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Order in Product Customization Decisions

Jonathan Levav, Mark Heitmann, Andreas Herrmann, and Sheena S. Iyengar

How should firms manage the product customization process? This study finds that the order of product attributes may provide a cost-effective lever to direct demand and increase revenues as well as customer satisfaction.

Report Summary

How does order of product attributes influence consumers as they make customization decisions? Here, authors Levav, Heitmann, Herrmann, and Iyengar examine that question in several experiments involving major durable products. In each experiment, participants were asked to configure a product (a men's suit or an automobile) with multiple attributes, each attribute including multiple options to choose from and different attributes having different numbers of options.

Their results suggest that order of attributes changes people's revealed preferences in customization decisions for major durable goods. When attributes with relatively few options follow attributes with relatively many options, people appear to be mentally depleted and are more likely to accept default options than when the sequence of attributes is reversed.

These findings have implications for the marketing of mass-customized products that involve a sequence of customization decisions. In particular, firms can use the interaction between the sequence of decisions and the pre-selected default alternative in order to promote the choice of certain attribute combinations. Defaults can be a particularly effective marketing instrument at the end of a decision-making sequence as opposed to its beginning, provided the earlier attribute decisions were more complex.

Furthermore, starting decision-making sequences with relatively simple decisions (i.e., fewer alternatives) followed by relatively complex decisions (i.e., more alternatives) leads to higher overall satisfaction with the product as well as with the decision-making process. Importantly, satisfaction and price paid in studies were not correlated, which suggests that customer satisfaction is highly dependent on the decision-making process. This finding should be of particular interest for firms who sell mass-customized products whose price does not differ greatly (e.g., fashion items such as running shoes), and may use product attribute sequence to influence customer satisfaction. ■

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Introduction

A distinctive feature of the modern consumer world is the possibility of customizing a product to a consumer's exact specifications. Customization contributes to consumer welfare because it enables each consumer to select an attribute bundle that comes as close as possible to matching his or her preferences; greater variety within each attribute increases the likelihood that he or she will obtain *exactly* the option that maximizes utility. One decision variable for firms that provide customizable products is how to order the product attributes in the configuration process. Does this order ultimately matter, even in cases where any attribute decision is reversible at any point in the configuration?

We argue and demonstrate empirically that order of attribute presentation can exert an important influence on what bundle of attributes a consumer purchases because considering alternative attribute levels is mentally depleting. In addition, we characterize the pattern of mental depletion and show that it creates an opportunity for firms. The basic experimental treatment we discuss below involves a major durable product possessing multiple attributes that is configured by a consumer. Each attribute includes multiple options for the consumer to choose from; different attributes have different numbers of options. The configuration process is ordered either such that the attributes with a greater number of options come first in the sequence and are followed by the attributes with a smaller number of options, or vice versa. This is our only experimental treatment.

Our argument relies on three basic premises. The first is that, in many cases, the prospective utility from an option is assessed at the time of the decision (Payne, Bettman, and Johnson 1993); options that elicit utility beyond some minimum threshold level are more likely to be chosen. The second premise is that assessing utility requires effort that depletes a limited mental resource. This idea is inspired by research in psychology and economics, in which self-control is modeled as a muscle: as self-control is exerted, one's capacity for self-control in subsequent situations is depleted unless there is adequate rest (Muraven and Baumeister 2000). The third premise is that consumers are partially "myopic" in their allocation of mental resources. Instead of distributing their mental effort efficiently across the configuration process, we invoke the Gabaix et al. (2006) directed cognition model to predict that consumers will behave as if the current decision in a sequence is practically their last (despite the fact that, in our experiments, it is obvious that subsequent decisions will follow). Consequently, in our setting, consumers "overspend" their capacity early in the configuration sequence, leaving them with fewer resources to assess their utility from subsequent attributes in the sequence.

In product customization decisions, these three premises can conspire to produce inconsistent choices. More specifically, as with self-control encounters, we suggest that the effort invested in previous attribute decisions affects subsequent attribute decisions because the previous decisions deplete people's capacity to evaluate options. Here, however, depletion is a function of not only the number of decision "encounters" (i.e., attribute decisions) the consumer has undertaken, but also of the number of options that he or she had to evaluate at each stage. We focus on the combined effect of these two factors, and how they influence revealed preferences. Our thesis is that early decisions in a customization sequence affect subsequent decisions in the sequence because the early decisions deplete people's mental capacity, but that this depletion effect depends upon whether or not the early decisions involve attributes that are high in number of options (high variety) or low in number of options (low variety).

People's depleted capacity may heighten the difficulty—and sometimes also reduce the

likelihood—of finding any option to be above their minimum utility threshold and hence, to be chosen. Such an experience of "choice overload" can prompt people to forgo making a choice altogether or, when avoidance is not a practical or possible alternative to making a choice, it can prompt them to embrace options that are simpler and easier to understand (Iyengar and Lepper 2000; Iyengar and Kamenica 2007). The simplifying strategy that we focus on in our experiments is people's likelihood of accepting the default alternative for a given decision in the sequence. Defaults simplify choice because they reduce decision-making effort, can sometimes be interpreted as options that are endorsed by the firm or policy-maker, and have pervasive influence on revealed preferences (Johnson and Goldstein 2003).

As mentioned earlier, our experimental treatment manipulates the configuration process such that the attributes with a greater number of options come first in the sequence and are followed by the attributes with a smaller number of options or vice versa. Normatively, the sequence should not affect choices or willingness to pay; the same preference should be revealed irrespective of the sequence. If, however, choices are sensitive to the stock of capacity to evaluate options, then each sequence should yield different revealed preferences because decision makers will be depleted at different parts of the sequence, depending on the experimental condition. In particular, we predict that people who encounter high-variety, depleting choices early in the sequence will evince a tendency to accept the default alternative in subsequent decisions, even if these decisions involve relatively few options that would ordinarily require less capacity to evaluate. In contrast, those who begin the sequence with less complex decisions, offering fewer options to choose from, will evince little effect of depletion later in a sequence, even if these subsequent decisions are of the complex, high-variety sort. This differential depletion pattern provides firms with an opportunity to extract higher revenues from their customers by modifying the order in which firms present product attributes and the option that they select as the default alternative. We conduct our empirical tests of depletion and its consequences in three field experiments involving financially consequential choices: custom-made men's suits and automobiles. The results provide a cost-effective lever to direct demand and increase revenues as well as customer satisfaction.

