DECISIONS ON REPLACEMENT CHOICES**

The studies reported thus far provide converging evidence that attribute-choice order in multi-stage decisions influences how consumers mentally represent their chosen options. However, one may call into question the behavioral implications of these findings by arguing that if consumers ultimately choose the same option, regardless of attribute-choice order, then the implications of these results may be of limited practical importance.

Contrary to this perspective, we argue that the shift in how consumers describe and use
their chosen option (studies 1a, 1c, and 1e), resulting from a subtle and easy-to-implement shift in attribute-choice order, is both conceptually and practically important. Further, we contend that although the chosen option is objectively identical (from the perspective of an outside observer), it is meaningfully different from the consumer’s perspective. In this and subsequent studies we demonstrate that shifts in how consumers mentally represent their chosen option can actually impact consumers’ preferences and choices when making subsequent replacement decisions.

Replacement decisions are important in their own right, particularly given their prevalence. In the marketplace, there are numerous instances in which consumers cannot have their first choice of a product or service (e.g., due to unexpected stock outs, legal restrictions, bidding processes, etc.). In such cases, the consumer is likely to choose a replacement option (e.g., Boland, Brucks, and Nielsen 2012). Assuming the initially chosen option was the consumer’s most preferred option, it is likely that the consumer will choose the most similar replacement option available in the set. Because we hypothesized and found that the order of attribute choices in multi-stage decisions influences the perceived similarity of the other remaining options (study 1b), we predict that individuals would be more likely to choose replacement options that share the attribute level selected in the initial (as opposed to the subsequent) stage of the multi-stage decision.

Returning to the coat example, the consumer that first chose a stylish design, then the wool material, would be more likely to choose the other stylish coat (i.e., stylish-leather) as a replacement coat. In contrast, this replacement choice would change to be the casual-wool coat if the consumer first chose the material of the coat then its design (see figure 1). In order to empirically test this hypothesis, and extend it to actual behavior, the current study involved consequential (non-hypothetical) replacement choices of bags that participants actually received.
Method

One hundred fifty-eight student participants (32% male, median age 20) completed this incentive compatible study as part of a larger battery of studies in a behavioral lab at a major northeastern university. At the end of the session, to ostensibly thank them for their participation, each participant was given a university-branded drawstring bag of his or her choosing. Participants could choose the logo design (two distinct designs were available) and material color (white vs. gray) of the bag (see figure 2 for a picture of the actual bags used in this study). Participants were randomly assigned to one of two conditions. In the logo-first condition participants first chose their preferred logo and then their preferred color. In the color-first condition the sequence was reversed and participants first chose their preferred color and then their preferred logo. After making their choices, participants were told that their chosen bag was unexpectedly unavailable. They were then offered the opportunity to choose a replacement bag which either had the same logo but different color or had the same color but a different logo.

Results and Discussion

As hypothesized, 65.8% of participants assigned to the logo-first condition chose a replacement bag that had the same logo as their most preferred bag, but a different color. In contrast, only 40.5% of participants assigned to the color-first condition made this same replacement choice. A binary logistic regression confirmed that this difference between conditions was significant ($\beta = 1.04, \text{Wald}-\chi^2 (1) = 9.94, p < .001)$. 
Consistent with the perceived similarity results reported in study 1b, study 2 demonstrates that consumers’ consequential replacement choices were significantly influenced by the order in which they made attribute choices in the multi-stage decision. Taken together, studies 1a, 1b, and 2 used three distinct dependent variables to demonstrate that merely changing the order of attribute choices in multi-stage decisions can significantly impact how consumers mentally represent and categorize their chosen options. The next study broadens the scope of the
investigation by testing the roles that choice and agency may have on the proposed effect.

**STUDIES 3A AND 3B: THE ROLE OF CHOICE AND AGENCY**

A question that remains unanswered is whether there is something unique about the gradual selection process of attribute levels in the multi-stage decision process that affects mental representations, or whether the effect is mainly driven by simple differences in the salience of the attributes due to the order in which they appear. Stated differently, would merely presenting the information about the attributes in a sequential manner without an impending choice produce the same results?

As alluded to earlier, a mental representation is an internal cognitive symbol that represents a certain stimulus (e.g., objects, concepts, people, etc.). Thus, when considering the psychological process involved in forming mental representations there needs to be a specific focal stimulus to be mentally represented. In the absence of such a focal stimulus, mental representations do not form. In the context of multi-stage decision processes, this focal stimulus is the option that is being gradually selected (or “formed” as attribute levels are selected). That is, as consumers gradually advance through the selection process, they assign meaning to and begin to mentally represent their soon-to-be-chosen option using the attribute choices they make in this gradual process. However, we argue that when merely viewing the attribute information in a sequential manner, without the need to choose, a focal stimulus does not exist and therefore mental representations will not form. Accordingly, outside the context of an impending choice—where no focal stimulus exists in consumers’ mind—shifts in attribute order will not impact consumers’ mental representations. More specifically, while the attribute location in the
sequence may impact the degree of attribute salience (i.e., engender primacy or recency effects), because no focal object exists or is being formed in the consumer’s mind, attribute order should not influence consumers’ mental representations. We directly test this hypothesis in study 3a.

Although the proposed mental representation account suggests that a choice process must occur for attribute order to impact mental representations, this account does not require agency. That is, based on the mental representation account, even if we observe someone else choosing a product sequentially, attribute ordering will impact how we (as observers) mentally represent the option that someone else chose. That is, we would expect to see the same shift in behavior (e.g., shifts in replacement options) even when someone else made the sequential attribute decisions for the consumer. In sum, we hypothesize that a selection process is necessary to produce shifts in mental representations, but that agency (i.e., choosing for oneself) is not required.

Studies 3a and 3b directly examine these hypotheses using replacement options as the dependent variables. In study 3a we test whether the mere sequential presentation of information is sufficient to produce shifts in mental representations or whether an actual selection process is required. In study 3b (and study 7 in appendix A) we test whether the same shifts in mental representations would occur even when participants observe someone else making the sequential decision process for them (i.e., without agency).

Study 3a: The Role of Choice

Method. Two hundred eighty-six paid AMT participants (58% male, median age 31) took part in this study, which used coffee-mug sets as stimuli. Participants were randomly assigned to
one of four between-subjects conditions in a 2 (choice vs. view) × 2 (attribute-choice order: material-first vs. color-first) design. In the choice condition participants were asked to imagine that they were offered a choice of a free coffee-mug set and that the sets came in two colors and two styles. Participants were informed that they would be required to choose their preferred color and style.

Participants assigned to the view condition were given the same information about the coffee-mugs sets varying on color and style, but were not put in a context of an impending choice. Participants were told they would be asked to view the different colors and styles but that they would not be asked to select their preferred levels. To ensure that participants in this condition paid attention to the information that would be displayed, they were asked to pay attention and memorize the attribute information. Subsequent recall measures, as well as time spent on choosing or viewing were collected across both conditions.

