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Empty the Shopping Cart? The Effect of Shopping Cart Item Sorting on Online Shopping Cart Abandonment Behavior

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Abstract: The vigorous development of e-commerce has led to online retailers or platforms increasing the capacity of online shopping carts. A large number of products are added to the online shopping cart, but they are not “emptied.” The resulting behavior of products being stuck in the shopping cart is called the “shopping cart abandonment behavior.” Previous literature has focused on the large number of antecedent variables that affect shopping cart abandonment behavior in the pre-decision stage of online shopping. This previous research has studied how to reduce shopping cart abandonment behavior from the perspective of consumers. By focusing on the post-decision-making stage of shopping, this research proposes to sort the products in a chronological order (ascending and descending order) after the products are added to the shopping cart and reduce shopping cart abandonment behavior through the intermediary of forgetfulness and choice overload. We use an exploratory study and two laboratory experiments to reveal the above intermediary mechanism. Our results show that online shopping cart abandonment generally occurs in shopping carts on all major platforms. Forgetting and shopping cart page rendering may be the reasons that lead to shopping cart abandonment behavior. In the case of targeted tasks, ascending order has a significant impact on abandonment behavior, choice overload mediated this effect.

Keywords: online shopping cart abandonment; online shopping; time order; choice overload



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1. Introduction

Consumers add a large number of products to the online shopping carts (shopping baskets) of the various e-commerce platforms, but not all of the added products are purchased. This behavior is called online shopping cart abandonment [1]. According to the survey, 75% of the added products are discarded after being added to the shopping cart [2,3]. The typical shopping cart abandonment rate for online retailers varies between 60% and 80%, with an average of 71.4% [4]. Americas has witnessed the most abandoned carts overall (72.44%), followed by APAC (71.97%), and then EMEA (67.54%). In terms of device type, mobile has been responsible for 74.09% of shopping cart abandonment, with desktop representing 65.17%, and 64.85% from tablet [4]. As more and more products are added to the shopping cart, online platforms continue to expand the capacity of the shopping cart to meet the needs of consumers. Some e-commerce platforms do not even set a product limit for the shopping cart (e.g., Amazon), and consumers continue to add goods to the shopping cart and wait or think before making a decision [5]. As a result, consumers finally give up buying the selected goods, and enterprises are forced to incur potential losses, such as advertising investment, platform recommendation fees, etc. [6,7]. In recent years, the question of how to reduce the abandonment of shopping carts has become a concern for merchants and marketing scholars alike. According to a report by FRPT Research in the United States, the abandonment of shopping carts has caused e-commerce companies to lose at least \$1 billion each year [8]. Besides, the abandonment of shopping carts has led to not only a reduction in the rate of product purchases but the

wastage of advertising expenditures. As the importance and relevance of e-commerce continue to grow, scholars must have a deeper understanding of “non-buyer behavior,” which is an important but not yet fully studied part of online consumer behavior. At the same time, to prevent the abandonment of shopping carts, e-commerce platforms spend a lot of money using Artificial Intelligence, UI design, and other methods to try to convert the abandonment rate into consumption [9]. Therefore, online shopping cart abandonment a common research focus of online consumer shopping behavior under the current e-commerce background, and it has an extremely important practical background and significance.

Enterprises continue to adopt various methods in combating online shopping cart abandonment behavior (such as issuing coupons, precise reminders, reminders to intervene in shopping cart abandonment behavior, increasing shopping cart item replacement functions, etc.). Many scholars have also researched the antecedents of online shopping cart abandonment and have determined the influencing factors of this behavior, but surprisingly, there are few empirical studies on the underlying mechanism of shopping cart abandonment [10–13]. It is even rarer to find studies on online shopping cart abandonment behavior from the perspective of online shopping cart ordering methods. In the context of the development of Artificial Intelligence, the push and sorting of e-commerce websites are based on consumer clicks and favorites. The use of Artificial Intelligence-based on deep neural network learning helps identify products suitable for consumers’ purchasing psychology for effective push [14]. However, what is surprising is that the ranking research of online shopping carts lags far behind the ranking push research in the pre-purchase decision-making stage.

Through three studies, we explored the impact of product sorting on online shopping cart abandonment behavior in the second stage of online shopping. Electronic business platforms can easily manipulate cart collation of goods—will add time in ascending or descending order, or provide consumers with their ‘sort’ button to reduce shopping cart abandonment. At the same time, we provide support for the selection of potential mechanisms for overloading and the target task with the sorting effect.

2. Literature Review

2.1. Online Shopping Cart Abandonment

When consumers shop online on e-commerce platforms, they compare and choose from a large number of products and generate a series of sequence data, such as clicks, favorites, adding products to shopping carts, and purchases. This process is called the buying cycle by the discipline of computer science [15]. There can be many items that are put into the shopping cart in this cycle, some of which are purchased, and the other unpurchased items continue to be stored in the shopping cart, which is called cart discard (abandonment) [14]. Broadly speaking, online shopping cart abandonment is also known as Internet Abandoned Cart Syndrome (ACS). It refers to consumers who put products into their online shopping carts during online shopping, but do not purchase any products or abandon the product in the shopping cart [16,17]. Understanding why consumers take time to make purchase decisions (browse and put products into online shopping carts), but abandon the products in the shopping cart is an important issue that scholars and companies are paying attention to.

Previous studies have tried to explain shopping cart abandonment in various ways, including considering the characteristics of online shopping and online shopping sites. The main influencing factors of shopping cart abandonment behavior are subjective consumer factors, shopping behavior factors, and product classification factors [7,18–20]. Past research has identified some variables that affect shopping cart abandonment behavior, such as perceived waiting time, perceived risk/privacy safety concerns, perceived transaction inconvenience, using shopping carts as a research tool, willingness to wait for lower prices, entertainment value, and lack of experience. Except for the perceived waiting time, the above variables are all positively correlated with shopping cart abandonment [11,21].

Among the motives of shopping behavior, careful consideration, offline physical inspection, and hedonic shopping value have a significant impact on the abandonment of shopping carts [22]. Product classification (high perceived importance, symbolic value, and price) has a significant impact on giving up shopping carts through three motivations (deliberate, offline inspection, and hedonic shopping value) [23]. Representative studies have researched consumers who have an abstract (rather than specific) mentality when shopping online. These consumers believe that the products in their shopping cart are important, and so they are more likely to buy these products, thereby reducing the waste of shopping carts [11]. Three perceptual conflicts, namely, attribute conflicts, interpersonal conflicts, and low self-efficacy, are the antecedents of emotional conflicts. The resulting emotional conflicts lead to hesitation and ultimately to the abandonment of the mobile shopping cart [24]. The time involvement of adding products to the shopping cart also affects the shopping cart abandonment behavior; that is, the longer the time it takes to add products to the shopping cart, the lower the possibility of purchase [25]. At the same time, compared with computer-side shopping, mobile shopping cart abandonment behavior is more due to the ambivalence, risk perception, price comparison, and other factors experienced by mobile-side consumers while shopping, which leads to hesitation at checkout and ultimately to shopping cart abandonment [26].

Strategies often used to combat the abandonment of online shopping carts include the provision of free shipping and e-coupons. According to reports, third-party escrow services, buyer feedback systems, and real-time customer support can effectively reduce buyers' perceived risk, thereby helping reduce the rate of abandoned shopping carts [27]. Also, advertising retargeting (tracking cart abandoners and pushing retargeted ads to them) and email notifications have proven effective in tackling this behavior. The latest research proposes to reduce shopping cart abandonment behavior by mainly focusing on promotion and resource scarcity to stimulate consumers to purchase shopping cart products through coupon issuance, discount reminders, and reducing the number of products [28]. However, price incentives also have some disadvantages [29]. They are costly and may indicate low quality [30]. Alternative methods use non-monetary incentives to allow companies to provide scarce information and emphasize limited supply [31]. Scarce information has no cost so that it can be used as an "attention grabber". The fear of missing out and a sense of urgency to buy prompt consumers to act immediately [32]. One disadvantage of scarce information is that it may not be as powerful as price incentives in facilitating customer purchases [33].

