Negative Effects of Complex Promotion Strategy in Online Shopping Evidence from Lab Experiment

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Abstract. This study discusses the negative Effects of the complex promotion strategy on consumers. Based on the dual-systems theory, we conducted lab behavioral experiments to obtain real decision data with Mouselab, a decision-making tracking technology. A sample of 116 students in Shaanxi Province participated in the experiment. The results show: (1) Under the complex promotion strategy, the quality of consumer decisions deteriorates. (2) Under the complex promotion strategy, the cognitive cost of consumers increases.

1. Introduction
The Internet has made online shopping a global daily phenomenon. To stay competitive, many online retailers have intensified their online promotions, which have become a core marketing tactic for businesses without physical stores. At present, most of the common promotion methods in the market are price reduction, such as discounts, two-for-one offers and so on. Straightforward promotions force online merchants to maintain sales rate at the lowest prices. The way cuts into the profits of online merchants. Therefore in the past two years, in order to get rid of this situation, e-commerce companies have designed more and more promotion strategies whose common feature is more and more complex. One of the most popular new methods is the superposition of various single promotion rules. In 2017, China's e-commerce transactions reached 29.16 trillion yuan, up 11.7 percent year-on-year, according to the National Bureau of Statistics. Complex promotion rules have yielded excellent results, but is this a long-term way to profit? Merchants set decision-making barriers for consumers through the complex promotion rules. Online consumers need to deal with more information in the process of making shopping decisions. The calculation of superimposed promotion rules is tedious and complicated, but what troubles consumers more is that it is not easy to understand the lengthy superimposed promotion rules. Consumers will infer that product promotion under complex rules is a scam, which will reduce their purchase intention. This may be due to consumers’ loss aversion.

2. Theoretical basis and hypotheses to be verified
Kahneman (2003, 2011) describes the two processes the mind uses to interpret the world, what he calls System 1 and System 2. System 1 operates automatically and quickly, with little or no effort and no sense of voluntary control. System 2 allocates attention to the mental activities that demand it, including complex computations. [1] The operations of System 2 are often associated with the subjective experience of agency, choice, and concentration. Our thinking is a combination of the two systems, with System 1 giving System 2 the first impressions it works with. In addition, numerous experiments have shown that people rely primarily on intuition (System 1) rather than reasoning.
The human brain has always avoided mental work as much as possible. Through the experimental design, Jiang et al. (2017) found that the increase of commodity name complexity based on information entropy evaluation and the perceived complexity of commodity name would reduce the shopping efficiency of users. Through mathematical analysis, Duan et al. (2012) compares the two discount methods of "full on delivery" and "full on reduction", and finds that merchants use the illusion effect of discount to blind consumers and mislead consumers to understand the promotion rules.

Buying behavior is a decision making process. When shopping online, people first need to understand the text of the advertisement, and then conduct price comparison through simple calculation. Finally, with some experience and online evaluation, shopping can be easily completed with the help of heuristic in System 1. It was supposed to be a great experience. But nowadays, the promotion strategy changed which become not simple. Consumers activate System 2 from reading promotion texts, which is undoubtedly a complicated decision-making process that consumes too much mind resources.

Merchants may argue that these well-designed promotions not only allow them to earn profits, but also provide appropriate discounts to different consumers, which should theoretically be a win-win situation for both merchants and customers. But that may not be the case. In standard utility theory, individuals are assumed to be able to make the right choices to get the best results. However, there are innumerable examples show that humans are not completely rational. Most of the time, people make decisions without much thought. Löfgren and Nordblom (2019) propose a model in which rational decision-making behavior is at the cost of cognitive cost. And they said decision-making consists of two stages: In the first stage, the decision maker considers whether to put in the effort to make an informed choice, that is either attentive or inattentive. In the second stage, the choices made in the first stage lead to two different decision outcomes. Inattentive decision is based on simple choice rule, not optimization, and can therefore lead to errors. There is a trade-off between the cognitive cost of making attentive choices and the error of making inattentive choices.

Suppose that when a consumer buy an item, he encounter two merchants offering the same product which just have different promotion rules. Due to understand and calculate, consumers have to choose between two promotion strategies—x and y, that is, to make a reasonable choice between x and y -- that is, to optimize, which requires some cognitive cost $\zeta$. If effort is made, the transaction price of the good will be known, and the consumer will make an attentive choice based on whether the utility $U(x)$ or $U(y)$ is the greatest. Thus, the total utility of attentive choice will be demonstrated ex post:

$$U_{\text{att}} = \max[U(x), U(y)] - \zeta$$

However, since the true utilities are known with exerting effort, the expected utility from the attentive choice of the effort cost is ex ante

$$E[U_{\text{att}}] = E[\max[U(x), U(y)] - \zeta]$$

To determine whether efforts, $\zeta$, are rewarded, the expected utility in equation (2) is compared with the expected utility of an inattentive choice, which we denote $E[U_{\text{in}}]$. $\theta$ is the consumer’s confidence about the probability of making the consumer optimum choices without optimization—that is, picking
the option that ex post turns out to yield the highest utility. Hence, ex ante
\[ E[U_{in}] = \theta E[\max\{U(x), U(y)\}] + (1 - \theta)E[\min\{U(x), U(y)\}] \]

The consumer will make the choice inattentively if \( E[U_{in}] > E[U_{att}] \)—that is
\[ \zeta > \frac{(1 - \theta)(E[U(x)] - E[U(y)])}{\Delta E[y]} \]

This means that if the effort exceeds the expected cost of making a rational attentive choice, the consumers will make an inattentive choice. The higher the required effort, \( \zeta \), the more likely the consumer’s inattentive choice is.