Suit Study

Design

We recruited 73 MBA students at a Swiss university under the aegis of a study about clothing taste in Switzerland and the United States. Participants were told that we would be raffling two business suits, custom-made according to their specifications and taste by a well-known local tailor shop. MBA students are an ideal participant pool for a study involving suits because, at some point or another, all of them purchase at least one suit for job interviews and summer internships. Participants were told that they would be asked to design a suit, including a shirt and tie, and that they would have to contribute 75 Swiss francs toward its cost (which was approximately 2,000 Swiss francs) in the event that they won the raffle. The fee, a substantial charge for the typical student participant, was included in order to ensure that participants would understand that their selections had a significant financial consequence.

Under the tailor's close guidance, we created a makeshift tailor shop in a laboratory space at the University. The tailor provided the shop's seven booklets of swatches of suit fabric (100 options), suit lining fabric (5), shirt fabric (50), tie fabric (42), suit buttons (20), dress belts (8), and dress socks (20). Upon arrival in the lab, participants were asked to complete a short survey in order to be provided a set of "standard recommendations" by the tailor. The survey asked participants to indicate their

prospective use for the suit (multipurpose, business, or private), whether and how often they intended to travel in their suit, and a subjective rating of their preference for a classic versus a modern look (on a 7-point scale with "rather modern" and "rather classic" as anchors). An assistant proceeded to compile the survey results.

Next, participants were randomly assigned to one of two treatment conditions, High (Hi)-to-Low (Lo) (N = 34) or Lo-to-Hi (N = 39). In the Hi-to-Lo condition, participants were presented with the booklets beginning with the attribute that had the most options (suit fabric, 100 options) and ending with the attribute that had the fewest options (suit lining, 5 options) in descending order, while in the Lo-to-Hi condition the order was reversed, i.e., in ascending order. The final choice for all participants in both conditions was the sock category (20 options). We included this item in order to ascertain the effect of our treatment for a category that was offered at the same point in the decision sequence for both conditions.

Participants were presented with each booklet of options in succession. For each booklet, one of the options was randomly chosen to be the tailor's recommended option, given the participant's survey responses.[1] This option was indicated by a small piece of poster board that was labeled "standard recommendation" and was attached to the item; the recommended option was considered the default option in our analysis. Participants' choices were recorded by the experiment's administrator. The dependent variable was whether or not the participant accepted the standard recommendation for each suit attribute.

After participants completed the suit configuration process, they were asked to complete a self-reported satisfaction survey that asked them to rate (on a 1–7 scale) their satisfaction with the outfit that they had selected, how certain they were that their selections matched their preferences, their likelihood of making a similar selection in the future, and their satisfaction with the decision-making process. Finally, we asked them to rate their knowledge about suits relative to an average peer.

Analysis

The first six choices were estimated using the following random-effects logistic regression model (socks were excluded and analyzed separately).[2]

$$Pr(\text{Default}) = \alpha + \beta_1 \text{Stage} + \beta_2 \text{Variety} + \beta_3 \text{Order} + \beta_4 \text{Knowledge} \quad (1)$$

The Stage variable was an index that took on a value from 1 to 6 and denoted the attribute's position in the decision sequence. It was included in order to control for any fatigue effects that were simply due to making choices. The Variety variable took on the number of options for that decision stage (e.g., for tie fabric, there were 42 options, so Variety was 42) and was added because heterogeneity in tastes dictates that the likelihood of choosing the default option will decrease as variety increases. Our key variable of interest was the dummy variable Order (0 = Lo-to-Hi; 1 = Hi-to-Lo). A significant effect of Order would suggest a greater propensity to accept the default in one kind of sequence, and would serve as evidence that people's choices are sensitive to attribute order. Finally, we included Knowledge because we speculated that more knowledgeable participants—even if self-proclaimed—would be less affected by our treatment.

Results

Table 1 presents the results of the logistic regression analysis. Not surprisingly, both Stage and Variety exert significant and opposite effects on default acceptance: as participants proceeded through the decision sequence, they were more likely to accept the default option, and as variety increased, they were less likely to accept the default option.

Table 1
Effect of Order on Default Choice Analysis for Suit Study

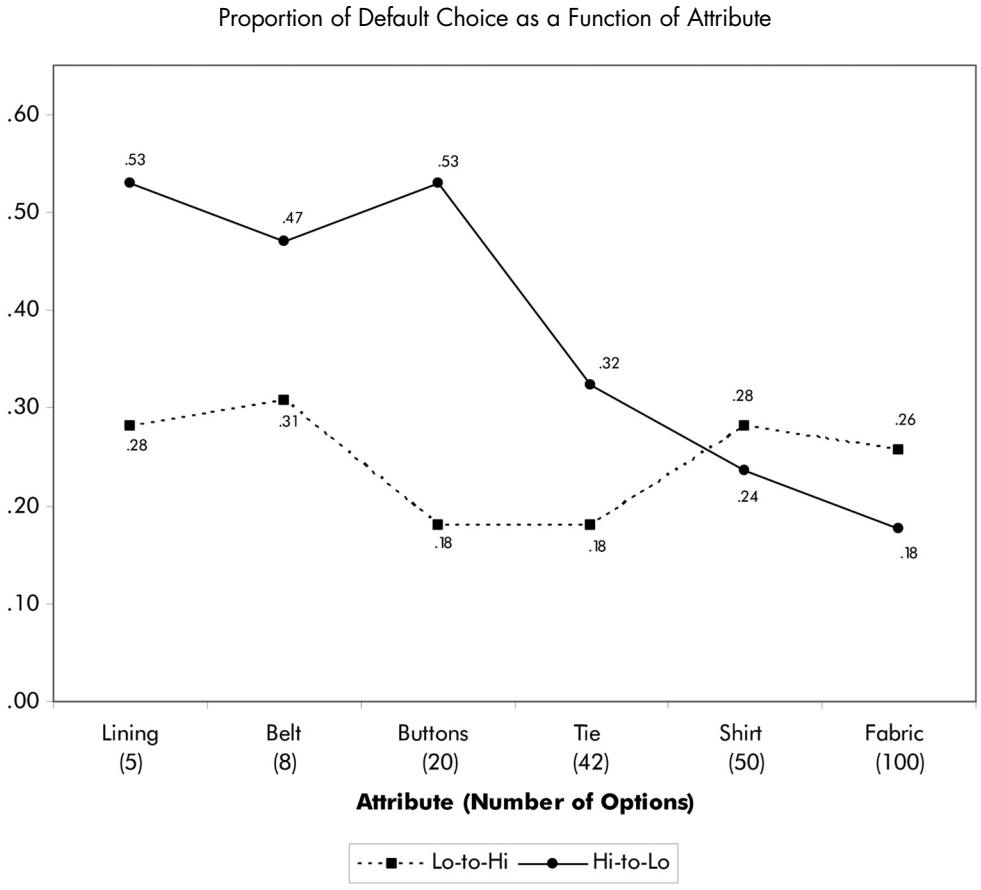
Parameter	Estimate	Std. Error	*p*-value
Intercept	–.1891	.2109	.37
Stage	.1599	.0713	.02
Variety	–.0098	.0040	.01
Order	–.5585	.2278	.01
Knowledge	–.1432	.0771	.06

Note: *N* = 73. Stage refers to the decision stage that the participant was in (i.e., which of the six configuration decisions). Variety refers to the number of options available for the attribute at a given decision stage. Order is our main, dummy variable of interest (0 = Lo-to-Hi; 1 = Hi-to-Lo). Knowledge is the participant's self-rated knowledge about suits.