Although the abandonment of shopping carts has had a huge impact on the e-commerce industry, and the industry has made great efforts to curb it, the development of online shopping carts continues to model on the shopping carts (shopping baskets) in physical stores. There is a significant difference between a physical store shopping cart and an online shopping cart. The former is usually used to collect and store products for one-time checkout. The latter not only has the functions of the former, but also can be used as a tool for collecting information, comparing products, and collecting functions [23]. The main factors that affect the abandonment behavior of physical shopping carts are the excessive flow of people and feelings about the wait [34–36]. Recently, the online shopping cart had more functions, such as information collection, experience, and entertainment [16]. In other words, consumers may use their virtual shopping cart as an online multifunction tool, rather than an actual buying tool [7]. Therefore, our research focuses on the occurrence of online shopping cart abandonment when consumers use the online shopping cart as a multifunctional tool. Based on previous scholars' definitions of online shopping cart abandonment behavior, we define it as: When consumers regard the shopping cart as a multifunctional tool, they will put the goods into the shopping cart for storage, entertainment, interaction, and information comparison, and leave all or part of the goods in the shopping cart until the goods are actively deleted (consumer removed) or passively deleted (system removed or deleted). From this angle, the current research lacks the second

stage of online shopping—the consideration stage to reveal the intermediary mechanism of shopping cart abandonment behavior through mixed research methods.

At the same time, due to the development of China's e-commerce, most e-commerce platforms allow the accommodation of more products in their shopping carts, such as a single product limit of 1000, a minimum of 100 multicategory products, and a maximum of unlimited products (see Table 1). To maximize the efficiency of information collection and reduce information overload, online shoppers can use virtual shopping carts to organize their consideration sets. Shoppers compare and contrast their selection criteria in the shopping cart, focusing on those attributes that stand out in their motivations. Therefore, consumers are more willing to expand their choice set to meet their differentiated needs. A larger choice set makes it difficult for consumers to choose a satisfactory product, leading to the choice overload effect. This eventually leads to the abandonment of online shopping carts [37].

Table 1. Comparison of shopping cart functions on mainstream Chinese websites.

Network Station	Website Address	Function							
		Commodity Information	Reduced Price Goods	Tight Inventory	Move to Favorites/My Follow	Promotions/Coupons	Add Product Cap	Automatically Delete Products	Sorting/Classification
Amazon	www.amazon.cn (Accessed date: 21 May 2021)	✓			✓		No upper limit	When out of stock, it will be automatically moved to the wish list	Sort by time added to shopping cart (descending order)
Taobao	www.taobao.com (Accessed date: 21 December 2020)	✓	✓	✓	✓	✓	A maximum of 120 products can be added in the logged-in state, and a maximum of 20 products can be added in the tourist (not logged in/unregistered) state.	×	By store and joining time
JD	www.jd.com (Accessed date: 21 December 2021)	✓	✓	✓	✓	✓	The upper limit of a single product quantity is 200; the upper limit of book single product quantity is 1000	×	By store, joining time, and Commodity category (optional)
Dangdang	www.dangdang.com (Accessed date: 21 December 2021)	✓	✓	✓	✓	✓	100	×	By store and joining time
Vip	www.vip.com (Accessed date: 21 December 2021)	✓	✓	✓			15	✓	By store and joining time

Notes: According to the purpose of this research, data collection ends in June 2021.

In summary, previous studies did not consider the versatility of the shopping cart and only considered the shopping cart as a single payment channel for research. However, with the increase of shopping cart functions, online shopping carts not only have the functions of comparison, information collection, and storage of goods, but also have the functions of promotion and entertainment. Therefore, this study examines the abandonment behavior when consumers use the online shopping cart as a multifunction tool.

2.2. Sorting

Consumers' online buying decisions are divided into two stages: Browsing and considering. The consideration stage is also known as the evaluation of products and the

implementation of the purchase stage (i.e., when the goods from the shopping cart are processed to the checkout order stage). Previous literature mainly focused on the influence of commodity ordering in the consideration stage on purchasing behavior [38–40].

In the browsing stage of shopping, scholars are mainly concerned about the influence of the order of information presented on the webpage on purchase intention (see Figure 1). The information on the web page includes product image sorting information, text description information, sales sorting information, etc. This information will attract consumers' attention under different sorting rules, leading to different purchase choices. For example, Huang, J (2016) proposed that in search products, putting product pictures in the first place and model pictures in the back will increase consumers' imagination and processing, leading to higher purchase intentions [38]. Liu, L (2017) shows that the online product sales (ascending order vs. descending order) ranking will provide consumers with a "reference point" and "anchor" effect [39]. In this case, consumers will also be less sensitive to prices in the subsequent selection process, making it easier to choose a relatively higher price.

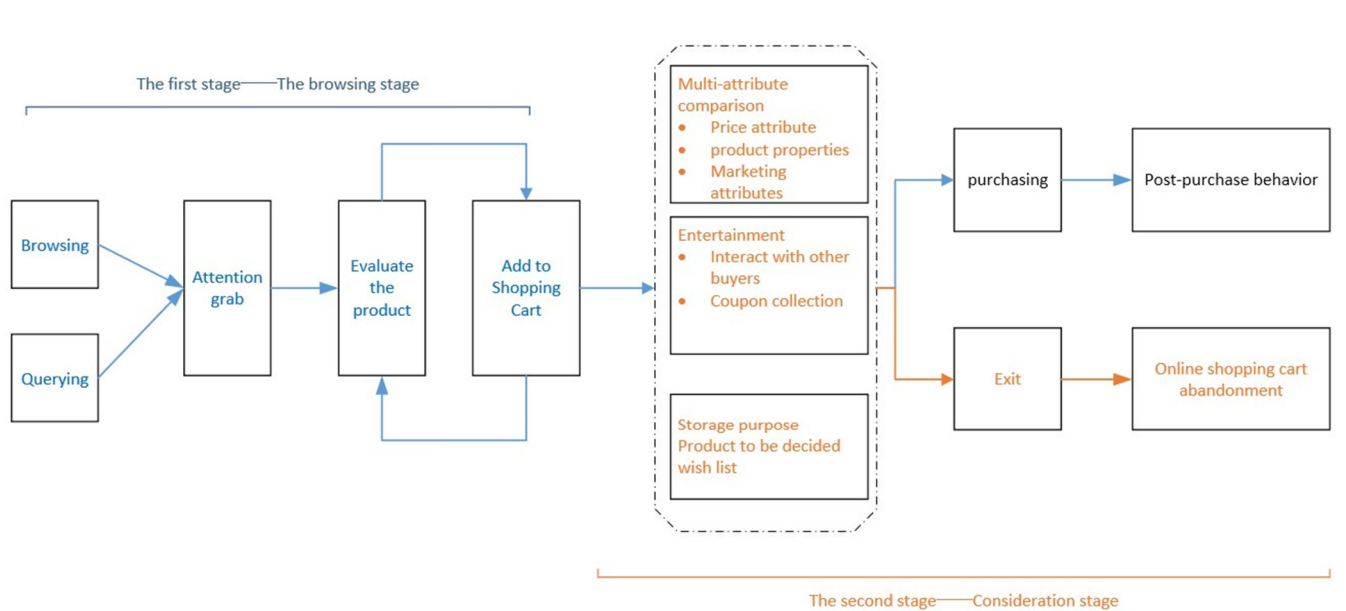


Figure 1. Online consumer buying decision process.

