

A Study on E-Commerce Product List

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Abstract—In recent years, e-commerce platforms have emerged in an endless stream, including Amazon and eBay in the high-end international market, Tmall and JD.com in the high-end Chinese market, Pinduoduo and Taobao in the low-end market. It is not so difficult for many companies to share a piece of the online shopping business. However, due to the serious homogeneity of online shopping platforms, it is difficult for users with special purchasing needs to find suitable e-commerce platforms. At the same time, different e-commerce platforms have different user stickiness for different products. Therefore, understanding users' preferences and reasons for purchasing on the platform can help enterprises improve the efficiency and accuracy of marketing. For example, after big data analysis, companies can push different products to different groups of people with more accurately and more appropriate prices. This paper chooses four popular e-commerce platforms at present: JD, Taobao, Pinduoduo and Tmall as the analysis objects. Analyzing consumers' purchasing tendency and reasons for different platforms by investigating. For different online review systems, reviews and comments have different effects on sales. Under the classified evaluation system, the total number of reviews and the number of positive comments have a significant positive impact on sales. Negative reviews or comments have a significant negative impact on sales [1]. Hence, in this experiment, the author hopes to collect feedback from consumers to analyze whether the four platforms are successful in marketing within different consumer groups, and to analyze the reasons why different consumer groups are attracted to these four platforms. According to the survey, users tend to have obvious preferences when buying different products. For example, they tend to choose JD.com when buying electronic products, while they tend to choose Taobao and Pinduoduo when buying low-priced daily necessities. At the same time, the author will also classify the consumers participating in the survey according to age and gender in order to analyze the impact of these factors on the choice of purchasing platform.

Index Terms—E-commerce, Marketing Strategy, Consumer Segmentation, Online Shopping, Business Analysis

I. INTRODUCTION

In recent 20 years, the way people live has changed radically. According to A New Marketing Paradigm for Electronic Commerce, Hoffman, Novak and Chatterjee suggested that a fundamental lack of faith between most online stores and consumers has prevented people from shopping online or even providing information to web providers in exchange for access to information [2]. The price of online shopping is more transparent, and the usage is easier. With the update of smart phones, people can completely buy any products they want at home. However, as in other industries, user stickiness remains

one of the most important factors for e-commerce companies. The tweaks and changes that shopping platforms make to user usability and stickiness are long-term process. Moreover, they still have a lot of space for improvement.

A company never wants to see that it limit itself to some consumers or certain products. Therefore, all e-commerce platforms are working hard to find and broaden their user groups and find appropriate marketing methods. Consumption is a two-way behavior. On the one hand, e-commerce platforms will select some consumers and market the products they want to sell to them. On the other hand, consumers have their own preferences for different platforms. Therefore, in this paper, the author randomly select some consumers and ask them to evaluate different e-commerce platforms. At the same time, the author try to help companies analyze different types of consumers, so that they can effectively market them. The interaction among consumer segments: Policy decisions rest on assumptions about the nature and type of interactions among consumer segments[Christine Moorman And Linda L. Rice 2013 [3] This means that companies must be aware of comments about different platforms, both themselves and others. According to the website features and their individual characteristics to the context of the influence of the network shopping acceptance, Zhong Xiaona claims that: On the relationship between cognitive and behavioral, useful cognition has positive influence on consumer shopping frequency, PEU have indirect effects on frequency of shopping [4]. Therefore, it is necessary to find out what factors affect consumer cognition from different perspectives.

II. QUESTIONNAIRE DESIGN

A. Respondents

In this experiment, the author randomly selected different types of respondents. There should be no limitations in the analysis of consumers on e-commerce platforms. Online shopping is not only the choice of young people, but also middle-aged and old people with higher purchasing power. According to research provided by iMedia Data Center, 58 percent of Internet users shop online multiple times a month, and more than 40 percent of this group are middle-aged users.