Self-rated expertise was also negatively correlated with default acceptance. Most critically, the Order variable was significant; Figure 1 presents the pattern of default acceptance in our experiment. It is apparent from the figure that the propensity to accept the default was roughly equal throughout the configuration process in the Lo-to-Hi condition, but that it increased steeply as participants advanced from stage to stage in the Hi-to-Lo condition. In other words, participants' revealed preference for their suit was determined by the order of attribute presentation. The results are consistent with the notion that participants' capacity to evaluate options was depleted differently, depending on the preceding choices in the customization sequence.[3]

In addition to our test of the order manipulation, we also tested the influence of the cumulative number of options ("Cumulative

Figure 1
Default Choice in the Suit Study



Note: Hi-to-Lo participants advanced from right to left; Lo-to-Hi from left to right.

Table 2
Effect of Cumulative Variety on Default Choice Analysis for Suit Study

Parameter	Estimate	Std. Error	*p*-value
Intercept	–1.0558	.2269	< .0001
Variety	–.0129	.0036	< .0001
Cumulative Variety	.0053	.0013	< .0001
Knowledge	–.1439	.0795	< .07

Note: $N = 73$. Variety refers to the number of options available for the attribute at a given decision stage. Cumulative Variety refers to the number of options that the participant had viewed to that point. Knowledge is the participant's self-rated knowledge about suits.

Variety") encountered by the participant on the likelihood of accepting the default alternative at each decision stage using a random-effects logit (details omitted in the interest of brevity; see Table 2). We find that the cumulative number of options that participants were exposed to exerts a significant positive influence on default acceptance. This analysis provides credence to our conjecture that the order effect we observe is a function of the number of previous options that a participant had been exposed to.

Lastly, the responses to the satisfaction questions were highly correlated with each other (Cronbach's $\alpha = .84$), so we created an overall satisfaction index. Participants reported being more satisfied in the Lo-to-Hi condition than the Hi-to-Lo condition (5.0 vs. 4.2, respectively, $t(71) = 2.97$, $p = .002$). This difference is important because customer satisfaction is related to stock price and financial performance measures such as ROI (Gupta and Zeithaml 2006).

Car Study 1

Next we elected to test our order effect on an actual purchase of a high-priced durable good: an automobile. This test also enables us to show how depletion may provide an opportunity to increase the firm's revenue. The next two experiments we conducted were natural field studies that were conducted in dealerships of a major European automobile manufacturer.[4] Participants were 750 car buyers (450 in the first study and 300 in the second) across three major metropolitan areas in Germany. There are some small but important design differences between the two studies, so we present them separately.

In Germany, customers of the manufacturer that participated in our experiments configure their vehicle to their own specifications and purchase it in advance of delivery; cars are typically not available for immediate purchase at the dealership. Customers either configure their car using the company's configuration software on the World Wide Web or use a catalog that is presented to them by the salesperson at the dealership. We restricted our sample to customers who had come to the dealership to purchase the manufacturer's entry-level sedan and who had not configured their car previously online. The studies were conducted at a computer terminal using the same configuration software available to customers who configure their car on the World Wide Web. Participants were not informed of the purpose of the study. Instead, they were told by the salesperson that the manufacturer was testing the use of its configurator at its dealerships. In exchange for using the configurator, participants were given a free miniature toy car (approximate value $7). (Note that the salespeople were also blind to the purpose of this experiment.)

The configuration process includes a sequence of 67 decisions about attributes of the car, made one at a time, and takes approximately 30 minutes to complete. Each decision appears on a different screen, with a side-screen indicating the total price of the car up to that point and all the features it includes. With each configuration decision the price is updated on the screen and, at any point, customers are free to revise their previous choices or scroll (click) forward. This is an important aspect because it means that all customers can

have access to information about any attribute at any point in time.[5] Each attribute consists of a different variety of options, and different options have different prices; for instance, there are 56 interior colors and 13 types of wheel rims to choose from. At every screen there is a default option that is already checked-off by the manufacturer (e.g., the default engine is 1.6 liter, five-speed manual transmission). For all attributes except exterior color, the default is the cheapest option and appears at the top of the list (e.g., engine).[6] We selected eight "target attributes" for the purposes of our experiment (number of options in parentheses): interior color (56), exterior color (26), engine and gearbox (25), wheel rims/tires (13), steering wheel (10), rearview mirror (6), interior décor style (4), and gearshift knob style (4). The target attributes were placed at the beginning of the configuration sequence, and our manipulation consisted of changing their order.

Design

Each customer-participant began by completing a short questionnaire where he (or she) was asked to state his or her willingness to pay for the new sedan. This question was designed to make the customer's budget constraint salient. Next, the participant was asked a series of self-rated knowledge questions, including whether he had ever owned a car produced by the participating manufacturer, had ever driven a car of that manufacturer, and felt knowledgeable about its cars (all on 1–7 scales). Finally, in the last phase of the pre-configuration survey, participants were asked to rate the importance of each of the eight target attributes using a constant-sum scale in which they allocated 100 points across the eight attributes according to subjective importance. The software forced participants to allocate all 100 points but allowed for ties and zeros. The purpose of this survey item was to test whether self-reported importance exerted any effect on customers' choices in our study.

Next, participants were randomly assigned by the configurator software to one of three groups. As in the Suit Study, we varied the order in which participants made their decisions regarding the (eight) target attributes. The target attributes appeared at the beginning of the configuration process. In the Hi-to-Lo group (N = 150) participants were presented with a sequence that was sorted by descending variety, such that the attribute that had the most options (interior color, 56) appeared first, and the attribute with the fewest options (gearshift knob style, 4) appeared eighth. The Lo-to-Hi group (N = 150) was presented with the exact opposite, ascending sequence (i.e., gearshift style was first and interior color eighth). Control condition participants (N = 150) were presented with a randomly determined sequence of the eight attributes. The remainder of the configuration was identical for all participants. Our dependent variable was whether or not the customer–participant accepted the default option at each of the eight stages of the (target) decision sequence. Thus, each customer provided eight observations. In addition to recording their selection, the software also recorded the price of the chosen option, the time taken to make the choice, and the total price paid for the configured car.