In the consideration stage of shopping—that is, the final selection stage after the product is added to the shopping cart, scholars are more concerned about the impact of the product's word-of-mouth information on the selection behavior. For example, Wang (2017) pointed out that the order in which consumer reviews are presented will affect product attitudes e-commerce platforms dominated by women are more suitable to present negative information first, and then present positive information, which will weaken the impact of negative information.

Even while making offline shopping decisions, the order of goods will significantly affect consumer purchase behavior. The order of display of goods can effectively reduce the difficulty of selection and improve purchase satisfaction [41]. The reason for this phenomenon may be the different attention caused by the sequence. The sequence effect refers to the phenomenon that the different sequences of a series of stimuli may affect the individual's final memory, impression formation, and decision-making judgment [42,43]. The number and order of the stimuli presented also affect the occurrence of the sequential effect. When there are too many stimuli, the individual's attention is not enough to cope with all the stimuli, which will reduce the interest in the stimuli. When the order of the stimuli is different, the primacy effect and the recency effect will occur. For example, the shopping cart products are sorted horizontally according to the list, and the products that

appear in a column are arranged in the order of product picture, price, and name from left to right. Then according to the primacy effect, the pictures that appear in the first column at the top and the leftmost will attract the most attention of consumers. The recency effect is just the opposite of the first cause-effect. The last item in the shopping cart list will attract more attention than the item in the middle [44].

Overall, product presentation and local presentation also enhance the appeal of advertising to consumers, improving cognitive fluency, which plays an important role in the intermediary mechanism.

2.3. Limited Attention Theory

Individual attention is a limited and scarce resource, especially when the individual is faced with numerous and complex choices [45]. As opposed to options that are less likely to attract individual attention, more significant features can help individuals make decisions. Effectively attracting individual attention makes decision-making easier. Conversely, when limited attention is distracted by irrelevant attributes or characteristics, the individual will feel higher confusion and pressure [25]. The research of limited attention mainly revolves around the information acquisition personality. For example, investors show abnormal buying behaviors on stocks that attract great attention, and individuals have slow responses when facing competitive information, and so forth [46–48].

Similarly, while shopping, there are target tasks and non-target tasks that affect the choice of attention. Online shopping mainly captures the fragmented time of consumers. Purposeful shopping is also called just-needed shopping. It attracts consumers' attention through search, price comparison, keyword advertising, and so forth, and consumers will complete the shopping process in a targeted manner. Specifically, in the context of targeted shopping, the information search method of a query is usually used. Users input keywords in the search box and then conduct attention filtering in the results presented on the website (see Figure 1). Compared with shopping with goals and tasks, purposeless shopping is also called leisure shopping. Consumers' needs are ambiguous and waiting to be awakened. Consumers will look forward to being awakened by novelty products, helped by the mood of browsing and adventure; at this time, the consumer's attention will be distracted and not concentrated [49,50]. The function of the shopping cart is mainly focused on the role of favorites, and the behavior of abandoning the shopping cart will be much higher than that of the target task. The products added to the shopping cart will no longer be actively searched, which will cause consumers to forget [51].

2.4. Forgetting, Choice Overload, and Psychological Ownership

It is very common to forget to buy something. For online retailers, the forgetfulness of consumers leads to the loss of sales. For consumers, forgetfulness means a missed opportunity, and they must reconsume cognitive resources to redraw purchase plans. Consumers can use memory-based search for shopping by recalling the products they plan to buy from memory and then directly searching for products. According to Ebbinghaus' forgetfulness curve, when a product is first added to the shopping cart, people's information about the added product can reach 100%, but as time goes by, if they do not open the shopping cart frequently to browse the product, people's product information will quickly drop to about 40% [52]. After consumers decide to purchase a product, they use certain strategies to search for the product they need (i.e., memory-based search and stimulus-based search), which will affect whether they will eventually buy the product. Although these two strategies (and a mixture of the two strategies) are common, most consumers do not use pure stimulus strategies [53]. Memory-based search is performed by recalling the goods they plan to buy from memory and then directly searching for the product. For example, consumers can use the search function in an online store to look for the product they have in mind. Stimulus-based search refers to systematically moving through the store, visually scanning inventory, and selecting items when they are needed. In the research of Fernandes (2016), it is found that in the online shopping context, if consumers

use the search bar to search for goods, searching out of memory will make it easier for consumers to forget the goods they infrequently buy [54]. However, if they use stimulating search, they are less likely to forget.

Choice overload refers to a negative experience of consumers when faced with a large number of options. The psychological conflict with too many options leads to confusion, anxiety, and inability to choose, ultimately avoiding the phenomenon of choice [55]. The presence of choice overload can be seen in all aspects of daily life, including in physical items (such as sauce, chocolate, etc.), as well as in virtual items (such as electronic goods, gift certificates, etc.). The measurement of the mediating effect of choice overload mainly adopts two kinds of indicators; one is the subjective feelings of consumers, and the other is the observable, objective behavior of consumers [56]. This study uses the second observable, objective behavior of consumers to measure the mediating effect of choice overload. This is done by measuring three indicators: Delaying consumer decisions or even not making decisions, changing previous decisions, and opposing big choices. Previous studies have also found that the presentation of information and product classification affect the generation of choice overload. For example, an orderly arrangement of information presentation and the classification of goods based on comparable and non-comparable attributes and complementary characteristics can adjust the effect of selection overload.

Consumers will have psychological ownership of products they have imagined, products they have not owned or have already lost [57]. Pierce, Kostova, and Dirks (2001) define it as the feeling that something is “mine” [58]. This is mainly derived from the need for a sense of belonging of psychological ownership, and individuals can have a sense of belonging to various items [59]. Psychological ownership is different from ownership and does not require legal or formal ownership. In other words, the psychological ownership of an item does not need to own the item—even if it is included in one’s exclusive domain, psychological ownership will be aroused [60]. Another situation is that when an individual exercises more control over an object, the sense of ownership of the object will increase [61]. We believe that the shopping cart is a relatively private space, and consumers will most likely think it is personal territory. At the same time, people have invested energy, time, and attention in the context of online shopping [62], adding products to the shopping cart, creating a connection between the product and the self [63], which may arouse psychological ownership of consumers [7].

3. Hypothesis

In an invisible Internet environment, the physical characteristics of the product are missing, so external clues become important (Mathews, 2006). The presentation and display of offline merchandise affect shopping behavior. Merchandise display mainly refers to placing products in a certain order in a specific location to attract consumers’ attention. Optimized presentation and display can reduce consumers’ decision-making difficulty and increase their willingness to buy. Designers of online shopping carts have evolved from offline stores. The original intention of the design is to reduce shopping complexity and make it easier for consumers to place a large number of orders. Based on this, it is inferred that the order of items in online shopping carts will affect online shopping cart abandonment behavior.

Current mainstream e-commerce platforms adopt a list arrangement mode for shopping cart products (no matter on mobile or computer); that is, the pictures, names, and prices of the products are arranged horizontally, and the purchase buttons are set on the left side of the products. The sorting of the research default shopping cart follows the list mode, and only the sort order is different. The display position of the product has a significant impact on purchase intention [64]. Controlling the size of the product portfolio and the different clusters in the shopping cart will also affect purchase intention [65]. The time involved in the purchase process also has an impact on consumers’ shopping cart purchase behavior [25]. Time will cause the items that have been stored in the shopping cart to have a forgetfulness effect. Generally, when you open the shopping cart, the products are sorted

by time. The first added product will appear at the top, and the previously added product will be forced to move down. Moving down means that consumers' attention will decrease. Consumers may forget the existence of goods after the continuous decrease, which will cause a lot of goods to accumulate in the shopping cart and increase the number of goods in the shopping cart.