Participants in both the choice and view conditions were then told that the computer would randomly determine the order by which they would either choose or view the attributes, respectively. This overt randomization procedure, also employed in studies 1a, 1d, and 4, was designed to eliminate inferences from the selection order.

The second factor manipulated the order of attributes. Specifically, participants were assigned to either the color-first condition (first choosing/viewing the mugs’ color then style) or the style-first condition (first choosing/viewing the mugs’ style then color). The color attribute was presented using two color swatches and the style attribute was presented with the mugs’ silhouettes. Unlike participants in the choice condition, those assigned to the view condition learned about the choice context (choosing a free coffee-mug set) only after viewing these attributes in the same sequential manner. Only then were they were presented with the entire
choice-set of four coffee-mugs and asked to choose their preferred mug.

On the next screen, participants in all four conditions viewed a picture of their chosen mug and were informed that it was unavailable. They were then told that they could select any of the three remaining mugs as a replacement (pictures of the three remaining mugs appeared below the selected mug). Accordingly, participants could choose a replacement mug set that shared the same color with their original mug choice, shared the same style, or was different on both attributes.

Finally, two attention check measures were used to ensure that participants paid attention to both the randomization of attribute choices procedure and the attribute information. As in studies 1a and 1e, the vast majority of participants across all conditions (95.5%) acknowledged that the computer randomly determined the order in which the attributes were selected from or viewed, and this did not significantly differ across the manipulated factors or their interaction (all p’s > .55).

Results and Discussion. As mentioned, in order to ensure that participants in the view condition paid attention, they were explicitly asked to memorize the attribute information. Indeed, participants’ recall of the available colors and styles (by checking a list of four color swatches and four style silhouettes) was very high (97.9%) and did not differ across the manipulated factors or their interaction (all p’s > .9). Excluding or including the six participants that failed these attention checks does not substantively changes the results. Thus, participants in the choice and view conditions equally attended to the attribute information they were presented with. Further, the average time participants spent choosing from (M = 5.35 seconds) versus viewing (M = 6.20 seconds) the attributes did not significantly differ (F(1, 284) = 2.32, p = .13). Hence, it is unlikely that any differences found between the choice and view conditions on the
primary dependent measures can be attributed to participants’ paying less attention to information in the viewing condition.

Participants’ replacement choices were analyzed via a logistic regression including both factors (attribute-order and choice vs. view) and their interaction as independent variables. The analysis revealed a significant interaction ($\beta = 1.37$, $\text{Wald-}\chi^2(1) = 5.81$, $p = .016$) with no significant main effects. The choice shares in the choice condition replicated the proposed attribute-choice order effect. Specifically, participants assigned to the color-first condition were more likely to replace their initially chosen option with an option that shared the same color (39.1%) compared with participants in the style-first condition (14.7%; $\text{Wald-}\chi^2(2) = 10.55$, $p < .005$). However, this effect did not hold for participants who merely viewed the attributes in a sequential manner outside the context of an impending choice. Specifically, in the view conditions, color-first condition participants were as likely to replace their initially chosen option with an option that shared its color (23.6%) as were style-first condition participants (24.7%; $\text{Wald-}\chi^2(2) = .29$, $p > .86$; please refer to appendix C for a table summarizing the choice shares of replacement options across conditions in studies 2-5).

Note that the choice proportions of replacement options sharing no attribute levels with the participants’ original choice were very low (3.8%) and did not significantly differ across conditions (both the main effects and interaction were non-significant all $p$’s > .33). Analyzing the data with or without these eleven participants does not substantively changes the results.

Study 3b: The Role of Agency
Method. One hundred forty-five paid AMT participants (67% male, median age 30) were asked to imagine that they had received a gift card from a friend for a pen from a well-known prestigious brand. The available pens varied on material (two levels) and finish color (five levels).

Participants were randomly assigned to one of four between-subjects conditions in a 2 (agency: yes vs. no) × 2 (attribute-choice order: material-first vs. color-first) design. Participants in the agency conditions chose their preferred level of each attribute. Participants in no-agency conditions were told that the friend who had given them the gift-card had selected the attribute levels for them. Whether participants chose the initial pen themselves or had the choice made for them by a friend, it was always chosen via a multi-stage decision. That is, participants either chose their preferred level of each attribute in a sequential manner (in the agency condition) or saw each attribute in a sequential manner with their friend’s selected level marked on the screen (no-agency condition). Thus, the difference between the conditions was that participants themselves completed the multi-stage decision in the agency condition, while those in the no-agency condition merely observed the sequence of attribute choices that their friend had made for them. Participants in the material-first condition made (or observed their friend making) the material choice first then the finish color choice. Participants in the color-first conditions made (or observed their friend making) these choices in the opposite order. The pen ostensibly chosen by the friend in the no-agency condition was randomly determined for each participant.

Next, participants were told that the chosen pen was unavailable because it was out-of-stock, but that all other combinations of material and color were available. All participants then indicated whether they would keep the same material but change the finish color or, alternatively, change the material but keep the same finish color.
Results. Participants’ replacement choices were analyzed via a binary logistic regression including both factors (attribute-choice order and agency) and their interaction as independent variables. As predicted, attribute-choice order had a significant main effect on participants’ replacement choices ($\beta = .93$, $Wald-\chi^2 (1) = 3.83$, $p = .05$); participants assigned to the material-first condition were significantly more likely to choose the replacement pen with the same material (70.4%) than those assigned to the color-first condition (50.0%). Neither the main effect of agency nor its interaction with attribute order were statistically significant ($\beta = .65$, $Wald-\chi^2 (1) = 1.93$, $p > .16$; $\beta = -.09$, $Wald-\chi^2 (1) = .16$, $p = .90$, respectively). Thus, the influence of attribute-choice order on participants’ replacement choices persisted even when participants did not make the initial choice themselves.

Discussion: Studies 3a and 3b

Studies 3a and 3b provide two important insights into the influence of attribute-choice order on mental representations of chosen options—both of which are consistent with our theoretical framework. First, study 3a demonstrates the role of the attribute selection process over and above saliency effects. Merely viewing the available attributes sequentially, outside the context of choice, does not affect consumers’ mental representations of their subsequently chosen option. While viewing the attributes in a specific order might make an attribute more salient (e.g., via primacy or recency effects), it does not involve the gradual formation of the chosen option, and therefore, does not trigger mental representations. One might challenge the null effect in the view condition by attributing it to lower involvement in the viewing (as opposed to choice) task. However, no differences in participants’ recall of attribute information,
nor in the average time spent choosing from or viewing the attributes, were observed between the choice and view conditions. Hence, the absence of an attribute-choice order effect in the view condition is unlikely to have occurred due to participants’ lower involvement or attentiveness.