From 2013 to 2018, the amount of online shopping transactions in China increased from 2,679 hospitals to 5,737 billion yuan, with a compound growth rate of 84.6shopping users in China reached 782 million, accounting for 79.1Whether or not the percentage of middle-aged and older users continues to grow, with such a large population base, the survey must include as many different types of users as possible to ensure diversity and credibility of the survey. Through the research on the service industry, McDougall found that customer valueperceiving (i.e., transferred value) can promote the formation of service industry loyalty. In ecommerce mode, the valueperceiving of customers is composed of product quality, service quality, price, brand image, etc. When the valueperceiving of customers is high, they will show behavioral loyalty and attitudinal loyalty [6]. Hence, the author conducted the survey from two different perspectives. The author asked users to choose their favorite platform with specific reason among the four online shopping platforms mentioned above. There are the reasons to choose: cost performance, product quality, software design, after-sales service, and product variety. Moreover, the author hopes to classify consumers by gender and age to understand the impact of these factors on their consumption behavior. The author thinks these two factors are the most critical. Female users may be more inclined to buy daily necessities, beauty products. Male users are more likely to favor electronics products, sports products and fashion products. Middle-aged users may buy health care products and pay more attention to quality. Young users and older users may choose products with high cost-performance. Data collection: In the process of the survey, the author collected 580 results from questionnaires and sent out a total of 1,300 questionnaires. The questionnaire was collected by the WeChat mini program on the Internet.

III. OBSERVATIONS

As shown in figure 1, 249 women and 331 men participated in the survey, accounting for 43respectively. Table 2 shows that consumers' preferences for platforms are Taobao, JD, Tmall, Pinduoduo. Product quality, product variety, product quality, and cost performance are the most positive responses for each of the four platforms. JD has been received well comments in terms of product quality, cost performance and after-sales service. However, there are many problems in product variety and UI design. There are no obvious problems with Taobao other than its software design. The overall audience of Tmall is small, and it get positive responses for product quality and after-sales service. Pinduoduo has the smallest audience and is poorly evaluated in other aspects except cost performance. By analyzing figure 2 and figure 3 at the same time, all respondents can be separated into eight groups. Among eight groups, four most common audience groups of these four

platforms are respectively men aged 18-30, women aged 18-30, women aged 30-50 and men aged over 50.

3.1. JD

JD enjoys a good reputation among young male users because electronic products such as graphics cards, CPUS, mobile phones and headsets are available in JD in many styles and at low prices. At the same time, JD is also very responsible for the after-sales service of electronic products. However, the author found from the data that JD's product diversity is very low and there is basically no marketing for female customers. The proportion of women of any age group who choose JD is very low.

3.2. Taobao

As one of the largest online shopping platforms in China, Taobao is favored by the most respondents. Seventy-nine percent of the respondents who liked Taobao were women. At the same time, Taobao is marketing to users of different age groups. It can be seen that the proportion of users aged 18-30 and 30-50 are 42.9proportion of elderly users over 50 is still not low. Moreover, Taobao's cost performance, product quality, after-sales and product diversity are also excellent. In particular, the product diversity got 102 votes which is basically ten times that of other platforms.

3.3. Tmall

Sixty-eight percent of those who chose Tmall were women. Most people aged 30-50 choose Tmall. However, in addition to the quality of the products, Tmall received a relatively low number of votes in other areas. For example, only 15 positive votes were received for the price performance.

3.4. Pinduoduo

Pinduoduo is the only platform with a majority of elderly users. Sixty-eight percent of users are over 50 years old, and the majority of users are men. It only got a high number of votes for the cost performance, but the votes related to product quality and after-sales service were very low.

IV Data analysis

The average age of the subjects was 20.4 years and 63% were female. The subjectswere business undergraduates, with 27% in their first year, 40% in their second year,and 33% in their third year of study. On average, the subjects have 5.6 years ofexperience using a personal computer, and 3.4 years of