H1: *Items sorted by the time of addition will influence purchase intention.*

H1a: *Descending (last item added at the top) will result in fewer purchases.*

H1b: *Ascending (last item added at the end) will result in more purchases.*

Under the impact of massive information and choices, consumers suffer from negative emotional experiences, such as dissatisfaction, anxiety, and postponement of their purchase decision. This situation is called the choice overload effect. The increase in the number of product portfolio options has caused the selection overload effect. As the product portfolio options or attributes increase significantly, consumers feel overwhelmed by the options before them, generating the choice overload effect [65]. With the increase in the capacity of online shopping carts, consumers can place hundreds of products in the shopping cart. Thus, they face a large number of product sets, which leads to increased decision-making difficulties, which leads to hesitating behavior in the post-decision-making stage, and which ultimately leads to abandoning the shopping cart. When the number of promotional items is small (compared to the overall shopping cart products), individuals spend less effort in making cognitive judgments, reducing the selection overload effect and consequently the shopping cart abandonment behavior.

H2a : *Forgetting is the explanation mechanism of shopping cart item sorting to online shopping cart abandonment behavior.*

H2b : *Choice overloading is the explanation mechanism of shopping cart item sorting to online shopping cart abandonment behavior.*

Most online shopping carts do not set a time limit; that is, as long as the products added to the shopping cart are not actively deleted or removed by consumers, they will be stored in the shopping cart for a long time. Studies have pointed out that in the absence of a time setting, the large number of product sets and long decision-making time will increase the likelihood that consumers will not make a choice.

When the functions of shopping carts become more diversified, the purpose of consumers adding products to the shopping cart becomes complex and diverse. Products can be compared horizontally in the shopping cart and can also be used as an information collection tool (similar to a favorite). The cart can also be used as a tool for waiting for price reduction promotions. After a large number of products are added to the shopping cart for various purposes, the size of the electronic device screen causes consumers to compare and choose between different products. Too many choices will cause consumers to overload their choices. The choice overload effect will cause consumers to think of abandoning their shopping carts, and in extreme cases, they may even choose to abandon the purchase.

H3 : *Shopping cart opening frequency will adjust the effect of sorting on online shopping cart abandonment behavior; that is, the higher the shopping cart opening frequency, the lesser the shopping abandonment behavior.*

The frequency of shopping cart openings may be able to adjust the effect of sorting, forgetfulness, and selection overload. Since retailers require shoppers to put goods into the shopping cart to complete the final purchase, the higher the frequency of using the shopping cart, the higher the frequency of purchases. At the same time, the longer the time of putting the goods in the shopping cart, the more the shopping cart is abandoned. That is, when consumers frequently open the shopping cart, the exposure time of the goods in the shopping cart is virtually increased. The more exposed, the more likely it is to attract the attention of consumers and reduce the possibility of forgetting. According to

the existing shopping cart sorting rules, only the newly added shopping cart items have more chances of being noticed. Since the products that were added in the past were all sorted down to the next page in order, consumers are required to browse through them consciously and purposefully to be noticed. Therefore, the sorting of the products in the shopping cart will increase the exposure opportunities of the sinking products, increase the purchase probability, and reduce the waste behavior of the shopping cart. Based on the above literature review and hypothesis, the research framework proposes a dual mediation path model for shopping cart abandonment behavior (See Figure 2).

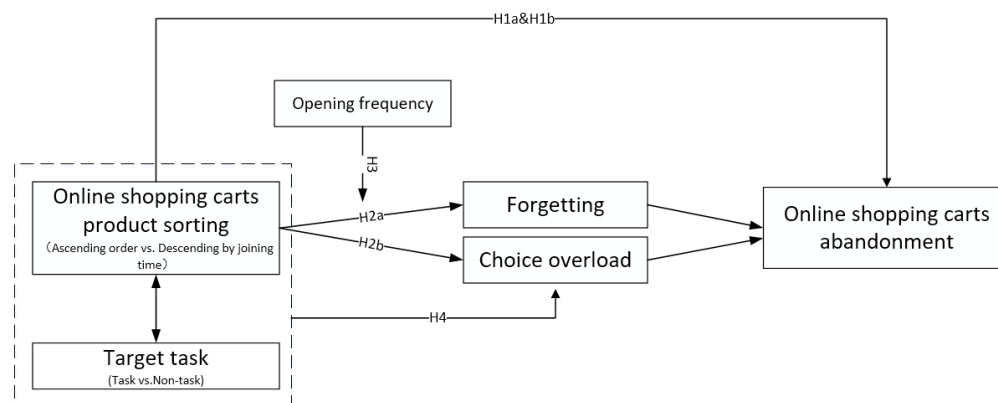


Figure 2. Research framework.

Under the influence of limited attention, every consumer is a cognitive miser. Compared with the shopping situation without a goal task, the shopping situation with a goal makes consumers more inclined to use the form of keyword search to quickly locate the desired product during the shopping consideration stage. At this time, the shopping cart function is more inclined to be used to compare product information and collect promotional coupons. Once enough products are added to the shopping cart, the consumer will jump directly to the shopping cart page—at this time, it enters the second stage of online shopping consideration. In the consideration stage, consumers will choose to buy or withdraw. At this point, if consumers exit the shopping cart page without purchasing any items, according to our previous definition of online shopping cart abandonment behavior, it is a shopping cart abandonment behavior. On the other hand, untargeted shoppers are more like shopping in offline stores. At this time, their attention is often more distracted, and they are more likely to be stimulated by front-end advertisements and add disorderly and uncategorized products to their shopping carts. Although some large websites will intelligently push similar or related products based on the products added to the shopping cart, the purchase needs of consumers are not clear at this time. We believe that in this scenario, shopping cart abandonment is more likely to occur. Therefore, based on the above discussion, we propose H4:

H4 : *Compared with non-task shoppers, shoppers with target tasks are more suitable to adopt ascending order to reduce cart abandonment behavior by choice overload.*

4. Research Methodology and Data Analysis Results

In summary, we conducted two studies that investigate the impact of time sorting on online shopping cart abandonment. Through an exploratory study, we found the universality of abandonment behavior—that is, it is universal in typical e-commerce platforms, and there is no difference in gender. Through data analysis, it is found that the intermediary mechanism may be forgetful and shopping cart page rendering. Then, through laboratory experiments, the mediation mechanism of selecting overload was verified, and the alternative explanation of forgetfulness and psychological ownership was eliminated (see Table 2).

Table 2. Research summary.

	Research Purposes	Methodology	Research Design
Study 1	Verify whether sorting affects online shopping cart abandonment behavior (H1)	Exploratory study	Online interview (Tencent Conference)
Study 2	Verify the mediating role of choice overload and forgetfulness (H2a and H2b) Verify the adjustment of the opening frequency (H3)	Between-group experiment	2 (Sorted ascendingly vs. sort descendingly) \times 1 (shopping cart abandon) (Laboratory recruitment for field experiments)
Study 3	Repeatedly verify the main effect to increase the external validity of the data (H4)	Between-group experiment	2 (Sorted ascendingly vs. sort descendingly) \times 2 (target vs. non-target)

4.1. Study 1

4.1.1. Materials and Methods

The purpose of Study 1 is to answer: Is the online shopping cart abandonment behavior happened in our daily lives every day? Why are these products not being purchased? Since it is uncertain whether the ordering of shopping cart products can affect shopping cart abandonment behavior, Study 1 uses interview data to understand whether ordering affects online shopping cart behavior. Since the interview is an unstructured text, to ensure the integrity of the data, the following measures are adopted: (1) Mainstream e-commerce platforms are determined as the specific targets of the interview. According to the frequency of use and the number of online shopping carts, Taobao, JD.com, and Amazon are selected as representatives of the e-commerce platform. (2) The interview sample is determined, and the sample size is screened according to the principle of accessible samples. Since this research mainly focuses on online shopping cart abandonment behavior, it directly excludes people without stranded goods in the shopping cart; that is, it directly selects interview samples from the population with stranded goods and shopping cart abandonment behavior. (3) The interview data is formally collected. We made sure that each interviewee accepts the questioning without understanding the purpose of the research. The location of the questioning is online, and the interview time is 5–10 min per person.