At the end of the configuration process, participants were asked to indicate their satisfaction with the configuration software and the car, their likelihood of configuring the same car again, and the extent to which the car they had configured matched their preferences (all measured on 1–7 scales). Having completed the configuration process, participants proceeded to complete the paperwork necessary to purchase their configured car.[7]

Analysis

The eight manipulated choices were analyzed using a random effects logistic regression of the following form:

$$Pr(\text{Default}) = \alpha + \beta_1 \text{Stage} + \beta_2 \text{Variety} + \beta_3 \text{Order} + \beta_4 \text{Importance} + \beta_5 \text{Importance} * \text{Stage} + \beta_6 \text{Knowledge} \quad (2)$$

Table 3
Results of Car Study 1

Attribute (options)	Lo-to-Hi	Hi-to-Lo	Control
Gearshift Style (4)			
Default proportion	.28	.41	.37
Average price	169.67	115.80	136.33
(Std. dev.)	(146.28)	(130.43)	(140.22)
Average time (secs.)	17.19	29.82	24.31
(Std. dev.)	(11.78)	(17.92)	(14.23)
Interior Décor (4)			
Default proportion	.33	.39	.36
Average price	181.53	108.53	147.13
(Std. dev.)	(300.82)	(182.13)	(246.39)
Average time (secs.)	19.43	30.47	27.41
(Std. dev.)	(12.69)	(20.03)	(19.47)
Rearview Mirror (6)			
Default proportion	.40	.55	.51
Average price	191.33	141.33	148.77
(Std. dev.)	(165.57)	(155.69)	(158.36)
Average time (secs.)	22.09	31.82	29.73
(Std. dev.)	(14.97)	(24.08)	(18.09)
Steering Wheel (10)			
Default proportion	.28	.38	.37
Average price	262.53	193.90	203.67
(Std. dev.)	(200.33)	(183.15)	(186.37)
Average time (secs.)	68.31	94.09	82.96
(Std. dev.)	(60.27)	(97.01)	(81.07)
Rims and Tires (13)			
Default proportion	.30	.37	.37
Average price	1006.00	895.00	906.33
(Std. dev.)	(557.98)	(456.82)	(495.53)
Average time (secs.)	76.25	102.17	93.63
(Std. dev.)	(60.78)	(84.53)	(120.80)
Engine and Gearbox (25)			
Default proportion	.19	.11	.12
Average price	28,543.53	29,986.93	29,346.53
(Std. dev.)	(3264.16)	(3580.49)	(3177.733)
Average time (secs.)	115.65	81.35	91.77
(Std. dev.)	(123.87)	(64.09)	(89.85)

Continued on next page

Stage and Variety, as in the Suit Study, were expected to have significant and opposite effects on default taking. The Order dummy (0 = Lo-to-Hi; 1 = Hi-to-Lo) was the critical variable; a significant parameter would indicate that our sequence manipulation affected participants' choices as predicted, even after controlling for Stage and Variety. We added the Importance parameter in order to ascertain whether participants resist the tendency to accept the default when they consider the attribute to be important and the interaction term in order to test whether the effect of importance was uniform throughout the sequence. Finally, we control for self-rated expertise with the Knowledge variable.

Results

Table 3 presents the key summary statistics, and Table 4 presents the results of our analysis of the influence of order in this study. We find a significant effect of Stage: customers were more likely to accept the default offering as they advanced through the decision sequence. As one would expect from simple taste heterogeneity, we find the intuitive result that, as variety increases, the likelihood of accepting the default significantly decreases. Third, (self-rated) greater attribute importance is associated with a decrease in default choice for that attribute. However, this relationship is qualified by an Importance × Stage interaction, such that the influence of importance on the probability of accepting the default diminishes as participants advance through the choice sequence. Depletion seems to overwhelm participants' ability or desire to best match their preferences for attributes that they consider important.

Most relevant to this investigation, we find a significant effect of Order: Where participants began the choice sequence with the highest variety attributes, i.e., interior color, they were more likely to later accept the default for the lower variety attributes compared with the condition where they began with the lowest variety attributes, i.e., gearshift style

Table 3
Continued

Attribute (options)	Lo-to-Hi	Hi-to-Lo	Control
Exterior Color (26)			
Default proportion	.33	.29	.31
Average price	561.27	660.27	625.87
(Std. dev.)	(486.31)	(532.64)	(520.62)
Average time (secs.)	157.83	121.87	133.17
(Std. dev.)	(162.62)	(98.68)	(114.16)
Interior Color (56)			
Default proportion	.19	.13	.13
Average price	131.93	347.27	199.47
(Std. dev.)	(579.27)	(940.03)	(756.69)
Average time (secs.)	135.25	107.43	117.79
(Std. dev.)	(156.65)	(95.19)	(118.45)
Price in euros (total)	35,808.00	37,290.37	36,424.07
(Std. dev.)	(3911.96)	(4160.09)	(3741.11)
Time in secs. (total)	1763.35	1762.23	1760.12
(Std. dev.)	(443.87)	(396.91)	(459.23)

Note: Table lists the attribute and (in parentheses) the number of options available for that attribute, proportion of customers accepting the default for the attribute, the average price paid for the attribute, and the average time in seconds it took from the moment that the attribute was displayed to the moment that the customers clicked over to the next attribute for each treatment condition and the control. In addition, the last rows display the total price and time taken. Note that in the Lo-to-Hi condition customers began with "Gearshift Style," i.e., the first row of the table and moved "down" the table, whereas in the Hi-to-Lo condition customers began with "Interior Color," i.e., the last row of attributes and then moved "up" the table.

Table 4
Effect of Order on Default Choice Analysis for Car Study 1

Parameter	Estimate	Std. Error	*p*-value
Intercept	–.3804	.0942	< .0001
Stage	.0808	.0222	.0003
Variety	–.0184	.0033	< .0001
Order	–.3078	.1142	.0070
Importance	–.0186	.0041	< .0001
Stage × Importance	.0051	.0024	.03
Knowledge	–.0609	.0270	.02