experience using the Internet. A majority of the subjects (81.3%) do not have online shopping experience at the time of the experiment. On average, the subjects made 7.36 clicks on the product listing pages during each shopping trip, indicating that the subjects were examining and comparing product information before making their purchase decision. We also collected data about the degrees to which a subject based his/her purchase decision on the prices or the brand names of the products with two 10-point Likert scale questions. There was no evidence that the subjects' choices of brands were influenced by either the prices or the brand names of the products in the experiment. Together with the fact that all other factors, including the font face, font size, and background, were kept constant across all the experimental conditions, we are confident that the results obtained in this study were due to the manipulation of the presentation mode and the information format. We performed control checks on subjects' experience with personal computers, the Internet, and online shopping. The results suggest that the random assignment of the subjects to the four experimental conditions was successful. There were no significant differences in experience with personal computers ($F(40:126;p(40:944))$), the Internet ($F(40:760;p(40:519))$), and online shopping ($F(41:552;p(40:206))$) among the four experimental groups. The correlations of these three variables with the dependent variables were also examined. There were no significant correlations, indicating that the subjects' experience with personal computers, the Internet, and online shopping did not affect the dependent variables under investigation. Hypotheses testing A MANOVA test involving all independent and dependent variables was performed. There were significant main effects for both presentation mode ($F(85:99p(414:51;p(40:000))$) and information format ($F(85:99p(43:615;p(40:005))$), while the interaction term was not significant ($F(85:99p(40:287;p(40:919))$). Therefore, we could proceed to analyse the results for each of the dependent variables, and summarize the hypotheses testing results for the main effects of presentation mode and information format respectively. The main effects of both presentation mode ($F(456:775;p(40:000))$) and information format ($F(45:555;p(40:020))$) on information search time were significant, supporting hypotheses H1a and H1b. The subjects spent significantly less time when images were available and when the product listing page was organized in the list format. Significantly better recall of images was found in the image-text presentation mode ($F(45:125;p(40:026))$), supporting hypothesis H2a. However, the image-text presentation mode did not lead to better recall of brand names than the text-only presentation mode, rejecting hypothesis H3a. Recall of both the images ($F(44:582;p(40:035))$) and the brand names ($F(47:672;p(40:007))$) were better in the list than in the array information format. Therefore, hypotheses H2b and

H3b were supported. Further analysis showed that consistent with the picture superiority effect, the overall recall of images was better than the overall recall of brand names ($t(49:750;p(40:000))$). In addition, there was no significant difference in the viewing time of the detailed product information pages across experimental conditions ($F(40:254;p(40:859))$). Hypotheses testing results on the perception measures were mixed. The image-text presentation mode was rated higher than the text-only presentation mode on both attitude towards the screen design ($F(412:451;p(40:001))$), and attitude towards using the website ($F(48:976;p(40:003))$), supporting hypotheses H4a and H5a. However, the subjects' attitude towards the screen design did not differ between the list and array information formats ($F(40:617;p(40:434))$), rejecting hypothesis H4b. Interestingly, the subjects did hold more positive attitude towards using the Hypotheses development 3.1. Independent variables We assume a two-layer hierarchy in presenting product information. The first layer is the product listing pages where a number of products are listed with general information (such as brand names and price).

Hypotheses development

The second layer is the detailed product information page, where the detailed attributes of one particular brand of product are presented. Online users can click on any of the products on the listing pages, and be directed to the detailed information page of that product. We choose this hierarchy for two reasons. First, major commercial websites adopt similar hierarchies to present multiple product information. Second, presenting all the attributes for all the products on the listing pages is likely to clutter the webpage. We then vary the presentation mode and the information format on the product listing pages. 3.1.1. Presentation mode: image-text versus text-only While product images are widely used on commercial websites to enable users to view the products, text versions of product listings can also be found on major websites to allow display of more products on a page and reduce time to download the page. Meanwhile, detailed product information, including larger product images, are normally included on the detailed product information pages to satisfy users' need to examine the characteristics of products. In this study, the image-text presentation mode refers to the design of product listing pages that contains both images and brand names; while the text-only presentation mode refers to the design that contains only brand names on the product listing pages. In both conditions, product images are still available on the detailed product information page. While both presentation modes are commonly available on

commercial websites, there is little empirical research that examines their effects on users' online shopping performance.

3.1.2. Information format: list versus array

There are two common formats to organize multiple products on a product listing page. The first format is to display only one product on each row, which we call the list information format. The second format is to display more than one product on each row, which we refer to as the array information format. Note that while the list and array information formats are widely used by major commercial websites (e.g. Yahoo and Walmart), there are a variety of other information formats available, such as iconic presentations in irregular positions and presentation of products in context. Nevertheless, the findings concerning list and array information formats will be relevant to many commercial websites.