Second, study 3b further demonstrated that although a selection process is a necessary condition to influence mental representations of the chosen option, agency is not. That is, consistent with our theoretical account, merely observing someone else sequentially choosing attribute levels influences mental representations of the chosen option based on attribute order. These results are notable as attribute order causes significant shifts in replacement choices even for products that consumers did not originally pick themselves. These results are also inconsistent with various choice-based accounts such as internal consistency (Festinger 1957), self-perception (Bem 1967), post-choice reasoning and justification (e.g., Shafir, Simonson, and Tversky 1993), and choice closure (Wright and Barbour 1977). All these accounts fundamentally relate to how consumers’ initial (active) choice impacts their subsequent behavior through different motivations. However, the attribute-choice order effect persists even when the initial choice was not made by the consumers themselves.

Finally, these findings are also inconsistent with the aforementioned rival account pertaining to inferences about attribute weights drawn from the order in which these attributes appear. Such inferences, to the extent that people form them, should occur regardless of whether people choose from or merely view the attributes sequentially. The absence of an attribute-choice order effect in the view condition in study 3a casts further doubt that inferences were the main driver for the observed effect. We further test the inferential account in the next study.

STUDY 4: MENTAL REPRESENTATIONS VERSUS INFERENCES
The main goal of study 4 was to further test whether inferential processes—as opposed to mental representations—drive the observed effect. In order to directly test this account, study 4 asked participants to choose which task, out of four available tasks, they wanted to complete. To make potential inferences about the attributes describing the tasks less plausible, we used meaningless labels (i.e., letters and colors) to describe the four possible tasks. Further, we also manipulated between subjects the ostensible procedure by which the order of attribute choices was determined: random versus non-random.

By our account, although these procedures should make inferences about attribute weights immaterial, the order of attribute choices should still impact how individuals mentally represent the stimuli. That is, because mental representations are formed spontaneously and automatically (Lakoff 1987; Markman 1987, 1989; Sato, Schafer, and Bergen 2013), we expected the effect to persist even when it was made explicit that the attribute-order was determined randomly and when the attribute levels did not convey any meaningful information.

Finally, in order to further broaden the scope of these findings, study 4 used a preference elicitation mode more consistent with screening decisions that are commonly used by online decision (or search) aids. That is, participants observed all possible task combinations and were asked to screen these options in stages based on the available attributes.

Method

Two hundred one paid AMT participants (63% male, median age 30) were asked to choose the task they would ostensibly complete from four different tasks. The tasks were
described on two meaningless dimensions—letter (H and M) and color (blue and red)—and a 2x2 table presenting all four combinations was shown to the participants in advance. Intentionally, no information about the content or characteristics of the tasks was provided and, thus, participants could not make meaningful inferences about the importance of the attributes or their levels.

Participants were randomly assigned to one of four conditions in a 2 (choice-order determination: random vs. non-random) × 2 (attribute-choice order: letter-first vs. color-first) between-subjects design. Participants assigned to the random conditions were given the same randomization instructions and procedure as was employed in studies 1a, 1d, and 3a. Participants assigned to the non-random conditions were simply told they would make their screening decisions in a prescribed order and then proceeded to the next screen.

On the choice screen, the participants saw a 2x2 table containing all four combinations of letters and colors, which ostensibly represented the four tasks they might complete. Participants assigned to the letter-first condition screened out tasks by first choosing a letter then a color, while those assigned to the color-first condition made these choices in the opposite order. When the participant chose a level for a specific attribute (e.g., “H”), the options containing the other level (“M”) faded to a darker color, signifying that they had been screened from consideration. After choosing a task, participants were informed that the chosen task had enough workers and was currently unavailable. Participants were then asked to choose a replacement task from the three remaining tasks.

Results
Participants’ replacement choices were analyzed via binary logistic regressions. Our primary dependent measure was the percentage of participants choosing a replacement task with the *same color* but a *different letter* as their initially selected task. A binary logistic regression revealed a significant main effect of attribute-choice order \((\beta = .56, \text{Wald-}\chi^2(1) = 14.74, p < .001)\). Specifically, 64.7\% of participants in the color-first condition chose the replacement task with the same color but different letter, compared to only 37.3\% of participants in the letter-first condition. Importantly, making it explicit that the order of attributes was determined randomly had no influence on replacement choices \((\beta = -.11, \text{Wald-}\chi^2(1) = .54, p > .46)\), nor did this factor interact with the attribute-choice order manipulation \((\beta = -.02, \text{Wald-}\chi^2(1) = .02, p > .90)\).

Note that few participants did choose the replacement task that differed from their first chosen task on both attributes, but the percentage of such responses was very low (highest percentage across all conditions reached 9.1\%). Moreover, the rate of these responses was not influenced by attribute-choice order manipulation \((\beta = .20, \text{Wald-}\chi^2(1) = .44, p > .50)\), the order-randomness manipulation \((\beta = -.28, \text{Wald-}\chi^2(1) = .81, p > .36)\), or the interaction of these two manipulations \((\beta = .00, \text{Wald-}\chi^2(1) = .00, \text{NS})\). Thus, the pattern of results cannot be explained by the percentage of participants that opted to replace their chosen option with a completely dissimilar option.

Discussion

The results of study 4 replicated our key order effect are clearly inconsistent with an inferential account. Even after making it salient to participants that the order of attributes was randomly determined by a computer, replacement choices were still influenced by the order of
attribute choices in the multi-stage decision process. Further, the effect persisted in a context in which the attributes themselves (letters and colors) could not meaningfully signal actual qualities of the available options. Study 5 explores an important boundary condition for these shifts in mental representations.

STUDY 5: THE MODERATING ROLE OF ESTABLISHED MENTAL REPRESENTATIONS

If the reported order effect of multi-stage decisions is indeed driven by shifts in how consumers mentally represent their chosen option, then this effect should attenuate when consumers already have pre-established or “fixed” mental representations of the target stimulus class. The current study tests this boundary condition.

Method

Three hundred five paid AMT participants (57% male, median age 32) were recruited for this study, which asked them to choose a coffee mug via a multi-stage decision process. This study was comprised of 4 conditions in a 2 (pre-established mug representation: fixed vs. control) × 2 (attribute-choice order: color-first vs. design-first) between-subjects design.

To manipulate the pre-established mug representation, prior to completing the multi-stage decision, participants first completed a randomly assigned task. In the fixed mental-representation condition participants were given a picture of two coffee mugs that varied in color and design (neither of the colors nor designs were used in the subsequent multi-stage decision)
and were asked to choose their most preferred mug. After indicating their choice, participants were asked to describe their chosen mug such that a person who could not see the option would be able to mentally visualize it. The purpose of this condition was to make participants form their mental representations of the target class of stimuli (coffee mugs) on the two dimensions of interest: color and design. In so doing, participants would have to rely on the two attributes and should presumably establish the hierarchy of attributes in their mental representation of coffee mugs. Regardless of which attribute hierarchy was established by this manipulation, this task should mitigate the impact of the attribute-order effect in the subsequent multi-stage decision.

