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Papers

Clicking through overload: When choice overload can actually increase choice

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Received (in revised form): 21st July 2014

Abstract

The existence of choice overload in the behaviour of online consumers is investigated through an experimental product category (electronic pencil sharpeners) on a fully functional online retail website for office supplies that was created for the field experiment. Emails were sent to potential customers with an assortment of product descriptions and links that led to a product category landing page on the retail website where visitors were then presented with an assortment of products. We find that the likelihood of click-through (either in the email or on the landing page) at first increases with the number of choices presented and then decreases consistent with choice overload. However, we also find that click-through subsequently increases as the number of choices increases after overload occurs. This suggests that another effect is also at work in the choice situations. We provide an explanation and evidence for this post-decline increase in click-through — specifically, as the number of link choices increases, not only does choice overload increase, but also the promise of richer information, which can help resolve or reduce the overload for the mere 'low cost' of a click.
Journal of Direct, Data and Digital Marketing Practice (2014) **16,** 24–35. doi:10.1057/dddmp.2014.37

Keywords: choice overload, information overload, online consumer behaviour, click-through behaviour, online retailing

Choice overload is a subset of information overload

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Introduction

The number of books to choose from in a typical library is both wonderful and terrible. Wonderful because of the vast amount of information available to read and terrible because the sheer number of choices can be overwhelming — so overwhelming, in fact, that Melvil Dewey in 1876 developed a classification system to organize it all for the purpose of making it more accessible. It is no wonder that the condition of 'library anxiety' causes a sense of powerlessness when beginning an information search.[1]

Similarly, shoppers appear to face what some researchers have deemed 'information overload'.[2] Loosely put, 'information overload' describes the state an individual reaches when the amount of information available exceeds his or her ability to process that information within an allotted time. Information overload was originally calculated as the number of options within an assortment multiplied by the number of product

attributes — choice overload is a special case of information overload where only the assortment is large.[3]

The digital age has greatly reduced the cost of generating and sharing information, thus complicating the potential problems of information and choice overload. As a result of the internet, a flood of information, goods and services is available to online consumers and, although this vast assortment may have increased the likelihood of satisfying a diverse consumer base,[4] there may be issues of information and choice overload.

Choice overload in the real world — an unpredicted effect

This paper presents a study where we observe actual online consumers experiencing choice overload. We avoid a potential price-demand endogeneity issue[5] by exhibiting full control over pricing in our own online store instead of observing the price choices of an independent retailer. The results of this study show that the likelihood of click-through in an email or website initially increases as the number of links to click increases and then decreases as the number of links presented continues to increase, consistent with choice overload. However, they also show a surprising subsequent increase in click-through as the number of alternatives offered increases beyond the point of overload. Next, we discuss the definitions and debate regarding information and choice overload.

Information overload

Coping strategies for overload

Many decades ago, Miller[6] provided evidence that humans can process about seven pieces of information, plus or minus two. Later research has more rigorously addressed this issue and suggested that that number is closer to four, plus or minus zero.[7] When the information available to process exceeds human ability to do so in the time allotted, this can lead either to sub-optimal choices or to coping strategies such as delaying choice.

The term 'information overload' was first presented in 1974.[2,8,9] The main idea of these studies was to show that 'dysfunctional consequences' resulted when consumers were presented with 'too much' information. These studies, however, received immediate criticism[10,11,12] and rejoinders[13,14] and led to additional empirical work[15,16] that addressed how to operationalize information and decision quality. Later research summed up the controversy of these previous papers and concluded that prior claims of information overload were 'questionable … [and that] consumers are capable of processing fairly large amounts of information'.[17]

More information helps — when information quality increases

Ironically, evidence presented by Malhotra,[18] which used the same basic design as Jacoby *et al.*, found that when consumers were asked to choose between houses, choice accuracy decreased when the number of attributes to be evaluated increased to 15 or more. Muller,[19] on the other hand, reports the results of a two-week field study of point-of-purchase signs hung in the aisles of grocery stores and finds that varying the amount of information on these signs produces no significant change in purchase behaviour. Lastly, Keller and Staelin[20] demonstrate that providing more information about product attributes can both help and hinder choice accuracy when they break information into quantity and quality.

According to their findings, quantity of information decreases choice accuracy while quality of information can increase choice accuracy.