3.2. Dependent variables

Prior research suggests that users shop online for both goal-oriented and experiential reasons (Babin et al., 1994; Hoffman and Novak, 1996). For

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3.3. Hypotheses

3.3.1. Presentation mode

The major activity that users conduct on the product listing pages is to examine and compare the products. As the detailed product information is kept on another webpage, users will need to go back and forth between a product listing page and its related detailed information pages to compare product attributes. Based on the DCT, we propose that there will be differences in terms of information search time, recall of brand names, and recall of product images between the image-text and text-only presentation modes.

First, according to the DCT, images involve parallel processing, which is faster and lighter on memory load than the sequential processing of texts. Hence, when product images are provided on the listing page, users' processing of the imagery information is likely to be

faster than their processing of the textual information of brand names. This will result in shorter information search time for the image-text presentation mode as compared to the text-only presentation mode (H1a). Second, brand names are normally nonconcrete words that are difficult to visualize. This is especially true when they are unfamiliar brand names (for familiar brand names, such as Coca-Cola, users might have already built an inner relationship between the image of the product and the brand name). Under such conditions, dual coding is more likely to occur when both brand names and product images are presented than when only the brand names are presented. Therefore, in the text-only condition, there will be limited dual coding between the brand names and the product images because the images are only available on the detailed information pages. Also, most of the comparison work will be carried out on the product listing pages, where only brand names are available, making it difficult to conduct associative processing between the images and the brand names. In the image-text condition, more dual coding is likely to occur as both images and brand names are available on the product listing pages. This will result in better recall of both product images and brand names in the image-text presentation mode. Therefore, we expect the recall of

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images (H2a) and brand names (H3a) to be higher in the image-text presentation mode than in the text-only presentation mode. H1a. Information search time will be shorter in the image-text presentation mode than in the text-only presentation mode. H2a. Recall of product images will be higher in the image-text presentation mode than in the text-only presentation mode. H3a. Recall of brand names will be higher in the image-text presentation mode than in the text-only presentation mode. According to the DCT, images can be more readily processed and encoded than texts. When users are examining the product listing pages for a potential item to purchase, product images make it easier for them to track which products they have examined previously, and subsequently reduce the number of unnecessary revisits of detailed product information pages. Also, a Web interface with images appears to be more vivid and increases the level of concreteness that is crucial to online shopping. Therefore, we expect users' attitude towards the screen design to be more positive in the image-text presentation mode than in the text-only presentation mode (H4a). Finally, as users are likely to feel more comfortable with the screen design and find it more convenient to conduct shopping when product images are present, their attitudes towards using the website are expected to be more positive in the image-text presentation mode than in the text-only presentation mode (H5a). H4a. Users' attitude

towards the screen design will be more positive in the image-text presentation mode than in the text-only presentation mode. H5a. Users' attitude towards using the website will be more positive in the image-text presentation mode than in the text-only presentation mode.

3.3.2. Information format

The task of comparing different products on the product listing pages is of a high processing proximity. According to the PCP, better performance can be expected if a high display proximity design is provided for high processing proximity tasks. A major difference between the list and the array information formats is the spatial proximity among the products. Assuming a 12 cm x 18 cm display space, the products in the list information format has an average distance of 4.67 cm between each other, while those in the array information format has an average distance of 8.45 cm (see Appendix A). Changing the screen size will not affect the relative display proximity of these two information formats. The list format consistently has a higher display proximity than the array information format. According to the PCP, a high display proximity is better at supporting high processing proximity tasks because it can save users' effort in moving their eyes.

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heads, or internal attention. For example, in the list information format, users can possibly examine two consecutive products without moving their eyes or heads; while in the array information format, users can only examine one product at a time before moving their eye fixation to another product. All these movements will cost not only effort, but also time. The time it takes to move one's eyes or head may be tiny, but when multiple comparisons among products are carried out, the time difference will be amplified. Therefore, we expect the information search time to be shorter in the list than in the array information format (H1b). Moreover, a high display proximity will reduce users' need to switch internal attention, which lowers the cognitive load. This will leave the users with more attentional resources to spend on processing the product information. Therefore, we expect the recall of both product images (H2b) and brand names (H3b) to be higher in the list than in the array information format. H1b. Information search time will be shorter in the list information format than in the array information format. H2b. Recall of product images will be higher in the list information format than in the array information format. H3b. Recall of brand names will be higher in the list information format than in the array information format. The PCP suggests that when the display proximity matches the processing proximity of the task, users can perform the task more effortlessly. Assuming that users prefer a screen design that allows them to conduct more efficient information search with less mental effort, we expect that users will prefer the screen design with the list information format to that of the array information format. Hence, users'