In contrast, the control mental-representation condition asked participants to do the same description task after choosing between two options of chairs. Although this task would fix these participants’ mental representations of chairs, it should not influence their mental representation of coffee mugs (the target product used in the subsequent multi-stage decision).

In the next stage, participants in both conditions were asked to imagine that they were looking to buy a new set of coffee mugs and that they would choose their preferred mug attribute-by-attribute. The available mugs varied on two attributes—design (two levels: contemporary or rustic) and color (two levels: yellow or blue)—yielding four possible combinations.

The second between-subjects factor was the attribute-choice order. Participants in the color-first condition first chose the mug’s color then design. In the design-first condition the order of these decisions was reversed. At each stage of the decision, participants viewed either pictures of the mug’s design (color was removed from these images, creating a gray-scale silhouette) or a color swatch indicating the mug’s color. After choosing a mug, participants across all conditions were told that their chosen mug was out-of-stock, and were asked to choose
a replacement mug. Note once again that the mugs’ colors and designs were distinct from those used in the first stage of the study.

Results and Discussion

As predicted, and replicating our key effect, the choice of replacement option significantly differed as a function of attribute-choice order in the control condition, where participants did not have pre-established representations of mugs. Specifically, 60.8% of participants in the color-first condition chose the replacement mug with the same color compared to only 43.2% of participants in the design-first condition ($\beta = -.71$, $Wald-\chi^2 (1) = 4.53, p < .04$). However, the effect was fully attenuated in the fixed condition, where participants had pre-established mental representations of mugs: 37.2% of participants in the color-first condition and 40.5% of participants in the design-first condition chose the replacement mug with the same color ($\beta = .14$, $Wald-\chi^2 (1) = .18, p = .67$). The interaction of the two factors was marginally significant ($\beta = -.85$, $Wald-\chi^2 (1) = 3.30, p = .069$). These results demonstrate that once the mental representation of a class of options is set (via visualization, in this study), the attribute-choice order in a multi-stage decisions does not impact how the chosen option is construed. This provides further support to the proposed mental representation account.

**GENERAL DISCUSSION**

The current research examines how the order of attribute choices in multi-stage decisions impacts consumers’ mental representations and categorization processes as well as subsequent
behavior. Using multiple established paradigms, we find that consumers mentally represent chosen options based on the attribute that is selected earlier in the multi-stage decision process. Accordingly, we find that the attribute-choice order changes how consumers (i) describe the chosen option, (ii) judge its similarity relative to other available options, (iii) categorize it, (iv) intend to use it, and (v) replace it.

Theoretical Contribution

The literature concerning mental representations and decision making has primarily focused on how mental representations impact choice. In contrast, this article demonstrates that the choice process itself can impact how consumers mentally represent and, consequently, categorize their chosen option. Our findings further show a range of consequences of such shifts in mental representations. Related work by Chakravarti, Janiszewski, and Ülkümen (2006) also proposed a type of a categorization effect in multi-stage decision processes. However, their proposed categorization process is distinct from the one explored in the current article. In particular, Chakravarti et al. (2006) explored how information/attributes used for pre-screening alternatives become less important relative to information acquired at later stages. These authors argued that after an option had passed the screening process it is categorized as an acceptable option (i.e., as part of the final consideration set). In the current article, however, we demonstrate a cognitive process that does not relate to whether an option passed a certain threshold, but rather relates to a shift in the mental representation of the actual option and its meaning.

Further, because the extant literature on multi-stage decision processes explored how such processes impact choice, it largely focused on path-dependent processes (including the
aforementioned Chakravarti et al. 2006). However, we focus on path-independent multi-stage processes, where all options are available regardless of choices made earlier in the process. We find that, although consumers choose the same option regardless of the order in which attribute choices are made, the chosen option is subjectively different from the consumer’s perspective. As demonstrated, such shifts in subjective perception can have important behavioral implications. Accordingly, the current article focuses on understudied, path-independent decision processes, which allowed us to explore pure order effects and disentangle such effects from other mechanisms explored in the past.

Relatedly, Boland, Brucks, and Nielsen (2012) report an attribute carryover effect which seems inconsistent with some of the results we report. In particular, Boland et al. (2012) examine consumers’ choice of replacement options after consumers engaged in a screening process and learned that their top choice was unavailable. They report instances in which consumers, instead of choosing their previously stated runner-up option (which met the initial screening criteria), tend to choose an option that does not meet the initial screening criteria but has another desirable feature shared with their top choice. We speculate that the seemingly inconsistent results may arise from several distinct features in the paradigms and procedures employed by Boland et al. (2012) that may have made it hard for participants to recognize the hierarchical process of their attribute selection (to the extent there was one). This, may have hindered participants from mentally representing their chosen option based on a certain attribute-selection process. We elaborate further in appendix D on the specific differences of the experimental paradigms.

Applied and Methodological Contributions
Beyond its conceptual contribution, this article also demonstrates that a relatively simple-to-implement change in the decision process could enable firms and policy makers to influence how individuals mentally represent their offerings in the market. Such shifts in mental representations are shown to impact several important behavioral dependent variables including preferences and subsequent decisions (e.g., replacement decisions). Further, given the importance of understanding consumers’ reactions to within-category versus cross-category substitutes (e.g., Huh, Vosgerau, and Morwedge 2016), shifting consumers’ perceptions of what constitutes within- or cross-category substitutes by a simple change in attribute-choice order may be beneficial. Finally, it seems reasonable, and worth testing, whether companies can influence consumers’ perceived set of competitive options in the marketplace as well as impact their brand’s perceived positioning by such shifts in mental representations.

Additionally, because mental representation is a construct often proposed and identified as a mechanism underlying different behavioral phenomena (e.g., Henderson and Peterson 1992; Lynch, Chakravarti, and Mitra 1991; Reinholtz, Bartels, and Parker 2015; Weiss and Johar 2013), researchers often seek to manipulate how participants categorize and mentally represent stimuli. Given the results of the current article, researchers investigating such mechanisms may find that manipulating attribute ordering in multi-stage decisions could serve as a simple and subtle manipulation of mental representations.

Alternative Explanations

One potential rival account for the observed pattern of results is that consumers infer the importance of the attributes based on their location in the sequence. That is, consumers believe
that important attributes typically appear early in the multi-stage decision process. In this article we empirically address this alternative explanation in multiple ways. Studies 1a, 1d, 3a, and 4 used an explicit and overt manipulation informing participants that the order of attribute choices in the sequence was randomly determined by a computer. Further, study 4 tested the effect in a context that rendered the attributes (and therefore their importance) meaningless. Lastly, in study 3a we find that merely viewing the attributes in a sequential manner does not change consumers’ mental representations although inferential processes about attribute importance should have still occurred. Thus, our data is inconsistent with a more deliberative inference making account. That said, we fully acknowledge that one could in principle still argue that such inferential processes occur automatically and would therefore apply also when people are explicitly made aware that the attribute order is determined randomly. Although it is not clear why such automatic inferential process would not apply in the view condition in study 3a, additional research could more thoroughly test different types of inferential processes.