Choice overload

Consumers avoid making a choice when things get complex

More recently, Timmermans[21] demonstrates that when choosing among multiple alternatives, subjects were more likely to use an elimination strategy as the number of alternatives increased. Hauser and Wernerfelt[22] suggest that as both the number of alternatives and the information about those alternatives increases, consumers tend to consider fewer choices and to process a smaller fraction of the overall information available. Additionally, research on choice overload[23] demonstrates that as choice-making complexity increases with the number of alternatives in the choice-set, individuals are more likely to avoid making a choice. Iyengar and Lepper[23] also note, after citing numerous studies that demonstrate only a positive correlation between the number of alternatives and the likelihood of choice, that 'the number of options presented in previous [choice] experiments was characteristically small, typically between two and six alternatives. It would appear, then, that what prior research has actually shown is that relatively limited choice among alternatives is more beneficial than no choice at all'.

More current research suggests that making a comparison of items within a large assortment may seem undesirable from a time-and-effort perspective.[24] Thus, extensive assortments may induce a decrease in the motivation to commit to a choice.[25]

Are thresholds higher when cost of choice is low?

The existence of choice overload has been supported in a retail setting, but do these effects exist in an online environment when the time and cost of click-through is considerably less? Haynes[26] found evidence for choice overload when he constrained the decision makers' time to make a decision. Most often, online shopping is an activity that happens at home with relatively fewer time constraints compared to a typical retail environment and, as such, it is worth examining whether overload exists in the electronic environment under this assumption.

Internet studies

Fewer constraints for e-commerce

Bricks and mortar retailers have a physical limit on the maximum number of products to display, but online shopping sites have virtually no limit.[27] One of the advantages of the internet retailer is the ability to convey large assortments and much information at lower costs, which can reduce the cost and effort for consumers to search.[28] As a result, researching the behaviour of online shoppers and their reactions to varying quantities of information and choice is relevant for today's e-market.

A 'state of the field' review classifies internet choice behaviour as within or across sites and whether choices are of a search or of a purchase nature.[29] This review mentions that 'when deciding to remain on a website by requesting an additional page, the website visitor may have the choice of clicking on one of many available links. The location and number of

links may influence the user's decision to click-through and which link to select'.

Researching searches within a site

Our study of information and choice overload is more related to the body of internet research that studies 'within-site search' behaviour. Other studies related to our research also fall within this category. Ansari and Mela[30] examine the effect of link order and placement on the probability of clicking a link. Clicking a link is a 'hit', as defined by Berthon *et al.*,[31] where surfers land on a site but do not necessarily interact with the information or options available. Nevertheless, the longer they stay there, the higher the possibility that they will move on to explore the site.[32]

Bucklin and Sismeiro[33] model browsing behaviour and find that visitors' propensity to continue browsing changes dynamically as a function of the depth of a given site visit and the number of repeat visits to the site. Huberman *et al.*[34] propose a 'law of surfing' model, which assumes that the utility of an additional page view is equal to the utility of the current page plus a normally distributed error, to accurately predict the distribution of the number of pages requested by users. This is a 'visit' according to Berthon *et al.*,[31] where the surfer interacts with the web page, such as time spent reading the text or viewing the graphics.[32] Mandel and Johnson[35] find that users dynamically adapt their behaviour in response to page-by-page stimuli, even when they are not aware of the adaptation. Moe[36] develops and tests typology of store visits that vary in terms of purchasing likelihood: knowledge building, hedonic browsing, directed buying and search/deliberation.

Low cost and commitment of clicking a link

Lee and Lee[37] believe that this ability to access seemingly endless amounts of information has compromised the utility of online information for many consumers and may result in overload. Yet, the cost of choosing to click a link is low in terms of time and effort, and includes the ability to reverse the action quickly and easily with the back button. Because of this, the propensity to choose may increase as overload increases due to the low click-through costs. Our research fits here by examining the effect of the number of choice alternatives offered while browsing or searching a site (ie number of links offered) on the likelihood of continuation (ie clicking a link).

Framework

Creating a choice overload situation

The framework underlying our field experiment is simple. If individuals experience choice overload, we should be able to create a situation where, when they are presented with a choice situation, they will be less likely to choose one of the available alternatives due to this overload and, thus, will be more likely to exit the choice situation. In order to accomplish this, we need to provide choice alternatives in an environment where we can vary the quantity of information associated with the choice situation, observe choices and show that, as the information provided increases, individuals reach a point where choosing one of the available alternatives becomes less likely.

We can create this situation in an online setting by presenting multiple links to individuals on which they can click. Information can be varied by

changing the number of links available to click and choices can be observed in the resulting clickstream data. We can then observe whether the probability of clicking one of the links available is related to the number of links non-monotonically.