4.1.2. Results

Through paid recruitment, 43 interviewees were recruited by snowballing. Subjects were required to have an online shopping experience and were not limited to gender and age. A total of 43 people were interviewed, of which five people left the interview midway, due to personal reasons and were deleted from the sample. Thus, the overall interview sample was 38 people. The sample sources involved a total of 12 provinces, with ages ranging from 18 to 60 years old, of which males accounted for 31.5%, and females accounted for 68.5%. Considering that women have higher shopping preferences and shopping frequency than men, the distribution ratio is in line with the needs of interview samples.

Chi-square data shows that there is no difference between men and women in shopping cart abandonment behavior ($\chi^2 = 2.25$, $p = 0.136 > 0.05$). Because the previous literature on male shoppers is more about men's tendency to "instrumental" shopping behavior, or "pure purchase-driven activities related to demand satisfaction" [66]. The stereotype for male shopping is mainly "Grab and Go" shopping, which means that, unlike women, men do not turn shopping into a social and/or entertainment experience as observed among women [67]. This is quite a surprising conclusion, showing that women and men have left goods in the shopping cart. Only one man said he did not have any products in his shopping cart in the interview.

During the interview, participants were asked to provide the number of shopping cart products on the three platforms in real-time (see Table 3). Taobao has the largest number of shopping cart products, and the number of shopping cart products is up to 241 (sample 9), which may be due to the reason that Taobao is the largest e-commerce platform in China. Compared with Taobao, JD.com and Amazon have significantly reduced numbers. JD.com has a maximum of 91 (sample 4), and Amazon has a maximum of 13 (sample 19).

Table 3. Statistics of abandoned items in online shopping carts of the three major online shopping platforms.

Platform	Number of Items in the Shopping Cart				
	Min	Max	Mean	SD	Variance
Taobao	0	241	30.18	43.717	1911.181
JD	0	91	9.29	20.242	409.725
Amazon	0	32	1.42	5.568	31.007

When asked why the product was put in the shopping cart and not purchased, 58% of the participants said that it was because of price factors, such as “compared to other platforms or other stores, the price is not needed yet,” “entanglement, etc.,” and “the price of shoes will be cheaper.” This is consistent with previous studies on the factors affecting shopping cart abandonment behavior [20], but it is worth noting that 20% of the participants mentioned forgetfulness as the reason for abandoning the shopping cart. Responses included “forgot to buy it or do not need it”; “when you have no goals, you will go to Taobao. If you see a bright spot, it will be included in the shopping cart, but it is not suitable for you. After adding it, you forget to delete the shopping cart”; “buy when you have a goal; a lot of styles will be added. Finally, choose one to buy, and the others will be ignored”; “I saw that I liked it at the time, but there was no substantial demand, so I put it in the shopping cart. After a long time, I forgot to clear it.”

The subjects, when asked which of the new sorting rules should the shopping cart products adopt, proposed the three most popular sorting rules, namely, “Sort by Promotion,” “Sort by Views,” and “Sort by Category.” The interviewees were further asked why such sorting would increase (or decrease) the possibility of them buying items stuck in the shopping cart—that is, the behavior of discarding the shopping cart caused by forgetfulness. Some interviewees mentioned that the sorting and presentation of shopping cart products cause mobile phones or other electronic devices to constantly browse the shopping cart products, resulting in too many choices to make a decision. This also clarifies the antecedents for the second explanation mechanism of this article. It is further in line with the mediation effect we proposed.

Qualitative interviews show that consumers use shopping carts as a multifunctional storage room, they added products that they are interested in and may be purchased into the shopping cart. However, not all products are put into the shopping cart and will eventually be purchased. Many products are forgotten in the shopping cart. On the one hand, shoppers’ attention is consumed by the stimulus of rapidly increasing new products. On the other hand, due to the sorting rules of existing shopping carts, the newly added products are always placed at the top of the shopping cart, thus burying other merchandise. If there is no new stimulus, it is difficult for consumers to actively remember the types and quantities of goods in their shopping carts, unless the shopping cart warns that “The shopping cart is full, please clear it in time” or the price of the shopping cart changes. At the same time, the qualitative interview also mentioned another interesting phenomenon. Due to different browsing devices, the number of items presented on the shopping cart page is inconsistent. On the computer, IPAD, and mobile phones, due to the different screen sizes, the number of items in the shopping cart within the page is different. Nowadays, consumers are called “consumers in the fast-food age”. They are more inclined to use

mobile phones for shopping. The fragmented time makes them impatient to search and browse the products in their shopping carts. They often only go back to the checkout page after a simple comparison of products. This also means that once the entire shopping process is disrupted, it is difficult to reshape the interrupted shopping process.

4.2. Study 2

The purpose of Study 2 is to further verify the main effect (that is, the shopping cart product sorting rules will affect the level of shopping cart abandonment behavior), while revealing the intermediary mechanism of sorting on the shopping cart abandonment behavior.

4.2.1. Materials and Methods

In the first stage, 120 subjects were recruited in two phases. Participants were asked to browse the website of an online retailer for 30 min. To eliminate the influence of experience on the subjects, a non-mainstream shopping website was chosen for this study. Moreover, to eliminate the influence of product categories on shopping willingness, a single product website was selected. A non-mainstream online book shopping website was chosen for the experiment to ensure the diversity of products and meet the needs of the subjects. To facilitate the development of the experiment, each participant was provided with a dedicated account and password. The subjects can log in to the website through the account password for browsing; then, the researchers can log in to the account number, and then change the order of the shopping cart after the screenshot of the shopping cart items is taken. To imitate a common online shopping experience, participants were told that they could view products in any category, and they could view any number of products. At the same time, participants were asked to put their favorite products into the shopping cart. To imitate the actual purchase process of consumers as much as possible and facilitate the development of experiments, participants were asked to add 20 kinds of products they would consider buying for themselves in the shopping cart. The participants were also asked to check the products they most want to buy and send screenshots of the products to the researchers.

Then, the subjects were asked to recall the products they added to the shopping cart after closing the webpage. Evaluate the degree of forgetfulness based on the number of forgotten goods (10 levels of forgetfulness; 0% indicates completely forgotten, and 100% indicates not forgotten), and a record was made. Participants were then asked to answer the shopping cart abandonment scale and online shopping cart situation (see Table 4). The subjects were also asked to evaluate whether the selection overload control test of the selection set was successful and asked how they evaluated the number of products (1 means too few choices, and 7 means too many choices).

Participants were told at this time that in the next 24 h, they could log in to the website to view the products in the shopping cart, but they could not add new products or place an order for purchase. They were asked to self-report the number of times they opened the shopping cart within 24 h. At this stage, the first phase is complete.

The second phase of the experiment began after 24 h. The subjects were asked to return to the laboratory again. At this time, the subjects were randomly divided into two groups. The shopping carts of one group were sorted in the ascending order of time (that is, the last added product was displayed at the top), and the other group's shopping carts were sorted in the descending order of time (that is, the last added product was displayed at the end). Both groups of the subjects were shown a screenshot of a shopping cart. The only difference between the two screenshots was the difference in the chronological order of the items in the shopping cart. For the control group, the pictures were the original pictures that had not been edited by Photoshop. For the control group, the shopping cart products were reordered by software. At the same time, the subjects were asked to fill in the perceptual questions about the shopping cart sorting rules and tick the goods they want to buy.