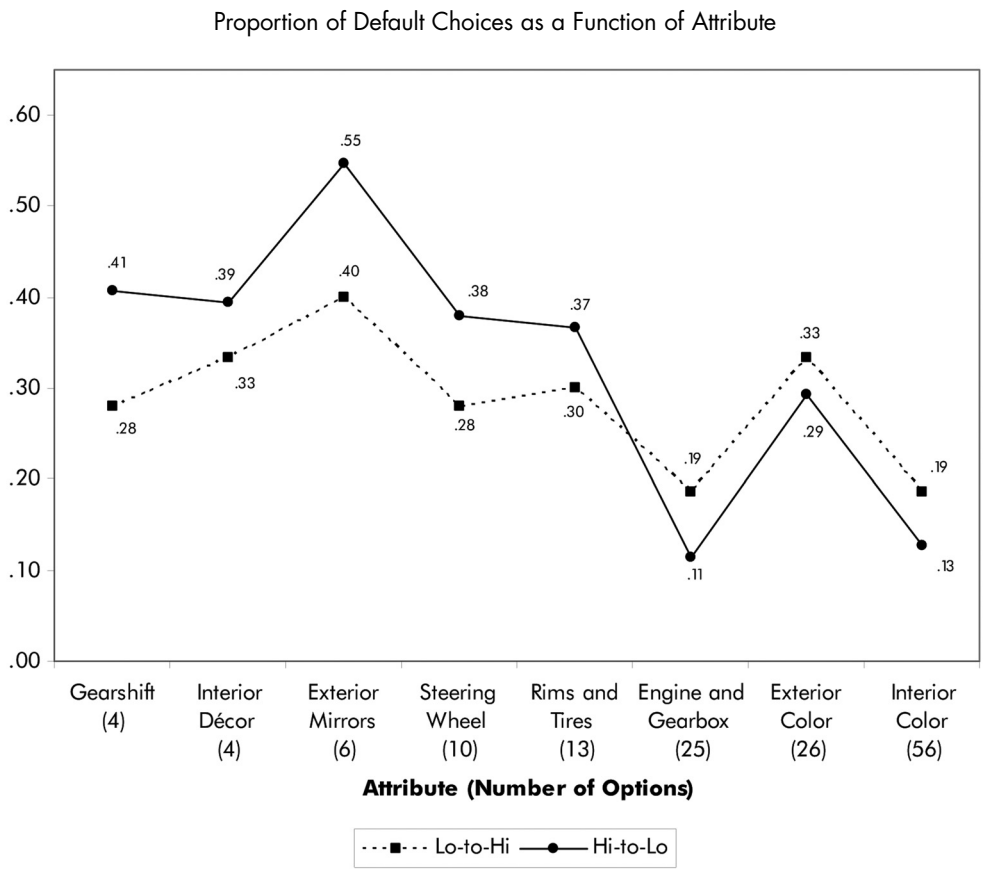
Note: $N = 300$. Stage refers to the decision stage that the customer was in (i.e., which of the eight configuration decisions). Variety refers to the number of options available for the attribute at a given decision stage. Order is our main, dummy variable of interest (0 = Lo-to-Hi; 1 = Hi-to-Lo). Importance is the customer's rating of the importance of that attribute. Knowledge is an index summarizing a series of questions about the customer's self-rated knowledge about the participating manufacturer's automobiles.

(Figure 2). Note that a mere change in attribute order gives rise to a significant change in real purchases, even where attribute information is equally available to all participants at all times (and there are no inter-attribute dependencies that restrict choice). In addition, we replicate the analysis and results of the cumulative effect of exposure to choice options that we report in the Suit Study (Table 5). This result bolsters the notion that our customer–participants experienced differential depletion—and consequently different levels of default acceptance—depending on the number of options that they had seen up to that point.

We also obtained data on how long it took each participant to make his or her choice at each decision stage, as well as the duration of the overall configuration process. At just under 30 minutes, the average total configuration completion times were within 3 seconds of each other (Table 3). The timing data for the eight manipulated attributes are plotted in Figure 3. Note that the pattern of the times tracks the choice pattern. If time is taken as a proxy for decision-making effort, then it is apparent that depleted participants who had difficulty evaluating options did not disengage from the decision-making process; customers actually spent more time on the attributes where they chose the default.

An analysis of the total price paid for the automobile demonstrates the financial consequences of our experimental manipulation in this study. Table 3 shows the prices paid for each of the eight target attributes and for the overall car in each condition. Since the order manipulation affected the features of the vehicle that participants chose and where participants accepted the default, it also affected its price: participants in the Hi-to-Lo condition paid 1,482.37 euros more than in the Lo-to-Hi condition, a statistically significant difference ($t(298) = 3.18$, $p < .01$). This difference indicates that the effects of our subtle order manipulation—recall that order was altered for only eight of the automobile's 67

Figure 2
Default Choice in Car Study 1



Note: Hi-to-Lo participants advanced from right to left; Lo-to-Hi from left to right.

configurable attributes—were of significant financial consequence both to our respondents and to the firm. The results suggest that the firm can increase its revenues with a potentially costless manipulation of its configuration process that consists of strategically altering the order of the configuration as well as the default option for certain attributes.

Finally, due to the high correlation between the satisfaction measures, we combined them to form a satisfaction index (Cronbach's α = .92). Replicating the Suit Study, participants reported greater satisfaction in the Lo-to-Hi condition than in the Hi-to-Lo condition ($t(298) = 5.12$, $p < .0001$). It is noteworthy that there was no statistically significant correlation between self-reported satisfaction and purchase price ($r = .01$, *n.s.*).

Car Study 2

The price difference that we find in the previous study raises the question of whether higher willingness to pay is endemic to Hi-to-Lo sequences. We suggest that this is not the case. Instead, we believe that the reason we observed price differences was because the target attribute sequence included a relatively high-priced item, engine, whose default option was substantially cheaper in absolute terms than its non-default options (a difference of 4,200 euros between the default and the next more expensive option). Since engine was a high-variety item (25 options), Hi-to-Lo participants chose it early in the sequence when they were less depleted, thus increasing their likelihood of choosing a more expensive, non-