Demonstrating information and choice overload

To be more clear, if the probability of clicking a link increases initially, but then reaches a peak and thereafter begins to decrease (all while the number of links continues to increase) even when controlling for other factors such as link placement and order, such a reverse in the effect should indicate that individuals are experiencing information overload.

Furthermore, the probability of choice should initially increase with the number of alternatives because, as each new alternative is included, the probability of being offered an alternative that yields greater utility than exiting the choice situation (ie not clicking but rather deleting the email or leaving the website) should increase. If individuals had unlimited mental capacity, the probability of clicking a link should be non-decreasing indefinitely as the number of links increases.

Probability of choosing falls beyond a level of choice

However, individuals do not have unlimited mental capacity and thus there should come a point as the number of alternatives increases above some optimal number, say n^*, where considering n^*+1 alternatives involves mentally processing more information than the individual is capable of processing in the time he or she is able or willing to devote to the choice. At this point where the choice becomes more complex, but the resources used to make the choice cannot be increased, we should observe a decrease in the probability of making a selection instead of leaving the choice situation.

The simple explanation for this decrease in the probability of choosing an alternative (instead of exiting the situation) is that, once an individual reaches n^*+1 choices and becomes overloaded (and thus is constrained because he or she can no longer increase the amount of mental resources devoted to the choice at hand), his or her probability of choosing any available alternative cannot be greater than the probability of choosing an alternative when the same number of mental resources is distributed over n^* choices (ie the unconstrained case).

Methodology

Creating a fully functional, online office supplies website

The data for this research were collected through a field experiment run on a fully functioning internet retail website that was created solely for the purpose of this experiment. The online retailer sold office supply products and was designed and run by a firm that specializes in creating such websites. This ensured that the website was of professional quality and had all of the characteristics of a typical online retailer (eg menus, product pages, shopping cart, checkout process, credit card payment, a home page with promotions, customer accounts).

Within the website, electric pencil sharpeners were chosen as the experimental product category for the following reasons:

1. most people are not familiar with the key brands in the category and therefore this reduced brand salience as a decision-driving attribute;

2. we could offer competitive prices in this category; and
3. we could offer many choices without changing the key benefit driving purchase (ie sharpening pencils).

The ten sharpeners sold in the store varied by price ($7.40–$44.76), form (vertical, classic, miniature), power (battery v plug-in), features ('full' indicator light, over-sharpening protection, multiple hole sizes, lifetime warranties, etc) and brand (Hunt, Panasonic and Sanford — the three leading brands).

Promoting the site by email with varying content

Emails that promoted the sharpeners were sent to 3.32 million addresses from a purchased list of US-based email addresses. The emails contained only text and for each sharpener they included the brand and model name, a brief description, a price and a link to the sharpener menu page on the website. Four types of email were sent that varied by the number of products they advertised. The emails contained two, four, seven or ten sharpeners, and each email type was sent to a fourth of the address list. Within each email type, two different emails were used that randomly varied the sharpeners included and their order of appearance in the email. When respondents clicked a link, they were taken to a website landing page that displayed a menu of up to nine sharpeners. The selection of sharpeners displayed and their order were randomized for each new respondent.

Clickstreams for each visitor were recorded. To control for learning through repeated visits, the clickstream data were filtered to drop all data except first-time visitors who entered the store through one of the experimental emails. A total of 1,368 unique individuals visited the website from email links.

Analysis and results

Modelling the predicted effect

The first question we address is how the number of links presented in the email affects the likelihood of clicking a link. We estimate this effect with a binary logit model:

$$\Pr\{Y_i = 1|L_i\} = \frac{e^{\gamma_i(L_i;\alpha,\beta)}}{1 + e^{\gamma_i(L_i;\alpha,\beta)}} \tag{1}$$

where

$$\gamma_i(L_i;\alpha,\beta) = \alpha + \beta_1 L_{i4} + \beta_2 L_{i7} + \beta_3 L_{i10} \tag{2}$$

For each observation i, the dependent variable $Y_i = \{0, 1\}$ represents whether or not the individual clicked on one of the links presented by the email (and entered the website). The independent variable L_i contains three dummies for the number of links in the email from which subjects came to the site. They are sub-scripted by the number of links found in the corresponding email. Estimates for the coefficients should be interpreted as relative to the effect of the intercept term.

Rate of choice decreased — then unexpectedly increased again

Table 1 shows the results of the model from Equations (1) and (2). The results show that emails with four links were clicked significantly more than emails with either two links (represented by the constant in Table 1) or

Table 1: Dependent variable: was the email clicked?