For the measurement of the dependent variable, the degree of abandonment of the shopping cart is measured by the number of items purchased in the shopping cart, and the difference between the items to be purchased in the shopping cart before the sorting and the items in the shopping cart after the sorting is compared to obtain the data of the dependent variable.

Table 4. Variable measurement table.

	Variable	Measurement	Cronbach's α
Sondhi (2017) Hughes (2019)	Online shopping cart abandon	I tend to leave things in my online shopping cart instead of buying them. I often close the shopping cart webpage or application before purchasing an item. When I buy goods in the shopping cart, I often hesitate. I will put an item in the shopping cart, but I will not buy it at the same time.	0.611
Chernev et al., 2015	Choice overload	The number of items in the shopping cart prevents me from making a choice. I want to compare more products before making a decision. I tend to decide which products to buy later. When I add items to the shopping cart, I feel that these items are mine.	0.584
Van Dyne and Pierce (2004) Yeung (2012)	Psychological ownership	I feel that the items in the shopping cart are what I want. I think these products belong to me. I feel connected with these products. I have a strong sense of intimacy with these products. It is difficult for me to imagine that the goods placed in the shopping cart are mine (reverse).	0.748
This research	Forget	The difference between the two memory product quantities.	

This research also excludes the explanation of psychological ownership. Adding a product to the shopping cart will cause consumers to have psychological ownership of the product. That is, when the consumers put a product in the shopping cart, they think that the product already belongs to them, even if the purchase has not been completed. It not only leads to the production of psychological ownership, but weakens the purchase incentive and reduces the probability of the final purchase behavior. Psychological ownership refers to a strong sense of belonging and possession that an individual feels without any formal ownership. The individual feels that the target or part of the target belongs to them [68]. Ownership will cause individuals to evaluate things more positively because it is manifested in a certain perceptual relationship between the individual and the object (that is, there is a psychological connection between the self and the object). The measurement of psychological ownership is adapted from the scales of Van Dyne and Pierce (2004) [69].

The control results of selecting overload show that 90.9% of the subjects considered more choices, indicating that manipulating the number of experimental commodities was successful ($M = 4.92$, $SD = 1.369$). Regarding the use of the online shopping cart according to the changes in the order of time, responses included, "I think the ordering rules of the shopping cart products have changed"; "The ordering of the shopping cart products is different from what I remember"; "The ordering of the shopping cart products has not changed" (reverse) (Likert 7-point scale; 1 means strongly disagree, and 7 means strongly agree, Cronbach's $\alpha = 0.915$). The independent sample t-test results show that manipulating the experimental group and the control group is successful, and the difference in the ascending order of time and the descending order of time on the purchased quantity is significant ($M_{\text{control group}} = 3.45$, $SD = 1.61$; $M_{\text{experimental group}} = 4.66$, $SD = 1.85$, $t = -3.616$, $df = 104.01$, $p = 0.000$). Since the experiment used a relatively unpopular book purchase website, to eliminate the influence of website use, three questions were answered: "I am familiar with the experimental website"; "the experimental website is easy to use"; "there is no difference in the experience of the experimental website and other online shopping

websites" (Likert 7-point scale; 1 denotes strongly disagree, and 7 denotes strongly agree, Cronbach's $\alpha = 0.647$). The results show that there is no difference in the use of websites between the two groups ($M_{\text{control group}} = 4.20$, $SD = 1.18$; $M_{\text{experimental group}} = 4.15$, $SD = 1.23$, $t = 0.239$, $df = 105.85$, $p = 0.812$). To measure the changes in discarding behavior, the experiment used two methods to measure the dependent variables. One is the difference in discarding behavior measured by the scale, and the other is to use the difference between the two purchase intentions. Gender, monthly shopping frequency, and average shopping cost were added to the model for analysis as covariates.

Study 2 adopted a between-subject experimental design (ascending order versus descending order * abandonment behavior), and 110 undergraduate students ($M_{\text{age}} = 20.3$ years old) were recruited from a Chinese university. The experiment needed the participants to return to the laboratory within 24 h. However, 2 participants did not return to participate in the follow-up experiment as scheduled. Thus, they were excluded from the sample. The sample of women (51.9%) participating in the experiment is slightly more than the sample of men (48.1%). As the post-1990s and post-2000s were born in the web 2.0 era, the participants' average daily online usage duration is more than 4 h, and the proportion of those whose usage is less than 10 h is as high as 84.6% ($M_{\text{average online time}} = 2.27$ h). The monthly disposable income of the student group is relatively small, and most students spend less than 500 yuan on online shopping each month, accounting for 79.6% of the total (see Table 5).

Table 5. Descriptive analysis of the sample.

Variable	Category	N	%	Variable	Category	N	%
Gender	Male	52	48.1	Online shopping frequency	0~5 times /month	70	64.8
	Female	56	51.9		6~10 times /month	21	19.4
	18	13	12		11~15 times /month	8	7.4
Age	19	49	44.4		16 times and above /month	9	8.4
	20	38	34.3	Online time	3 h/day	18	16.7
	21	10	9.3		4~6 h/day	47	48.5
Online shopping expenses	Below 500 yuan	86	79.6		7~10 h/day	39	36.1
	Above 501 yuan	22	20.4		11 h or more/day	4	3.7

4.2.2. Results

Main effect test: The default order of all current e-commerce platforms regarding shopping cart products is sorted in descending order of the time of addition—that is, the last added product is ranked at the top. Therefore, the control group in descending order is coded as 0, and the experimental group in ascending order is coded as 1. Independent sample t-test analysis of the comparison between the control group and the experimental group for purchase intention showed uneven variances; $t = -8.779$, $df = 105.36$, $p = 0.000$, $CI [-15.64207, -9.87645]$. Here, the difference between the two purchase intention commodities is used as the dependent variable analysis. For example, for the first time a participant is asked how many products you want to buy, they answer 10, and 24 h later, after we control the sorting, and then ask them the number of purchases, they answer 3. At this time, the purchase difference is -7 . It showed that after manipulating the shopping cart sorting, the purchase difference was significantly increased ($M_{\text{control group}} = -7.56$, $SD = 8.23$; $M_{\text{experimental group}} = 5.20$, $SD = 6.80$). The main effect of H1 has been verified. Table 6 shows the correlation matrix and descriptive statistics between all variables—the results show that there is no multicollinearity among all the variables. There is a significant positive correlation between choice overload and shopping cart abandonment, which indicates that the more serious the choice overload is, the more likely the abandonment is. There is a significant negative correlation between abandonment behavior and willingness to buy, which indicates that the more serious abandonment behavior is, the smaller the difference is. In other words, once abandonment occurs, it is not easy to generate additional purchase

intention, and the number of consumers' purchase intention decreases with the occurrence of abandonment. In addition, there is no significant correlation between psychological ownership, forgetfulness, and shopping frequency.

Table 6. Descriptive statistics and variable correlation.

Variable	M	SD	Min	Max	1	2	3	4	5	6
Choice overload	4.53	0.83	2.50	6.00	1					
Forget	−0.29	2.51	−8.00	6.00	0.144	1				
Psychological ownership	4.09	0.99	1.50	6.50	−0.007	−0.009	1			
Frequency	1.25	3.46	0.00	30.00	0.083	−0.023	−0.009	1		
Abandonment	4.24	1.10	2.00	6.25	0.471 **	−0.011	0.120	0.000	1	
Purchase difference	38.82	9.88	0.00	64.00	0.112	0.024	−0.084	0.065	−0.377 **	1

Note: $N = 108$, ** $p < 0.05$. Purchase difference refers to the difference between two purchases before and after. Frequency refers to how often the shopping cart is opened within 24 h. Forgetting refers to the extent to which subjects forget the items in the shopping cart after 24 h.