attitude towards the screen design will be more positive in the list information format than in the array information format (H4b). Similarly, everything else being equal, a website design that is more conducive to users' tasks will generate more positive attitude among users and increase their willingness to revisit the website. Therefore, we expect that users' attitude towards using the website will be more positive in the list than in the array information format (H5b). The hypotheses are summarized in Table 1. H4b. Users' attitude towards the screen design will be more positive in the list information format than in the array information format. H5b. Users' attitude towards using the website will be more positive in the list information format than in the array information format.

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This is consistent with the visual angle analysis. If assuming a 45–50 cm average viewing distance of users looking at a computer monitor (Cakir et al., 1980), the optimal visual angle of 5° (Tullis, 1983) will be translated into an area of 19.7–21.5 cm diameter. Therefore, according to the calculations in Appendix A, users can comfortably have two products in the optimal visual angle in the list information format, while it will be very difficult to cover more than one product in the array information format. website with the list rather than the array information format ($F(45:749;p(40:018))$).

Therefore, hypothesis H5b was supported

Research methodology

Pretest—stimulus preparation

Grocery products were chosen for the experiment as they are familiar to most people including the subjects. Moreover, similarity among the product categories favors the Latin Square design (Kirk, 1995) that we used to balance the order of shopping trips and brands presentation. The marketing literature suggests that product class knowledge, brand name, and price can influence users' information searching and shopping behavior

(Brucks, 1985; Dodds et al., 1991). Therefore, a pretest was conducted on 29 subjects to select the stimulus of the main experiment. 14 grocery product categories with 15 brands under each category were presented to the subjects. To control for product class knowledge, the subjects were asked to rate their familiarity with the 14 product categories. Six product categories that are at similar level of familiarity to the subjects were selected for the main experiment (i.e. cookies, boxed chocolate, toothpaste, facial tissue, distilled water, and orange juice). All the brand names were either fakes or based on brand names in foreign countries from where the experiment was conducted in order to remove the brand name effect. The subjects were asked whether they had heard of these brand names. Based on their responses, six brand names were

selected for each product category. After the product categories and brand names were selected, other attributes of each brand of product were created by referring to the Consumer Reports in the US and a similar type of local magazine. Price was controlled at 75% within each product category. Product images were captured on the Internet and modified by Photoshop 5.0 to replace the original brand name or logo with the fake or foreign brand names derived from the pretest.

4.2. Pilot study An online grocery shopping system, written in ASP and Java, was developed specifically for this study. It was installed on a Windows 2000 server in the same local area network as the PCs in the laboratory to ensure a consistent high network speed.

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Table 1

Summary of hypotheses

Dependent variables	Independent variables
Presentation mode	Information format
Information search time	H1a: Image-text > Text-only
H1b: List > Array	Recall of images
H2a: Image-text > Text-only	H2b: List > Array
Recall of brand names	H3a: Image-text > Text-only
H3b: List > Array	Attitude towards the screen design
H4a: Image-text > Text-only	H4b: List > Array
Attitude towards using the website	H5a: Image-text > Text-only
H5b: List > Array	W.

Hong et al. / Int. J. Human-Computer Studies 61 (2004) 481–503 489 for all subjects. All the subjects accessed the system using the same Internet browser (i.e. Internet Explorer 5.5). Twenty-four subjects (not included in the main experiment) from the same subject pool were asked to shop on the experiment website and describe what they like or dislike about the screen design through an open-ended question. The purpose of the pilot study is two-fold. First, it tested various aspects of the experiment system, including page loading speed, reliability, and whether the design of the web pages is easy to understand and follow. Feedbacks from the subjects were used to fine-tune the design of the website. Second, based on the subjects' responses to the open-ended question, we developed a three-item instrument to measure users' attitude towards the screen design. Following the guidelines by Ajzen and Fishbein (1980), the three most frequently mentioned terms in the answers were selected in constructing the items (see Appendix B).