Parameter	Estimate	Std. Error	*t*-statistic
Intercept	−8.586***	0.080	−106.879
4 Email Links	1.097***	0.093	11.821
7 Email Links	−0.116	0.117	−0.993
10 Email Links	1.372***	0.090	15.256

$N = 3.32$ million × observations split equally across the four conditions.
*, **, *** = 5 per cent, 1 per cent, 1 per cent significance levels, respectively.

seven links, and that emails with ten links were the most likely to be clicked of all four email types. We did not predict this final increase in click-through rate and will address this finding in the discussion.

Modelling whether product count affects page views

The second question we investigate is whether the number of items presented to the subject when they enter the experimental category affects the number of times the subject successively clicks deeper into the store (number of page views). Because the number of successive clicks is discrete, non-negative and a counting variable, we perform a maximum likelihood estimation using a conditional Poisson distribution, as is shown in Equations (3) and (4), using the 1,368 observations of respondents who clicked an email link.

$$\Pr(Y_i = y_i | x_i) = \frac{\lambda_i^{y_i} e^{-\lambda_i}}{y_i\,!}, y_i = 0, 1, 2, \ \dots \ . \tag{3}$$

with

$$\lambda_i = \alpha + \beta_1 x_{i2} + \ \dots \ + \beta_{19} x_{i19} \tag{4}$$

Here, Y_i represents the number of page views. The covariates in X include number-of-item dummies (x_{i2} through x_{i9}), link dummies to control for email-type effects, and item dummies to control for individual sharpener effects.

The same unexpected post-overload page view increase

Table 2 shows the results from this estimation. Observe in Table 2 that the relationship between page views and the number of items displayed appears to have the same local maximum (at 5 menu items) and final increase (at 9 menu items) found previously in the email analysis. Thus, in two similar situations we observe similar results (including both our predicted result and a curious unexpected result that we will discuss later). Note that additional analysis reveals that the estimates for the intercept and *2, 3* and *4 Menu Items*, as well as *6* and *7 Menu Items*, are all significantly different from *5 Menus Items*. In addition, *9 Menu Items* is significantly different from *6, 7* and *8 Menu Items*.

Discussion

Low-cost choice prompts people to seek information to resolve overload

Table 1 shows the predicted result that email recipients were more likely to click-through the four-link email than the two- or seven-link email. The unexpected result we discovered in addition was that this maximum is only local and that the probability of click-through actually increases again

Table 2: Dependent variable: page views after entering the website at the landing page

Parameter	Estimate	Std. Error	*t*-statistic
Intercept	1.701***	0.029	58.726
2 Menu Items	−0.105**	0.035	−2.954
3 Menu Items	0.065	0.057	1.158
4 Menu Items	0.121	0.074	1.618
5 Menu Items	0.509***	0.103	4.935
6 Menu Items	0.422***	0.126	3.334
7 Menu Items	0.364*	0.156	2.340
8 Menu Items	0.382*	0.188	2.027
9 Menu Items	0.634**	0.213	2.980
4 Email Links	−0.289***	0.015	−19.632
7 Email Links	−0.223***	0.020	−10.955
10 Email Links	−0.407***	0.014	−29.559
Product 1	−0.026	0.028	−0.923
Product 2	−0.116***	0.035	−3.269
Product 3	−0.144***	0.033	−4.345
Product 4	−0.034	0.025	−1.349
Product 5	−0.298***	0.040	−7.462
Product 6	0.031	0.033	0.921
Product 7	−0.222***	0.041	−5.377
Product 8	−0.071	0.043	−1.641

Number of observations = 1,368.
*, **, *** = 5 per cent, 1 per cent, 1 per cent significance levels, respectively.

when the number of links included in the email increases to ten. At first glance, this second increase appears inconsistent with a choice overload explanation. However, the internet is a domain with inherently low information access costs. More information (and potentially richer or more specific information) is often only a click away, and the ability to reverse a click lies in simply clicking a back button; therefore, the commitment involved in obtaining more information is also very low.

Resolving information overload through more information

For example, when an individual receives an email with links, he or she can learn more about the information contained in the email by clicking a link, which promises richer information in the form of a web page. For individuals who experience little or no overload (fewer links) when looking at an email, their decision to click on a link is most likely out of interest in one of the advertised products or curiosity about the unknown website. By contrast, for individuals who experience a moderate to high amount of overload, their decision to click on a link is more likely made to gain richer information than is supplied by the email (recall that the email was all text). Since the cost of one click is very small, one additional click in order to get a better understanding of the offer requires little effort or commitment. Here is a seemingly contradictory action where email recipients seek to resolve information overload by seeking more information.