Study 3b is also inconsistent with other rival accounts, such as internal consistency (Festinger 1957), self-perception (Bem 1967), post-choice reasoning and justification (e.g., Shafir, Simonson, and Tversky 1993), and choice closure (Wright and Barbour 1977). All these alternative accounts fundamentally relate to how consumers’ initial (active) choices impact their subsequent behavior through different motivations. However, we find that the effect persists even when the initial choice was made randomly by a friend (study 3b) or by a computer (study 7 in appendix A). Thus, our findings cast doubt on these various choice-based accounts.

Finally, throughout the studies we systematically demonstrate that the observed pattern of results is not driven merely by differences in the option that consumers initially chose. That is, we neither expected nor observed shifts in the initial choice shares when employing path-
independent multi-stage processes with different attribute-choice orders.

It is important to emphasize that what distinguishes the multi-stage decision process is the gradual, piecemeal “formation” of the object (either through consumers’ choice, or choices made by a third party). Merely providing consumers the complete set of available attributes and levels in advance (or even in a sequential manner outside the context of choice; see study 3a) does not influence their mental representations. Indeed, in several of the studies reported in this article and in appendix A (studies 1a, 1b, 1e, 2, 3b, 4 and 7), the complete set of attributes and levels were given to participants in advance, yet the actual attribute-choice order in the multi-stage process influenced the way by which chosen options were mentally represented.

Boundary Conditions, Limitations, and Future Directions

Given the process we propose, we do not expect the effect to occur in situations where consumers’ mental representations of the stimuli are already well-established and relatively fixed. Accordingly, in study 5 we experimentally induced the formation of prior representations of the focal class of stimuli and found that the effect attenuates. Similarly, we expect that such shifts in mental representations are limited to situations in which the attributes involved in the hierarchical process are reasonably representative of the category. For example, we do not expect that consumers will represent their chosen car based on its upholstery when other, more basic attributes such as brand name or the car’s class appear in the sequence. However, we do suggest that once such “basic level” attributes are controlled for, for example when configuring the internal design of a BMW sedan, the order of more comparable attributes in the sequence (such as the upholstery’s color and pattern) could shift consumers’ mental representations of the car’s
design. More broadly, we suspect that the degree to which the attributes in the sequence are perceived as basic-level descriptors of the category, as well as their level of abstractness, would impact the degree to which their order might actually impact consumers’ mental representations (see Rogers and Patterson 2007 on the basic level effect).

Furthermore, our investigation focused on short time horizons, and we do not have evidence for how long the shifts in mental representations will last. Still, in many situations, even local shifts in mental representations could have important, possibly long-term, consequences; especially when considering cases where consumers’ mental representations are still malleable (e.g., novel categories, products, and attributes). Examining the long-term impact of these effects is an important and potentially fruitful avenue for future research.

We also limited our investigation to relatively small number of dimensions. This provided us a simple and strong test of our predictions. In the market place, however, multi-stage decision processes may sometime involve a greater number of both attributes and levels. Examining the focal effect in settings with a larger set of dimensions seems important and could inform companies and policy makers about the extent to which this effect may be employed. Additionally, whether the mere number of levels of a certain attribute (controlling for its position in the sequence) changes the degree to which it impacts mental representations seems interesting and important from both theoretical and applied perspectives.

In sum, this article demonstrates that merely changing the order in which consumers select attribute levels in a multi-stage decision alters how they mentally represent the chosen option. Although the initial choice remains the same, this option is conceptualized very different from the decision maker’s own perspective. We argue more broadly, that this finding may highlight a class of instances which, in our view, is relatively under explored in the judgment and
decision-making literature. Specifically, the core focus of research in the field of decision-making is to explore how and why certain actions and interventions may lead to shifts in choice shares. Such shifts in choice shares are essentially defined and measured by decision makers’ choice of an objectively different option from the set. However, the current article suggests that perhaps broadening the scope of what constitutes a “different” choice may benefit the field and lead to additional important research questions. After all, if the same option is construed differently and therefore described, used, and replaced differently, perhaps it meaningfully ceases to be the same option.
Study 1c: The Impact of Multi-Stage Decisions on How Consumers Describe Their Choice

Method. Two hundred one paid Amazon Mechanical Turk (hereafter, AMT) participants (53% male, median age 34) were asked to imagine that they were looking to purchase a coat and that the available options varied on two attributes: design (stylish vs. casual) and material (wool vs. leather). Participants in the design-first condition first selected their preferred design then their preferred material type. Participants in the material-first condition made these attribute choices in the reverse order.

To test our proposition that participants’ descriptions of their chosen coat would differ based on the order in which they made their attribute choices, we asked them to choose which of two sentences best described their chosen coat. The two sentences differed on which attribute was used as the primary descriptor. In particular, one sentence used design as the primary descriptor and material as the secondary descriptor (e.g., “I chose a stylish coat made out of wool.”). Conversely, the second sentence used material as the primary descriptor and design as the secondary descriptor (e.g., “I chose a wool coat that is stylish.”).

Admittedly, the structure of these sentences always places the primary descriptor earlier in the sentence. This may pose a concern as one may argue that participants would merely choose the sentence in which the attributes are presented in the order in which they were chosen. In other words, the aforementioned sentences fully confound the primacy of the descriptors with its location in the sentence. In order to address this concern, we employed an additional version of the sentences (in a between-subjects design) such that the primary descriptor appeared later in
the sentence. In particular, the first sentence used design as the main descriptor and material as
the secondary descriptor but had them appear in the opposite order (e.g., “I chose a wool material
for my stylish coat.”). Conversely, the second sentence that used material as the main descriptor
and design as the secondary descriptor also had them appear in the opposite order (e.g., “I chose
a stylish design for my wool coat.”). Thus, the study employed a 2 (attribute decision made first:
design vs. material) x 2 (primary attribute appearance in the sentence: first vs. second) between-
subjects design.

Results and Discussion. We performed a binary logistic regression with participants’
choice of sentence as the dependent variable. The two independent variables were the attribute-
choice order in the multi-stage decision process (style vs. material first), and the version of
sentence structure (primary descriptor appears first vs. last). As expected, the analysis confirmed
that the order of attribute choices in the multi-stage decision process affected which attribute was
chosen as the primary descriptor. In particular, 53.5% of participants that chose style first used
style as the primary descriptor of their choice. Conversely, only 37.3% of participants that chose
material first used style as their main descriptor ($\beta = .34, \text{Wald-}$-$\chi^2(1) = 5.26, p < .022$). In
addition, although the main effect of sentence version was significant ($\beta = .38, \text{Wald-}$-$\chi^2(1) =
6.86, p < .01$), the interaction was not ($\text{Wald-}$-$\chi^2(1) = 0.84, p > .15$): We find a similar pattern
regardless of which sentence version we use (44.7% vs. 27.5% when using version 1; and 61.5%
vs. 47.1% when using version 2). Finally, an additional analysis verified that the actual choice
shares of the coat options that participants chose did not significantly differ across conditions ($p
> .34$).
Study 1d: The Impact of Multi-Stage Decisions on Grouping Decisions

Method. One hundred nineteen paid AMT participants (48% male, median age 33) were asked to imagine they were offered a choice of a free coffee-mug set out of four possible options and that the sets came in one of two colors and in one of two styles (we counterbalanced whether color or style appeared first in this introduction sentence). Next, we employed the same salient randomization procedure described in study 1a in the main text. Again, the vast majority of participants (90.8%) acknowledged at the end of the survey that the order of attributes was determined randomly by the computer and analyzing the data with and without the few participants who failed to recognize the randomization procedure does not substantially change the results.