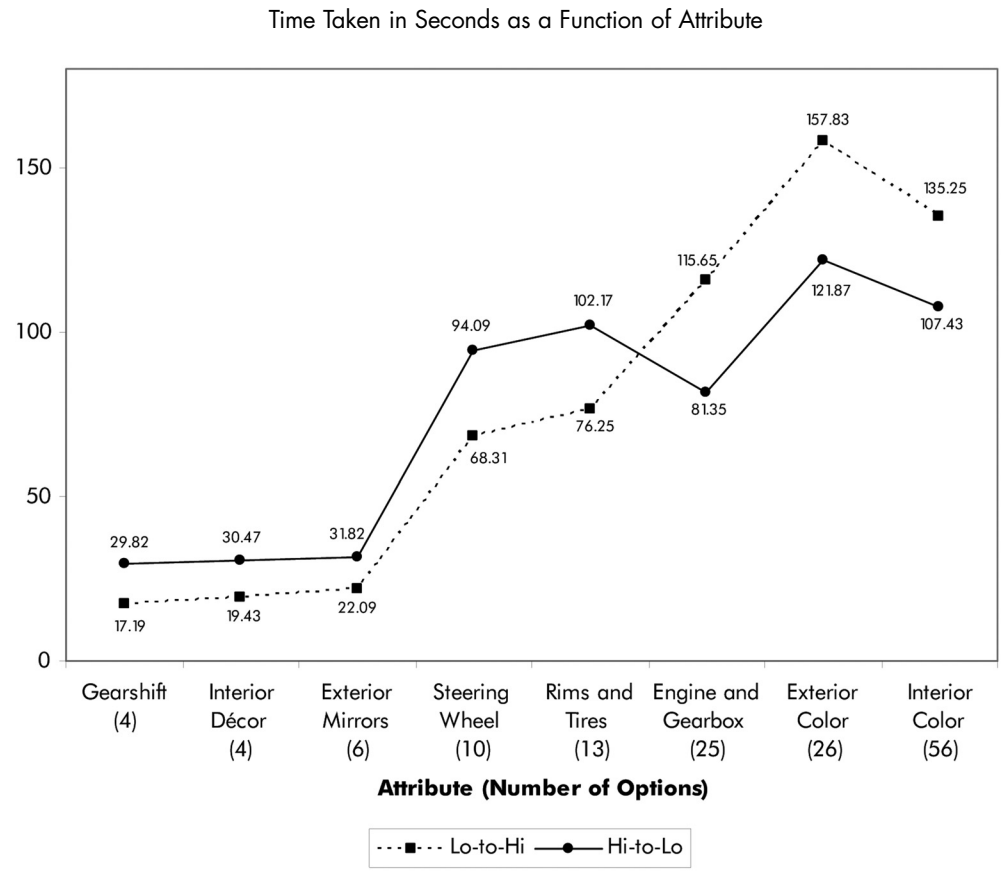
Table 5
Effect of Cumulative Variety on Default Choice Analysis for Car Study 1

Parameter	Estimate	Std. Error	*p*-value
Intercept	–.6862	.1203	< .0001
Variety	–.0198	.0035	< .0001
Cumulative Variety	.0023	.0012	< .06
Importance	–.0030	.0112	.78
Importance × Cumulative Variety	–.0002	.0001	.15
Knowledge	–.0597	.0275	< .03

Note: *N* = 300. Variety refers to the number of options available for the attribute at a given decision stage. Cumulative Variety refers to the number of options that the participant had viewed to that point. Importance is the customer's rating of the importance of that attribute. Knowledge is an index summarizing a series of questions about the customer's self-rated knowledge about the participating manufacturer's automobiles.

default engine. If this is the case, then placing engine *after* the target attribute sequence should diminish the price difference that we observed in Car Study 1 because, by the time they make their engine selection, participants in both the Hi-to-Lo and Lo-to-Hi conditions should be relatively depleted. This is a particularly important issue for firms because it means that willingness-to-pay might depend not only on the configuration sequence, but also on the price of the attributes in the sequence. In order to address this matter we replicated Car Study 1 with another group of 300 entry-level sedan purchasers in the same participating dealerships approximately 6 months after the first study. In addition to replacing engine with a cheaper item, radio (4 options), we also removed the importance rating task from the pre-configuration questionnaire. Engine now

Figure 3
Timing of Choices in Car Study I



Note: Hi-to-Lo participants advanced from right to left; Lo-to-Hi from left to right.

Table 6
Results of Car Study 2

Attribute (options)	Lo-to-Hi	Hi-to-Lo
Radio (4)		
Default proportion	.28	.31
Average price	506.60	471.03
(Std. dev.)	(358.49)	(348.67)
Average time (secs.)	26.25	30.73
(Std. dev.)	(17.80)	(18.59)
Gearshift (4)		
Default proportion	.29	.35
Average price	160.40	128.27
(Std. dev.)	(143.70)	(129.44)
Average time (secs.)	19.73	26.91
(Std. dev.)	(11.21)	(16.02)
Interior Décor (4)		
Default proportion	.31	.35
Average price	160.93	144.53
(Std. dev.)	(276.46)	(237.95)
Average time (secs.)	20.17	29.63
(Std. dev.)	(12.02)	(20.60)
Rearview Mirror (6)		
Default proportion	.39	.49
Average price	194.40	155.20
(Std. dev.)	(163.42)	(159.23)
Average time (secs.)	21.53	29.67
(Std. dev.)	(12.64)	(18.63)
Steering Wheel (10)		
Default proportion	.31	.38
Average price	242.23	215.70
(Std. dev.)	(196.12)	(197.55)
Average time (secs.)	76.69	89.50
(Std. dev.)	(63.68)	(75.27)
Rims and Tires (13)		
Default proportion	.32	.34
Average price	955.33	931.67
(Std. dev.)	(502.88)	(482.42)
Average time (secs.)	83.47	81.19
(Std. dev.)	(64.27)	(57.74)

Continued on next page

appeared after the target attributes in both the Hi-to-Lo (N = 150) and Lo-to-Hi (N = 150) conditions. We did not include any control conditions in this study.

Results

We followed the same analytic strategy in this experiment as in the first car study (except for the parameters for attribute importance). Table 6 presents the summary statistics and Table 7 presents the results of the logistic regression testing our order manipulation. The order effect that we observe in the Suit Study and Car Study 1 manifests in our participants' pattern of default acceptance, but somewhat more weakly (Figure 4). This is not surprising given the fact that we replaced a high-variety item (engine had 25 options) with a low-variety item (radio had only 4 options), which would naturally reduce the degree of depletion experienced by our participants. Indeed, this observation highlights the link between depletion, variety, and attribute order: higher (lower) variety items early in the sequence will lead to greater (lower) depletion, and in turn, larger (smaller) effects of attribute order on choices. We also estimated a logistic regression to test the effect of cumulative variety on default acceptance (Table 8). Its results bolster the interpretation that our order effect is a consequence of participants becoming depleted by the cumulative effect of evaluating options in previous decision stages.

The average duration of the total configuration process in this study was within 5 seconds of the duration in the previous car study, and again stood at just under 30 minutes. Figure 5 plots the average duration of each decision in the configuration process in each experimental condition. As in the previous car study, here, too, the timing data pattern tracks the choice data pattern, and suggests that default choice was not the result of lack of effort.