Higher interest, lower bounce

If this explanation were correct, we should expect to see a difference in who makes a second click (after entering the website) depending on whether they came from the two-, four-, seven- or ten-link email. Individuals who received a two-, four- or seven-link email should be less likely to bounce (ie less likely to request an additional page view once they arrive at the landing page) because they are interested in the products

Table 3: Dependent variable: second click into the website (ie not bouncing)

Parameter	Estimate	Std. Error	*t*-statistic
Intercept	−0.325*	0.163	−1.999
4 Email Links	−0.232	0.189	−1.224
7 Email Links	0.034	0.237	0.141
10 Email Links	−0.410*	0.184	−2.223

Number of observations = 1,368.
*, **, *** = 5 per cent, 1 per cent, 1 per cent significance levels, respectively.

advertised in the email. Furthermore, they should be less likely to bounce as their interest increases or, in other words, as the number of email links increases, up to the point of overload.

One the other hand, individuals who enter the website from a ten-link email where overload is likely should be more likely to bounce because a larger proportion of visitors are only seeking information to resolve their overload. Only a fraction of those who enter will actually be interested in one of the products displayed or in the landing page. Thus, visitors coming from a ten-link email should have a higher bounce rate than those coming from the other emails.

Modelling bounce rate by number of links

We investigate this explanation using the same binary logit model we used in Equations (1) and (2) with the same co-variates as in Equation (2) (ie the number-of-link dummies). The one difference is that we change the dependent variable. In the original model, we used click-through rates. Now, we use the inverse of the landing page bounce rate as the dependent variable (eg rate at which visitors did not bounce). With this configuration, we expect to see increasing co-efficients for the two-, four- and seven-link email dummies, but then a subsequent decrease in the dependent variable for the ten-link email. Table 3 shows the results of this model. Note the decrease in bounce rate (ie the increase in the inverse of the bounce rate) from two to seven email links and the subsequent increase in bounce rate for the ten-link email.

Fewer choices increases quality, more choices increases quantity

As stated, we suggest that this difference in co-efficients appears because many subjects entering the website from the ten-link email are entering the site for a different reason than the other subjects. Specifically, we suggest that they enter the site to obtain richer information in general (which is different from the others who are more likely to be entering out of interest in the site or a specific product), and therefore a greater portion of them bounce once their information needs have been met and they have decided that they are not interested in the products offered.

Conclusion

Interpreting the paradox

In this paper, we provide evidence of choice overload in a real-world, online retail setting. We also find an additional effect, specifically that as the number of alternatives increases beyond the point where overload begins, the likelihood of clicking a link first decreases, but then begins to increase again. We propose an explanation for this effect, specifically that

this second rise in the likelihood of clicking a link results from individuals seeking richer information before making a choice. Because of this different reason for entering the website, these individuals are also more likely to bounce from the landing page.

Limitations

Possible order and product effects

Due to limitations placed on the researchers by the email address vendors, only four types of email could be sent out, each with two revisions. Ideally, emails would have had between one and ten links and each of these ten types of email would have had many more revisions so that emails would have been completely randomized across products, product order and number of products offered. As the data currently stand, the potential order and product effects do not seem to affect the results, since we observe a similar effect in the second stage where randomization was performed, but it is difficult to provide stronger evidence that this statement is true.

Future research

There is a great deal of future research that can be done using the field experiment technique described in this paper, namely, the use of an experimental online retailer connected to a real back-end for order fulfillment. This set-up gives the researcher complete control of the store, provides detailed data regarding the behaviour of subjects, and eliminates the price/demand endogeneity problem. We have learned how difficult (and expensive) it can be to drive traffic to a new online retailer. However, if successful, such a site can produce many research opportunities.

Researching the likelihood of purchase

Research can and should be extended to see how information overload affects initial behaviours on the internet such as clicking a link, and also to see how information overload affects the likelihood of purchase. This was not possible in the current study due to low traffic and purchase rates on the site, and thus would require creating a site with much more traffic to be successful.

In addition, an extension of the concept of information overload tested in this paper is to find the ideal number of categories in a product structure (when searching an entire web page) to determine the optimal level of choice at each level in the category structure and to the optimal number of levels in the web page structure.

Acknowledgement

We would like to thank Ravi Shanmugam and Yakov Bart and Roman at SisIQ for their extensive work and help in setting up website and study conditions through which the data for this paper could be collected. Thanks to Miguel Villas-Boas, Stefano DellaVigna, Noah Lim and Mario Capazzani for their valuable feedback.

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