4.3. Experiment website The presentation mode was manipulated on the product listing pages. Subjects in the image-text condition will see product images along with their brand names (see Figs. 1a and b), while subjects in the text-only condition will see the brand names only (see Figs. 1c and d). A detailed product information page, containing brand names, product images, and more attributes of a particular brand, was displayed when the subjects clicked on a brand name (see Fig. 1e). Two information formats, list and array, were used on the product listing pages. In the list format, six brands were organized in a top-down manner, with only one brand on each row (see Figs. 1a and c). In the array format, the brands were organized in blocks with three brands on each row (see Figs. 1b and d). The detailed

product information pages are the same across different presentation modes and information formats. Product information, font size, image size, and color scheme were held constant across the experimental conditions.

4.4. Experiment procedure We employed a 2 x 2 between-subject full-factorial design varying presentation mode and information format. A total of 107 business undergraduate students from a major university in Hong Kong were recruited for the experiment. Participation in the study was voluntary. As an incentive, the subjects were paid US\$13 each for their participation. Four experiment sessions were conducted in a laboratory with 60 identical Pentium III PCs connected to the Internet. The subjects were randomly assigned to each of the four experimental conditions (see Table 2). At the start of each experiment session, the subjects were informed that all the instructions were provided online and that they should read the instructions carefully and complete the experiment individually. First, subjects entered their demographic information online. Next, a cover story was provided that an international company was intending to market its products online and had developed a prototype website. The subjects were asked to shop at their own pace on the website based on their personal preference. No time constraint was given. A trial shopping trip of a product

V. MERITS AND DRAWBACKS

A. Merits

One of the merits about my research is that it covers all potential consumer types as much as possible, so the results are general. It is not enough for a company to analyze only a portion of consumers, because online shopping is not limited to a specific group of people. At the same time, this survey of the industry considered external and internal factors. The advantages of these e-commerce companies were not only investigated, but also analyzed corresponding to gender and age. The survey The authors designed had relatively fewer individual variations. This survey is not to get the respondents' reviews or experience of a specific product, their reviews of the e-commerce platform were highly correlated with the overall data obtained. For example, most consumers choose JD.com because of product quality and after-sales service, and most users of JD.com are young people. If a large number of elderly people choose JD.com, the author may consider the validity of the whole experiment, and vice versa. In fact, however, very large deviations in such a questionnaire are rare, especially in highly correlated one.

B. Drawbacks

The analysis of specific gender and age groups is more subjective. The author did not do more detailed research on the specific products such as phone or beauty products. In order to better understand what factors drive consumers to buy. The

factors are internal or external? How internal and external factors interact with each other. On the other hand, all my data are obtained based on WeChat. Some middleaged and elderly people may not use WeChat, which leads to a low proportion of elderly people in the survey. Another limitation is that there is only single choice questions for respondents to choose. It is possible that some respondents may have more than one positive response to their platform which may leading to a bias in the data. What is more, these evaluation options for the platform are selected by my subjective consideration. Respondents may have different reasons to choose their favorite platform. The conclusions about consumers might be biased.

CONCLUSION

Through the analysis of internal and external factors, female users usually choose platforms with a larger variety of products to shop. Women pay more attention to product quality than price, even regardless of age. Therefore, the company can offer different types of products to female users and pay attention to the quality of the products. Unlike women, young and middleaged men (18-50 years old) pay more attention to product quality and after-sales support. While ensuring product quality, they prefer low-priced products. Digital electronic products are one of their favorites. Older men pay more attention to cost performance and have no obvious requirements for product quality or other factors. Therefore, for male consumers, businesses should pay more attention to quality and try to make small profits but high sales. Moreover, all online shopping platforms have not been well received by consumers in terms of software design, which is also a direction of enterprise efforts. In such a fast-paced world, any stagnant company will be eliminated. Companies should analyze all user groups as much as possible to make marketing the most reasonable. This analysis of consumers is also preliminary. The author hopes that more people can classify and analyze the types of consumers in detail, so as not only to enhance the user's online shopping experience, but also to help companies better marketing.

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