Removing engine from the target attribute list eliminated any statistically significant differ-

Table 6
Continued

Attribute (options)	Lo-to-Hi	Hi-to-Lo
Exterior Color (26)		
Default proportion	.34	.29
Average price	575.13	625.87
(Std. dev.)	(505.05)	(555.79)
Average time (secs.)	151.13	128.67
(Std. dev.)	(107.93)	(75.24)
Interior Color (56)		
Default proportion	.19	.22
Average price	164.87	305.13
(Std. dev.)	(631.67)	(758.25)
Average time (secs.)	145.11	106.47
(Std. dev.)	(99.84)	(82.08)
Price in euros (total)	36,435.83	36,200.80
(Std. dev.)	(4176.08)	(4181.72)
Time in secs. (total)	1755.65	1759.65
(Std. dev.)	(387.99)	(392.15)

Note: Table lists the attribute and (in parentheses) the number of options available for that attribute, proportion of customers accepting the default for the attribute, the average price paid for the attribute, and the average time in seconds it took from the moment that the attribute was displayed to the moment that the customers clicked over to the next attribute for each treatment condition and the control. In addition, the last rows display the total price and time taken. Note that in the Lo-to-Hi condition customers began with "Gearshift Style," i.e., the first row of the table and moved "down" the table, whereas in the Hi-to-Lo condition customers began with "Interior Color," i.e., the last row of attributes and then moved "up" the table.

Table 7
Effect of Order on Default Choice Analysis for Car Study 2

Parameter	Estimate	Std. Error	*p*-value
Intercept	–.5561	.1996	< .01
Stage	.0166	.0181	.35
Variety	–.0127	.0027	< .0001
Order	–.1642	.0934	< .07
Knowledge	.0021	.0369	.95

Note: $N = 300$. Stage refers to the decision stage that the customer was in (i.e., which of the eight configuration decisions). Variety refers to the number of options available for the attribute at a given decision stage. Order is our main, dummy variable of interest (0 = Lo-to-Hi; 1 = Hi-to-Lo). Knowledge is an index summarizing a series of questions about the customer's self-rated knowledge about the participating manufacturer's automobiles.

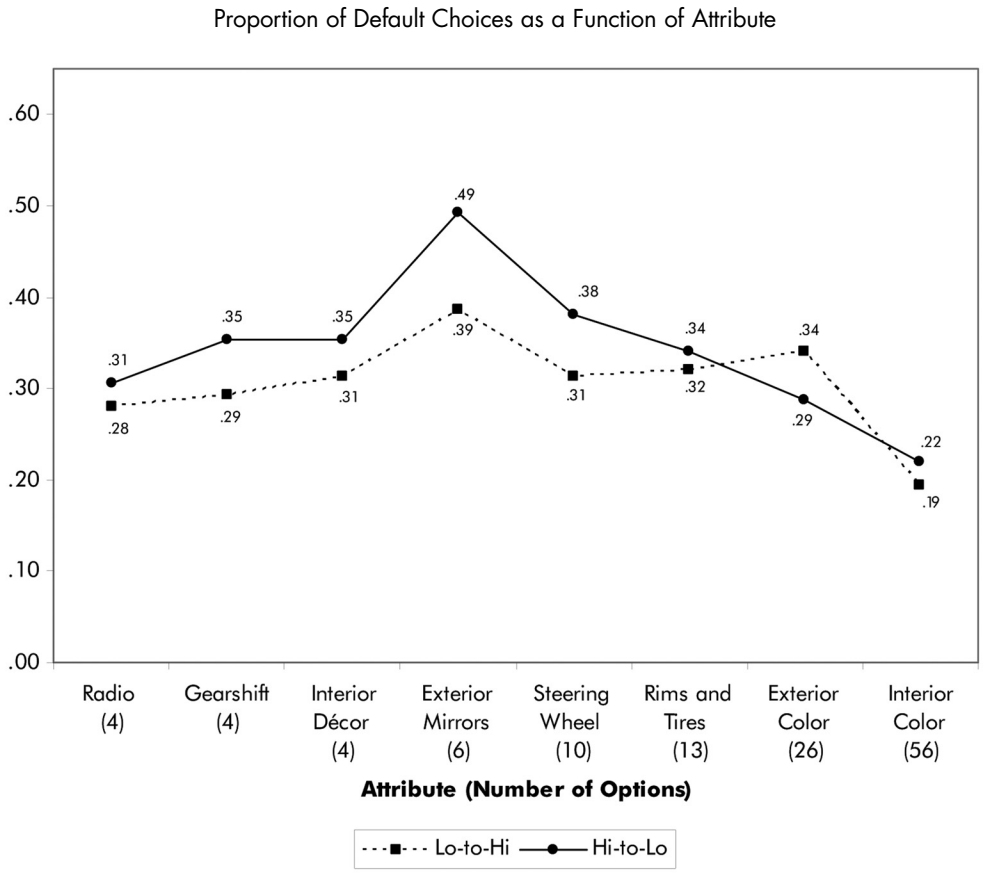
ences in purchase price between conditions (Table 6). This finding is important because it indicates that higher prices are not endemic to certain sequences, e.g., Hi-to-Lo, but instead, are sensitive to which attributes are in the sequence and where the attributes appear. Armed with this insight, a firm can increase revenues by adjusting the placement of its high-priced attributes in the configuration sequence to either coincide or not coincide with the periods in which its customers tend to evince depletion. In our setting, the firm was able to achieve significantly higher revenues in Car Study 1 by rearranging the location of the engine; prices paid were higher where customers elected to purchase something other than the lower priced, default engine option.

Finally, we replicate our satisfaction result from the previous studies. We again created a satisfaction index from the satisfaction question (Cronbach's $\alpha = .88$); Lo-to-Hi participants reported being more satisfied than Hi-to-Lo participants ($t(298) = 3.68$, $p < .0001$).

Conclusion

We have examined the importance of attribute order on product customization decisions. Our findings are consistent with the hypothesis that assessing utility depletes consumers' stock of the mental resources necessary to evaluate options. Depletion results in the need to simplify decisions, which, in our experiments, was reflected in a participant's likelihood of accepting the default option for an attribute. We observe a consistent pattern of data suggesting that order of attributes changes people's revealed preferences in customization decisions of major durable goods. When attributes with relatively few options follow attributes with relatively many options, people appear to be depleted and are more likely to accept default options than when the sequence of attributes is reversed.

Figure 4
Default Choice in Car Study 2



Note: Hi-to-Lo participants advanced from right to left; Lo-to-Hi from left to right.