Participants were then randomly assigned to one of two conditions. In the color-first condition participants first chose the mug set’s color and then style. In the style-first condition the order of decisions was reversed. After choosing, participants observed the four possible mugs (i.e., 2 colors x 2 styles) and were asked to group them as they saw fit by dragging-and-dropping each mug into one of two bins on the other side of the screen and placing two mugs in each of the two bins.

Results and Discussion. Based on how participants grouped the mugs into the bins we were able to determine which of the two attributes participants used for grouping. Specifically, if each bin contained mugs of the same color then color was the attribute used for grouping. Alternatively, if each bin contained mugs of the same style then style was the attribute used for grouping. The vast majority of participants (98.3%) used either color or style for grouping. Only two of the participants used neither (i.e., grouped together mugs of both different color and
different style). Analyzing the data with or without these two participants does not substantially change the results.

As hypothesized, 80.7% of participants assigned to the *style-first* condition used the style attribute for grouping the products. In contrast, only 61.7% of participants assigned to the *color-first* condition used the style attribute for grouping. A binary logistic regression confirmed that this difference between conditions was significant ($\beta = .96$, $Wald-\chi^2 (1) = 4.98$, $p = .026$).

Study 1e: Intended Usage

Representations in memory may not only impact the way we describe a given stimulus but also guide our actions and behavior. As Smith (1998) noted: “representations in memory influence all our perceptions and judgments. What we know influences the way we interpret the world around us, put our experiences in context, and plan our actions.” Indeed, previous research suggests that the intended usage of a product or service maps onto how that option is mentally represented and categorized relative to other options (e.g., Barsalou 1983; Day, Shocker, and Srivastava 1979; Huh, Vosgerau, and Morwedge 2016; Ratneshwar and Shocker 1991). Thus, another way of examining shifts in mental representations is to test the impact of attribute-choice order on how consumers intend to use the chosen option.

*Method.* Ninety-four paid AMT participants (54% male, median age 34) were asked to imagine they had won a free two-night stay from a hotel company and that they would be able to choose the specific hotel chain at which they would redeem this free stay. The option of hotels varied on two attributes. The first attribute specified leisure-related amenities (i.e., spa services vs. dining and nightclub/bar facilities) and the second attribute specified business-related
amenities (i.e., free business center access vs. free dry-cleaning). Participants learned about these attributes and their associated levels prior to commencing the multi-stage decision process.

Participants were then randomly assigned to one of two between-subjects conditions. Those in the leisure-first condition first indicated their preferred leisure-related amenity and then chose their preferred business-related amenity. Participants assigned to the business-first condition made these choices in the opposite order. After indicating their preferences, participants in both conditions were asked to indicate for which of two upcoming trips they would most likely use their free hotel stay: a business-related trip or a vacation trip (responses were collected using a 1 = business trip to 8 = vacation trip scale). Because we expect that choosing leisure-related amenities first would make participants mentally represent the hotel as a vacation hotel, we predicted that participants in the leisure-first condition would be more likely to use the free hotel stay for their vacation trip (compared with those who chose the business related amenities first).

**Results and Discussion.** As hypothesized, participants assigned to the leisure-first condition were significantly more likely to use their free stay for their vacation trip ($M = 6.67, SD = 1.64$) compared to those assigned to the business-first condition ($M = 5.69, SD = 2.25; F(1, 92) = 5.94, p = .017$). Thus, participants’ intended use of their chosen option varied as a function of attribute-choice order. Since the mental representations of alternatives are strongly tied with their intended usage, these results provide additional support for our contention that attribute-choice order in multi-stage decisions influences how consumers mentally represent their choice.

Study 6: Multi-Level Attributes in Multi- vs. Single-Stage Decisions
Study 6 is distinct from the ones reported thus far in three main ways. First, in contrast to previous studies, study 6 included a single-stage control condition where no multi-stage process was employed as a benchmark. Second, study 6—like study 3b in the main text—used a multi-stage decision process in which one attribute offered more than two levels (i.e., one attribute with two levels and the other with five). Third, because how one mentally represents and categorizes a chosen option should influence the perceived importance of the attributes on which a chosen option is defined, study 6 also explicitly measured participants’ post-choice attribute weights. In the context of our previous example, if a chosen coat has been primarily represented in terms of its style then the consumer should be likely to assign greater importance to this attribute.

Method. One hundred forty-seven paid AMT participants (57% male, median age 32) were asked to imagine that they had received a gift card for a prestigious pen from a well-known brand and were choosing from several different models. The available pens varied on two attributes—material (two levels: titanium or platinum) and finish color (five levels: light blue, gold, black, red, or dark blue)—yielding 10 possible material-color combinations.

Participants were randomly assigned to one of three between-subjects conditions. In the control condition participants were simultaneously presented all 10 color-material combinations—randomly organized—and asked to choose one pen. Participants in the color-first condition first chose their preferred finish color and then proceeded to choose their preferred material. In the material-first condition the order of these decisions was reversed and participants first chose material and then the pen’s color. After choosing a pen, participants across all conditions were told that their chosen pen was out-of-stock, but that all other combinations were available to choose from.

Participants then indicated whether they would keep the same finish color and change the
material or, alternatively, change the finish color and keep the same material. Subsequently, participants indicated the importance of each attribute (material and color) when choosing pens by allocating 100 points to reflect the relative importance they assigned to each. Finally, participants indicated the extent to which they were annoyed and disappointed by the unavailability of their originally chosen pen (both on a 1-7 scale).

**Results.** The initial choice shares of the ten material-color combinations did not vary by attribute-choice order condition ($\chi^2 (18) = 15.17, p = .65$). Thus, any replacement choice results cannot be attributed to shifts in initial choices across conditions. Additionally, no differences were found across conditions in terms of how disappointed ($F < 1$, NS) or annoyed ($F < 1$, NS) participants felt upon learning that their first choice of pen was out of stock.