Mediation effect test: This test used model 4 in process version 3.4 to test the mediation effect of the model [70], shopping cart item sorting (time ascending order and time descending order) as independent variables, and open shopping cart frequency and shopping cart quantity. Cognition is used as a control variable, and differences before and after purchase are used as dependent variables. Under the 90% confidence interval, the results show that choice overload mediates the influence of time sorting on shopping cart abandonment behavior (LLCI = −1.77, ULCI = −0.01), which is marginally significant supports H2b (based on 1000 bootstrap samples, 90% confidence interval, see Table 7). It should be noted that the mediating effect is not established under the 95% confidence interval.

Table 7. Regression Analysis.

Variables	Model 1 (DV:AB)				Model 2 (DV:CO)				Model 3 (DV:AB)			
	B	SE	t	Boot 95%CI	B	SE	t	Boot 90%CI	B	SE	t	Boot 90%CI
constant	−17.74	3.78	13.64	[−25.61, −19.77]	6.54	0.38	17.05 ***	[5.82, 7.29]	−17.20	4.33	−3.96 ***	[−25.61, −19.77]
frequency	0.08	0.11	0.69	[−0.14, 0.30]	−0.12	0.16	−0.77	[−0.47, 0.19]	−0.66	0.95	−0.69	[−2.19, 0.76]
Number of items in the shopping cart	−0.73	0.57	0.69	[−0.15, 0.31]	0.47	0.04	11.15 ***	[−0.12, 0.03]	0.31	0.29	1.08	[−0.19, 0.84]
Group	14.63	1.07	13.64 ***	[12.49, 16.75]	−1.24	0.14	−9.04 ***	[−1.46, −1.01]	14.20	1.06	13.39 ***	[−1.46, −1.01]
Choice Overload									−0.87	0.56	−1.53 **	[−1.77, −0.01]
R ²			0.798				0.677				0.887	
F(df)			3.24 (1106)				27.80 (3104)				94.76 (4103)	

Note: ** $p < 0.01$, *** $p < 0.001$. 'AB' is abandon behavior, 'CO' is choice overload. 90% confidence interval.

The experiment also tested the mediation effect of forgetfulness and psychological ownership, which is rejected H2a. Through the independent sample t-test, it was determined that there was no significant difference in the degree of forgetfulness ($M_{\text{control group}} = -0.07$, $SD = 2.34$; $M_{\text{experimental group}} = -0.50$, $SD = 2.66$, $p = 0.380$) and psychological ownership ($M_{\text{control group}} = 4.07$, $SD = 0.83$; $M_{\text{experiment group}} = 4.01$, $SD = 1.13$, $p = 0.872$) between the two groups.

The adjustment effect of the opening frequency (H3) has not been verified (see Figure 3). It is inferred that the opening frequency is too low, with an average of 1.25 times per person; hence, it does not fit the actual online purchase situation. Moreover, the products on the experimental website are all books; thus, purchase intensity may be low, resulting in insignificant adjustment effects.

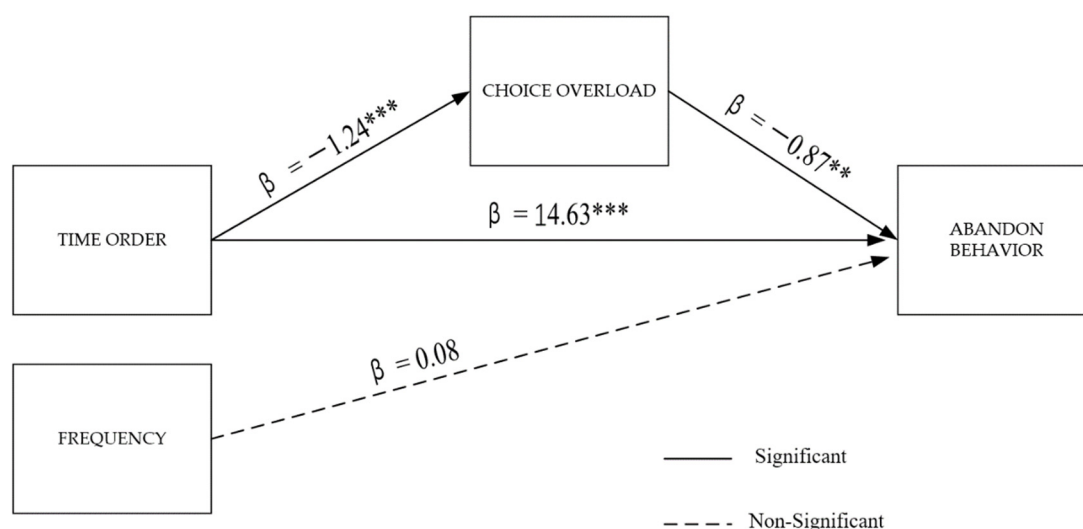


Figure 3. Model statistical diagram. $** p < 0.01$, $*** p < 0.001$.

Some studies believe that forgetfulness is one of the main factors that cause shopping cart abandonment [54,71]. In this experiment, the time for subjects to return to the laboratory is only 24 h, and most subjects open the shopping cart very rarely during this period. Therefore, inferring from the Ebbinghaus forgetfulness curve, most of the products are still in the middle of the forgetfulness curve; that is, they are still in the middle of the memory retention rate. According to the normal frequency of using an online shopping cart, forgetfulness may be more likely to increase over time. Once consumers add a product to the shopping cart, they will psychologically think that the product belongs to them. However, the data shows that products added to the online shopping cart do not have the same high psychological ownership as those added to the offline shopping cart.

The experimental results of Study 2 verified the mediating effect of choice overload, but did not support the explanatory mechanism of forgetfulness and psychological ownership. We believe that this may be due to a problem with the experiment setting. The experiment set was recalled after 24 h, and most of the subjects might not forget the product of their choice (if they were asked to recall it deliberately). In addition, although products in offline shopping carts (shopping baskets) are generally not abandoned, it is because the functions of offline shopping carts are relatively single, unlike online shopping carts that have the functions of comparison, storage, and even entertainment interaction. Therefore, we infer that the insignificant psychological ownership of products added to the online shopping cart may be because people do not think that “being added” is equivalent to “being mine.”

4.3. Study 3

4.3.1. Materials and Methods

The purpose of Study 3 is to verify the main effect (H1), the mediation effect (H2a and H2b), and to verify the moderating effect of the shopping cart abandonment behavior (H3b) under the shopping situation with and without target tasks. The results based on the small sample size of the previous Study 2 and experimental manipulation are not very robust. Study 3 uses contextual arousal 2 (sorted ascendingly and descendingly) by 2 (target shopping and non-target shopping) mixed design to experiment.

First of all, to simulate the real buying situation, we asked the participants to recall a targeted shopping process and describe it in detail in the text before starting. Then the participants answered the question on the forgetfulness scale, followed by the introduction of the textual context. The only difference between the text of the target group and the non-target group is the description of the shopping goal. For example, the text in the target group is: Today, you remembered to buy chocolates online. Then you opened the

application that you often use to buy chocolate. Opening the homepage, entering keywords in the search box, and after some comparison, you have selected 30 products that you are interested in and added them to your shopping cart. The untargeted group is: Today, as usual, you accidentally opened the shopping webpage (or mobile phone application). After entering the homepage, you are attracted by the products that appear on the homepage. After browsing, you choose 30 products that you are interested in and added them to the shopping cart. 30 products are our manipulation of choice overload. According to the control of the number of products by Brucks, M (1985) and Lin Rang (2020), compared with 6 products, 30 products are more likely to stimulate consumers' choice overload effect [72,73]. Regarding the choice of overload measurement, the same scale as Study 2 was used.