Table 8
Effect of Cumulative Variety on Default Choice Analysis for Car Study 2

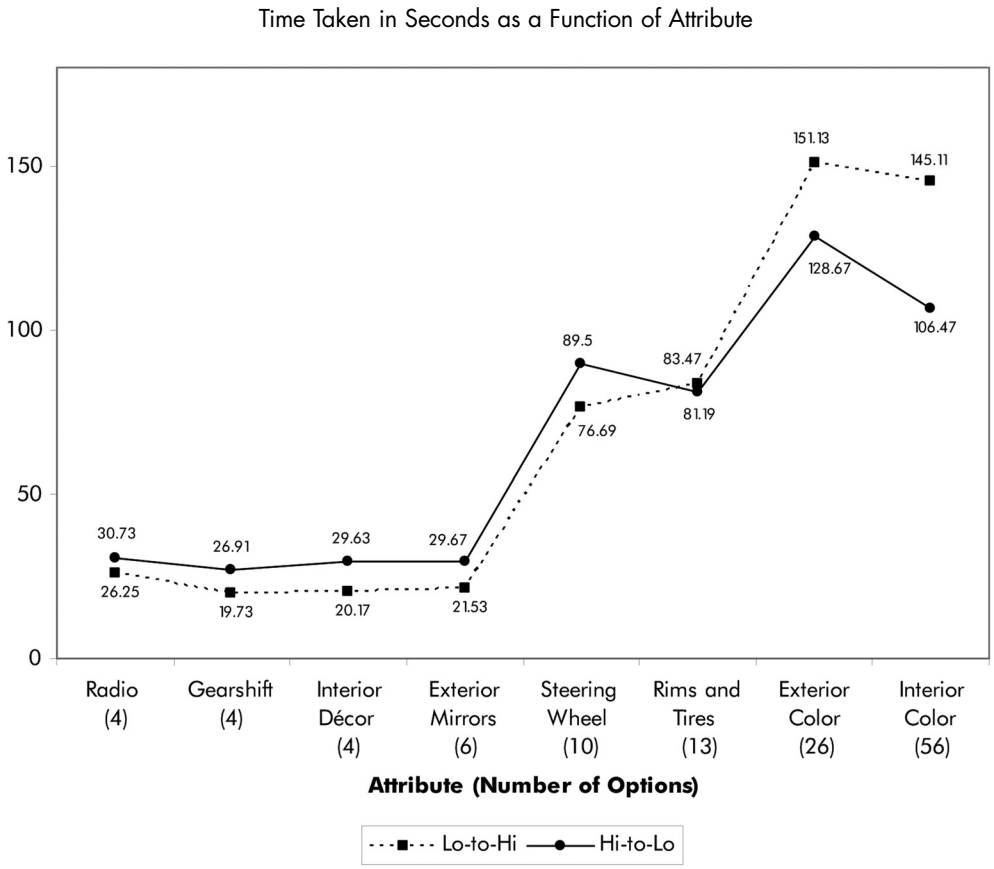
Parameter	Estimate	Std. Error	*p*-value
Intercept	–.6307	.0811	< .0001
Variety	–.0155	.0030	< .0001
Cumulative Variety	.0021	.0010	< .05
Knowledge	.0001	.0350	.99

Note: *N* = 300. Variety refers to the number of options available for the attribute at a given decision stage. Cumulative Variety refers to the number of options that the participant had viewed to that point. Knowledge is an index summarizing a series of questions about the customer's self-rated knowledge about the participating manufacturer's automobiles.

The pattern of behavior that we document has implications for the marketing of mass-customized products that involve a sequence of customization decisions. In particular, we show how firms can use the interaction between the sequence of decisions and the pre-selected default alternative in order to promote the choice of certain attribute combinations. This presents firms with the opportunity to increase the sales of attribute options that yield higher profit margins. We have shown that defaults can be a particularly effective marketing instrument at the end of a decision sequence as opposed to its beginning, provided the earlier attribute decisions were more complex.

A corollary of this finding is that the price paid for a mass-customized product can depend on attribute order. Note, for instance, the difference obtained in Car Study 1. Here the attribute sequence included a particularly expensive attribute (engine) and the default level for that attribute was the cheapest

Figure 5
Timing of Choices in Car Study 2



Note: Hi-to-Lo participants advanced from right to left; Lo-to-Hi from left to right.

option. Moving such a decision toward the beginning of the configuration process decreased default selection because depletion is lower in the early rather than the late customization stages. Consequently, in this study customers were willing to pay more when the expensive attribute was presented early.[8] The second car study (Car Study 2) shows how malleable customers' willingness-to-pay can be: as soon as engine was moved out of the sequence of eight target attributes, the difference in prices paid between the two sequences disappeared (although the ultimate bundle that customers configured did differ, a critical issue). Note that default options are typically the cheapest alternatives, which suggests that firms may be forgoing relatively easy-to-obtain profits.

An important feature of our studies is that we relate the interaction of customization sequence and default acceptance to customer satisfaction. Our results show that starting decision sequences with relatively simple decisions (i.e., fewer alternatives) followed by relatively complex decisions (i.e., more alternatives) leads to higher overall satisfaction with the product as well as with the decision-making process. Importantly, satisfaction and price paid in our studies were not correlated, which suggests that customer satisfaction is highly dependent on the decision-making process. This finding should be of particular interest for firms who sell mass-customized products whose price does not differ greatly (e.g., fashion items such as running shoes), and who can now, based on our results, use the

sequence to influence customer satisfaction. In addition, although in our experiments participants purchased their configured items, it is likely that in other situations more satisfied customers will be more inclined to order the product that they configured. Consequently, managing the order of decisions can not only serve to increase the revenues per customer but also the fraction of customers who decide to purchase.

Notes

1. In order to make the study's administration more manageable, the recommended option was randomly chosen from a subset of three possible options that the tailor reported as representing the mainstream.

2. In this analysis, as in all the logistic regressions reported in this paper, participants were treated as a random factor in order to account for the individual-specific tendency to accept a default (i.e., observations were "grouped" by individual). Note that, because we do not have a full factorial experimental design (here and in the subsequent studies), we do not test interactions between Stage, Variety, and Order. (Irrespective of the experimental design, our primary interest is in the main effect of order.)

3. The results for the sock decision also hint at a depletion effect. Hi-to-Lo condition participants were much more likely to accept the default sock than their counterparts in the Lo-to-Hi condition (53% vs. 36%, respectively). Unfortunately, due to sample size limitations, this difference was not statistically significant at conventional alpha levels ($\chi^2 = 2.14$, $p = .14$).

4. The manufacturer requested that we withhold its name.

5. Some readers might be concerned about inter-attribute dependencies in our experiment, such that choosing one option would restrict potential choices in subsequent options. This was not the case for any of our target attributes (in fact, only the top-of-the-line sport package creates a restriction on some attributes; only two participants in the control conditions actually chose this package).

6. Note that the manufacturer specified the default levels and did not allow us to manipulate them. However, recall that we obtained a significant order effect in the Suit Study, where defaults were randomly determined. This suggests that any effect we find in the car studies is unlikely to be due to the fact that the default was fixed on one option.

7. There was no opportunity to bargain on the car price.

8. Note that, in our studies, customers were allowed to revise and modify previous selections throughout the decision-making sequence. Thus, budget constraints do not offer a plausible explanation for this result.

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