Compared with single promotion strategies, under the superimposed promotion strategies, consumers need to invest significantly more energy and resources. In such intense engagement, consumers quickly become distracted and lose attention. Distracted consumers make intuitive choices. System 1 quickly pulls consumers into the trap of decision-making bias when they encounter elaborate promotion strategies designed by merchants. Based on this, the paper proposes the hypotheses:

(H1): Under the complex promotion strategy, the quality of consumer decisions deteriorates.
(H2): Under the complex promotion strategy, the cognitive cost of consumers increases.

3. Experiment Design

The experimental design of this study is implemented by MouseLab, which is a process tracking tool that can be used to monitor the information acquisition process of decision makers. [5] This experiment uses many programming languages to generate a user interaction system, such as HTML, es5, Less, Vue, Golang, Mysql, MouseLab, etc. This is an operational platform for conducting experiments and collecting data via a network connection. Subjects visited the experiment page through the experiment link. Information is provided to the subjects through a series of information boxes on the computer screen. The information boxes is not visible unless the subject clicks or mouseover a certain box. In the process of the experiment, the experimental program can record the time, sequence and mode of the subjects' viewing of the information box. The real decision-making process data can help us to infer the internal decision-making process of subjects when faced with a specific information matrix. In addition, the cognitive cost was measured by combining real process data with personal reports.

There are 116 college students taking part in the experiment. They were randomly assigned to the Experimental Group (61 students) and the Control Group (55 students). The Experimental Group made consumption decisions under the superimposed promotion strategy, while the Control Group made consumption decisions under a single promotion strategy. The database stores the decision-making time and final choice of the two groups of subjects.

Entering the experiment page, all subjects fill in three basic information, namely student number, gender and grade. After the experiment started, the subjects first completed a group of practice tasks to familiarize themselves with the experimental environment and process. All the subjects read a paragraph of experimental task description and then went to the purchase page (controlling for all factors except promotion strategy). After completing shopping, the subjects filled in questions related to cognitive cost with the five-point Likert Scale.

4. Experiment results and analysis

After sorting and cleaning the data, the basic data of the experimental group and the control group are as follows:

Table 1. Descriptive Statistics of dependent variables under different promotion strategy

|            | Group | N  | Mean  | Std.  | Min | Max |
|------------|-------|----|-------|-------|-----|-----|
| Total Clicks| CG    | 55 | 15.85 | 6.98  | 2   | 39  |
|            | EG    | 61 | 22.75 | 8.93  | 6   | 53  |
From the results of descriptive statistics, it can be seen that there are indeed differences between the Experimental Group (EG) and the Control Group (CG) in the dependent variables such as total click times, decision quality, average decision time, but whether the differences are significant or not needs to be further analyzed and verified. MANOVA analysis was conducted on the experimental data. As can be seen from the analysis results in table 2, all kinds of variance analysis results were consistent. Different promotion strategy made the overall difference of the dependent variable significant (F=84.669, Sig=0.000).

Table 2. MANOVA analysis of dependent variables under different promotion strategy

| Effect               | Value  | F       | Hypotheses df | Error df | Sig. |
|----------------------|--------|---------|---------------|----------|------|
| Pillai's Trace       | 0.694  | 84.669  | 3.000         | 112.000  | 0.000|
| Wilks' Lambda        | 0.306  | 84.669  | 3.000         | 112.000  | 0.000|
| Hotelling's Trace    | 2.268  | 84.669  | 3.000         | 112.000  | 0.000|
| Roy's Largest Root   | 2.268  | 84.669  | 3.000         | 112.000  | 0.000|

In this study, we used Independent-Samples T Test to analyze whether there were significant differences in the dependent variables under various promotion strategy. The analysis results are shown in table 3. The total clicks, decision quality and average decision time are significantly different under different promotion strategy (Sig. <0.05).

Table 3. T test for dependent variables between promotion strategy groups

| Test Method      | Levene's Test | t-test |
|------------------|---------------|--------|
|                  |               | F      | Sig. | t    | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| Total Clicks     | 1.202         | .275   | -4.599 | 114 | 0.000 | -6.900 | 1.500 |
| Decision Quality | 4.434         | .037   | 2.730  | 113 | 0.007 | .246   | .090 |
| Decision Time    | 15.677        | .000   | -9.041 | 80.726 | 0.000 | -4225 | 467.328 |

Based on the above series of analyses, we can conclude that the complexity of promotion strategy significantly affects the total number of clicks (15.85<22.75, t=-4.599, Sig=0.000) and decision time (2376.90<6602.00, t=-9.041, Sig=0.000). The more complex the promotion rules, the more times the subjects repeatedly looked at the information, and the longer each time they looked at the information. Secondly, complex promotion strategy significantly affects the decision quality of subjects (0.67>0.43, t=2.730, Sig=0.007). Under the complex promotion strategy, the decision quality of the subjects becomes worse. To sum up, the more complex the promotion rules are, the greater the cognitive load of consumers will be. In this paper, the time of repeatedly viewing information and reading information is significantly longer. Secondly, the more complex the promotion rules are, the lower the decision-making accuracy of consumers. Therefore, hypotheses 1 and hypotheses 2 are supported.
5. Conclusion
The Internet has made online shopping a global daily phenomenon. To stay competitive, many online retailers have intensified their online promotions, which have become a core marketing tactic for businesses without physical stores. Promotion and information display need to pay attention to the dual-system characteristics of consumer decision-making. The online retailers should make full use of consumers’ behavior rules, avoid the negative effects caused by the promotion competition among merchants. The sales promotion information should be simple and easy to understand. The way that information is presented should conform to the laws of human behavior.

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