**Replacement Choice.** As hypothesized, the percentage of participants choosing to retain the same material and change the finish color was higher in the material-first condition (64.0%) than in color-first condition (37.5%), and the control condition fell between these two extremes (46.9%). A binary logistic regression confirmed that this pattern across conditions was significant ($\beta = .54$, Wald-$\chi^2 (2) = 6.92, p = .03$). Most germane to our theory, the difference in replacement choices between the material-first and color-first conditions was significant (Wald-$\chi^2 (2) = 4.15, p = .04$).

**Attribute Weights.** Consistent with the replacement choices, the relative importance of the material (vs. finish color) also differed significantly across conditions ($M_{\text{material-first}} = 51.38$, $SD = 27.01$ vs. $M_{\text{control}} = 44.90$, $SD = 24.82$ vs. $M_{\text{color-first}} = 38.27$, $SD = 28.82$; $F(2, 144) = 2.90, p = .06$). Of particular importance, the contrast between the color-first condition and the material-first conditions was significant ($F(1, 144) = 5.81, p < .02$). Thus, the order of attribute choices in the multi-stage decisions significantly influenced participants’ replacement options and the
weighting of the attributes on which the options were described.

Discussion. Study 6 replicated the replacement choice results found in studies 2 through 5 in the main text using a choice context containing a greater number of attribute levels and, consequently, number of available options. Further, study 6 included a control (single-stage) decision context as a reference. Although we made no specific prediction for this condition, the results were consistent with our theory: Since participants chose from a set of options, as opposed to sequentially choosing levels of attributes neither attribute was a dominant categorization cue, on average, and thus choice shares were in between the two specific attribute-choice order conditions.

This pattern was further reflected in participants’ attribute weights. Specifically, attributes were weighted more heavily when they appeared earlier in the multi-stage decision process. To verify that the shift in attribute weights was triggered solely by the attribute-order in the multi-stage decision process and not due to some interaction with the unavailability cue, we replicated this study and measured attribute weights either before or after the participants learned about the unavailability of the chosen pen (see study 6b below). The results hold regardless of whether attribute weights were measured before or after learning about the pen’s unavailability, further supporting our hypothesis.

Study 6b

Method. One hundred fifty-three paid AMT participants (47% male, median age 30) were asked to imagine that they had received a gift card for a prestigious pen from a well-known brand and were choosing from several different models. The stimuli and procedures were
identical to those in study 6 (above) with only two differences. First, unlike study 6, this study did not include the control condition (in which participants did not use a multi-stage decision process). Second, in the current study, the timing of measuring the attribute weights was manipulated between subjects and measured either before participants learned that their first choice of a pen was unavailable or after. Thus, this study employed a 2 (attribute order: material-first vs. color-first) × 2 (attribute weight measure: before learning about unavailability vs. after choosing a replacement) between-subjects design.

Replacement Choice. As predicted, the percentage of participants choosing to retain the same material and change the finish color was higher in the material-first condition (50.6%) than in color-first condition (26.3%). A binary logistic regression confirmed that this pattern across conditions was significant ($\beta = 1.11, SE = 0.51, Wald-\chi^2 = 4.66, p = .03$). However, there was no evidence that participants’ replacement choices were affected by when they responded to the attribute weight measure ($\beta = 0.55, SE = 0.53, Wald-\chi^2 = 1.07, p = .30$) or its interaction with attribute-choice order ($\beta = -0.08, SE = 0.70, Wald-\chi^2 = 0.01, p = .91$).

Attribute Weights. Consistent with the replacement choices, the relative importance of the material (vs. finish color) also differed significantly across attribute-choice order conditions ($M_{\text{material-first}} = 46.62, SD = 21.95$ vs. $M_{\text{color-first}} = 37.12, SD = 24.46; F(1, 149) = 6.29, p = .01$). This pattern of results held regardless of when attribute weights were measured. In particular, neither the main effect for when attribute weights were measured nor its interaction with attribute-choice order was found to be statistically significant ($F(1, 149) = .131, p = .72; F(1, 149) = 0.121, p = .73$; respectively).
Study 7

One way to separate the proposed mental representation account from several choice-based explanations is to test the focal effect in situations in which consumers do not make the initial choices themselves. That is, merely observing the multi-stage choice process and the order by which attributes are arranged should impact how consumers mentally categorize the resulting option. Rival choice-based accounts for the proposed effect, such as internal consistency (Festinger 1957), self-perception (Bem 1967), post-choice reasoning and justification (e.g., Shafir, Simonson, and Tversky 1993), and choice closure (Wright and Barbour 1977) depend on consumers independently making their initial choice in the multi-stage process. To tease our account apart from these other choice-based accounts, the computer made the initial attribute choices for the participants in study 7. Subsequently, participants chose their preferred replacement options in an incentive compatible design.

Method. One hundred twenty AMT participants (57% male, median age 30) were told they would be asked to complete one of four possible tasks. Participants were further told that the computer would randomly choose the task they would complete. The four tasks were described on two attributes framed as (i) the ability being tested in the task (perception vs. cognition), and (ii) the activity being performed (identification vs. categorization). We intentionally used these relatively ambiguous cues to describe the tasks. Participants were also informed that the best performers amongst all the participants completing the same task would be awarded $2 bonus payment. Hence, participants were expected to be motivated to choose the task they believed they would perform best at, thereby increasing their chances of winning a bonus payment (i.e., the choice was incentive compatible).
Next, participants observed the multi-stage process in which the computer chose the task they would be asked to complete. In the ability-first condition, the computer first chose perception (over cognition) from the ability attribute and then chose identification (over categorization) from the activity attribute. In the activity-first condition, the computer made the same choices but in the opposite order. Thus, all participants were initially assigned the same task: perception-identification. Subsequently, participants were shown a loading screen and waited for the selected task to load for a few seconds. After few seconds a message appeared stating that the task chosen by the computer had failed to load. Participants were then asked which of two other available replacement tasks they would prefer. Each of the two available tasks retained one attribute level from the original task chosen by the computer, but differed from it on the second attribute level. In particular, the first potential replacement task tested perception ability (same as the original task) but used the categorization activity. The second potential replacement task tested cognitive ability and used the identification task (same as the original task).

After making their replacement choices, participants worked on the same word-find puzzle in which they identified words containing four or more letters in a matrix of letters. Participants who found the greatest number of words received the $2 bonus.

Results and Discussion. As predicted, a greater proportion of participants assigned to the ability-first condition (65.0%) chose the replacement task that was consistent with the computer’s choice of the ability attribute (i.e., the perception-categorization task) compared to participants assigned to the activity-first condition (45.0%). A binary logistic regression confirmed that this difference between conditions was significant ($\beta = .82$, $Wald-\chi^2 (1) = 4.78$, $p = .03$). Thus, even though the original choice was ostensibly randomly determined by the
computer, participants predominantly chose replacement options sharing the same attribute-level selected in the initial (vs. subsequent) stage. The fact that the effect persisted (in an incentive-compatible design) even without participants’ making the original choice of a task, lends further support for a categorization process and casts doubt on choice-based accounts. Moreover, consistent with findings in studies 3a and 3b in the main text, an impending choice that can be mentally represented is a necessary precursor to the documented effect, but agency is not.
APPENDIX B. INITIAL CHOICE ANALYSIS ACROSS ALL STUDIES

<table>
<thead>
<tr>
<th>Study</th>
<th>p-values for change in shares of each specific option using multinomial logistic regression</th>
<th>Likelihood Ratio Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study 1a</td>
<td>**(.92; .71; .83; .92; 1)</td>
<td>5.20 8 0.74</td>
</tr>
<tr>
<td>Study 1b</td>
<td>(.67; 1; .64)</td>
<td>0.71 3 0.87</td>
</tr>
<tr>
<td>Study 1c (appendix A)</td>
<td>(.08; .73; .84)</td>
<td>3.32 3 0.34</td>
</tr>
<tr>
<td>Study 1d (appendix A)</td>
<td>(.72; .44; .85)</td>
<td>1.44 3 0.69</td>
</tr>
<tr>
<td>Study 1e (appendix A)</td>
<td>(.22; .87; .27)</td>
<td>2.78 3 0.43</td>
</tr>
<tr>
<td>Study 2</td>
<td>(.57; .46; .69)</td>
<td>0.59 3 0.89</td>
</tr>
<tr>
<td>Study 3a</td>
<td>(.88; .56; .81)</td>
<td>1.67 3 0.64</td>
</tr>
<tr>
<td>Study 3b</td>
<td>**(.82; .36; .37; .87; .78; .16; .51; .68)</td>
<td>5.45 9 0.79</td>
</tr>
<tr>
<td>Study 4</td>
<td>(.66; .34; .73; .41; .18; .34; .75; .46; .92)</td>
<td>0.08 3 0.99</td>
</tr>
<tr>
<td>Study 5</td>
<td>(.92; .48; .43; .92; .19; .48; .38; .19; .60)</td>
<td>3.13 3 0.37</td>
</tr>
<tr>
<td>Study 6 (appendix A)</td>
<td>(.29; .83; .93; .52; .75; .19; .93; .22; .43; .62; .61; .16; .94; .45; .22; .85; .66)</td>
<td>15.17 18 0.65</td>
</tr>
<tr>
<td>Study 6b (appendix A)</td>
<td>(.41; .58; .90; .73; .69; .56; .21; .82; .80)</td>
<td>3.74 9 0.92</td>
</tr>
</tbody>
</table>

* Across all of these studies, we also tested using a multinomial logistic regression whether the choice shares of each specific option were affected by the order manipulation (or its interaction with other manipulated constructs). Overall, across all studies, none of the 83 tests revealed
significant impact of the order manipulation on the alternatives’ choice shares.

** Note that two options in study 1a and one option in study 3b had 0% choice frequency. We excluded these 3 options from our multinomial logistic regressions as these cannot be estimated due to the separation problem.
# APPENDIX C. CHOICE SHARES OF REPLACEMENT OPTIONS ACROSS CONDITIONS

## IN STUDIES 2-5

<table>
<thead>
<tr>
<th>Study 2 (n = 158) Backpacks</th>
<th>Conditions</th>
<th>Logo First</th>
<th>Color First</th>
</tr>
</thead>
<tbody>
<tr>
<td>% choosing replacement option with the same logo</td>
<td></td>
<td>65.8%</td>
<td>40.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study 3a (n = 286) Coffee Mugs</th>
<th>Choice Conditions</th>
<th>View Conditions</th>
<th>Color First</th>
<th>Style First</th>
<th>Color First</th>
<th>Style First</th>
</tr>
</thead>
<tbody>
<tr>
<td>% choosing replacement option with the same color</td>
<td>Color First</td>
<td>39.1%</td>
<td>14.7%</td>
<td>23.6%</td>
<td>24.7%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study 3b (n = 145) Pens</th>
<th>Agency Conditions</th>
<th>No Agency Conditions</th>
<th>Material First</th>
<th>Color First</th>
<th>Material First</th>
<th>Color First</th>
</tr>
</thead>
<tbody>
<tr>
<td>% choosing replacement option with the same material</td>
<td>Material First</td>
<td>64.9%</td>
<td>42.1%</td>
<td>76.5%</td>
<td>58.3%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study 4 (n = 201) Tasks</th>
<th>Non-Random Conditions</th>
<th>Random Conditions</th>
<th>Color First</th>
<th>Letter First</th>
<th>Color First</th>
<th>Letter First</th>
</tr>
</thead>
<tbody>
<tr>
<td>% choosing replacement option with the same color</td>
<td>Color First</td>
<td>62.5%</td>
<td>34.1%</td>
<td>66.7%</td>
<td>40.0%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study 5 (n = 205) Coffee Mugs</th>
<th>Control Mental Representations Conditions</th>
<th>Fixed Mental Representations Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>% choosing replacement option with the same color</td>
<td>Color First</td>
<td>Design First</td>
</tr>
<tr>
<td></td>
<td>60.8%</td>
<td>43.2%</td>
</tr>
</tbody>
</table>
Appendix D. DISCUSSION ABOUT HOW THE CURRENT FINDINGS COMPARE TO THOSE REPORTED IN BOLAND ET AL. (2012)

Boland, Brucks, and Nielsen (2012) report an *attribute carryover effect* which seems inconsistent with some of the results we find. In particular, Boland et al. examine consumers’ choice of replacement options after consumers engaged in a screening process and learned that their top choice is unavailable. They report instances in which consumers, instead of choosing their previously stated runner-up option (which also met the screening criteria), tend to choose an option that does not meet the initial screening criteria but has another desirable feature shared with their top choice. Using the terminology used in the current paper, Boland et al.’s findings may suggest instances in which consumers prefer to choose a replacement option that shares an attribute that appeared later in the sequence (i.e., after the initial screening decision). We speculate that the seemingly inconsistent results may arise from several distinct differences between the paradigms and designs employed in the two papers. First, Boland et al. did not employ a path-independent decision process (i.e., they used three binary attributes in all their studies and offered only four target options characterized by these attributes). Second, one of the binary attributes (quality) was not described explicitly and participants had to infer it through a combination of four different attributes (i.e., the pen’s barrel color, point size, type, and appearance). Third, the selection task was not at the attribute level but, rather, at the alternative level (i.e., forming a consideration set of two options). Fourth, participants were asked to first rate all options prior to constructing their consideration set. Taken together, we speculate that Boland et al.’s stimuli and main procedures may have made it hard for participants to recognize the distinctiveness of the main attributes and especially the hierarchical and sequential process of
their attribute selection (to the extent there was one). This, may have hindered participants from mentally representing their chosen option based on a certain attribute-selection process. It will be interesting to examine whether the effect observed by Boland et al. is more likely to occur when consumers process options in the alternative space (e.g., forming and selecting from consideration sets) while the effects observed in the current paper are more prevalent when consumers process information in the attribute space (e.g., configurators and attribute-based sorting tools).

REFERENCES