Since we cannot fully simulate the real shopping situation, we choose to use pictures and text (ascending and descending order). Like Study 2, the descending order of adding time refers to the first added product is at the end of the shopping cart. At the last item in the shopping cart list, which is the same as the default sorting rules of most online shopping platforms, we will set it as the control group in descending order of time. In contrast, the ascending sorting rule according to the time of adding is that the last item added to the shopping cart appears in the last item list of the shopping cart. To prevent consumers from being unfamiliar with the rules and reading the text carelessly, we used a screenshot of the shopping cart page of the real platform to hide the price, brand, store name, and using eye-catching text to mark the order of adding time in the picture. To verify the effectiveness of the test control, we used the same control test problem as Study 2. Different from Study 2, we use purchase intention as the dependent variable measurement and past abandonment behavior as the control variable measurement. This is because, in this experiment, we cannot actually measure the degree of rejection of the participants, and can only be measured by the four items of purchase intention. Of course, purchase intention significantly influences consumers' abandonment behavior.

Finally, the participants were asked to fill in a scale of abandonment behavior, purchase intention, and demographic questions.

Due to epidemic control reasons, the field experiment was not approved by the university. Therefore, we adopted the form of online organization, relying on China's largest questionnaire survey website Wenjuanxing (www.wjx.cn), to enter the questionnaire.

A total of 347 Chinese residents were requested on wenjuanxing for the experiment in exchange for a small amounts of monetary reward. Our exclusion criteria were: (1) Incomplete responses, which means participants who did not finish all the questions we asked; (2) participants who failed attention check questions; (3) extreme outliers, which means participants give all the questions the same answers. Follow these rules, we finally have 262 usable responses ($M_{age} = 34.55$, $SD = 12.5$, 49.6% female).

Demographic data shows that the average monthly income of 54 cities from 20 provinces is randomly assigned to 4 groups ranging from 4000 yuan to 6000 yuan ($N_{group1} = 65$, $N_{group2} = 67$, $N_{group3} = 66$, $N_{group4} = 64$).

The experiment uses chocolate as the target stimulus. According to the recommendations of Iyengar and Lepper (2000) and Scheibehenne, Greifeneder, and Todd (2010), the preference and familiarity of the stimulus need to be controlled [74,75]. Therefore, we asked the subjects in the experiment: My understanding of chocolate products. (Likert 7 points, 1 for very unfamiliar, 7 for very familiar) How much do I like chocolate? (1 for does not like it at all, 7 for likes it very much). How often do I buy chocolate? (1 for extremely low, 7 for extremely high).

Manipulation showed that there was no significant difference in preference for chocolate between groups. There are significant differences in the cognition of ranking rules between the ascending group and descending group.

4.3.2. Results

Main effect test: First, we tested whether the sorting rules will affect purchase intentions. The independent sample t-test showed that the buying intention of the ascending group was significantly higher than that of the descending group ($M_{\text{ascending}} = 5.64$, $M_{\text{descending}} = 4.98$, $F = 72.04$, $p < 0.001$, $\eta^2 = 0.121$), which support H1a and H1b. Then, we examined whether the categorical tasks affected the online shopping cart behavior and the intent of purchase. The same conclusion also appears when the independent variable is the target task, compared with the target task, the purchase intention of the non-target task is stronger ($M_{\text{target}} = 4.86$, $M_{\text{non-target}} = 5.75$, $F = 73.49$, $p < 0.001$, $\eta^2 = 0.220$).

Mediation effect test: There were also significant differences in the degree of forgetfulness and selection overload among the 4 groups. Compared with the non-target group, the target group has a lower degree of forgetfulness ($M_{\text{target}} = 5.07$, $M_{\text{non-target}} = 4.27$, $F = 47.68$, $p < 0.001$, $\eta^2 = 0.155$) and a higher choice overload ($M_{\text{target}} = 4.14$, $M_{\text{non-target}} = 5.39$, $F = 7.70$, $p = 0.006$, $\eta^2 = 0.029$). On the contrary, compared with the target group, the non-target group has a higher degree of forgetfulness and lower choice overload (see Figure 4).

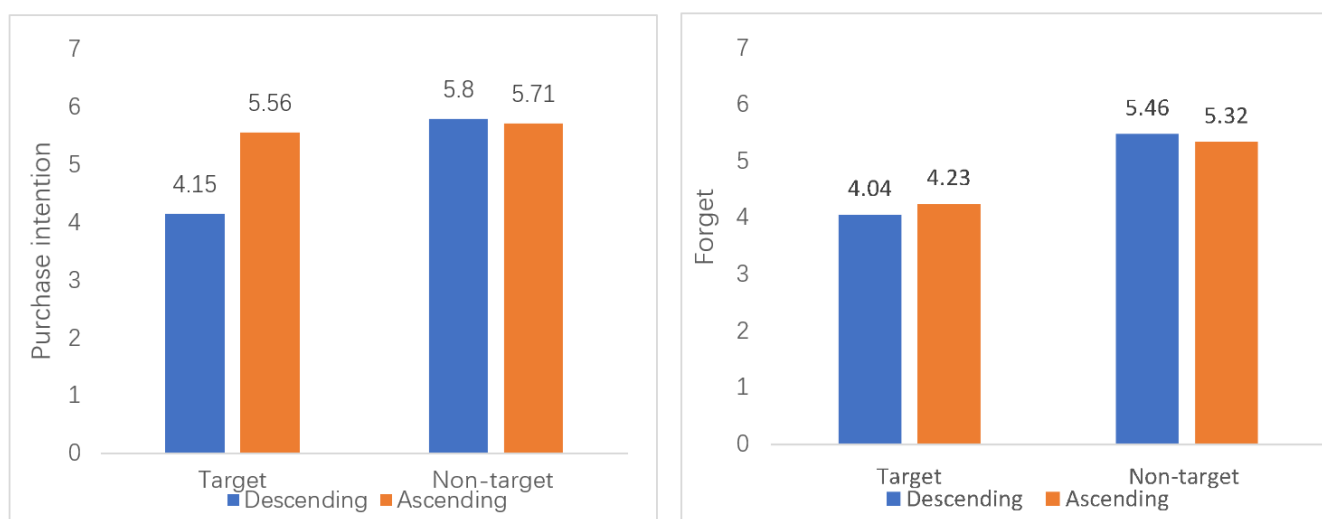


Figure 4. Results of Study 3 on purchase intention and forgetfulness.

There is no significant difference in the degree of forgetfulness between the descending group and the ascending group relative to the descending order of the time of adding the product ($M_{\text{ascending}} = 4.76$, $M_{\text{descending}} = 4.75$, $p = 0.983$). However, compared with the ascending group, the descending group has a higher choice overload ($M_{\text{ascending}} = 4.29$, $M_{\text{descending}} = 5.07$, $F = 43.353$, $p < 0.001$, $\eta^2 = 0.143$).

Then, we used model 4 of process 3.4 in SPSS 26.0 to verify the mediation mechanism of selecting overload and forgetfulness. The results showed that after controlling for gender, age, income, and past abandonment behaviors, the mediating effect of forgetfulness was not significant in the four groups (LLCI = -0.0486 , ULCI = 0.0184 , 95% level of confidence, 2000 number of bootstrap samples). However, the choice overload mediating effect be supported validated our hypothesis H2b (LLCI = 0.0179 , ULCI = 0.1344 , 95% level of confidence, 2000 number of bootstrap samples).

Model 8 was used to verify H3, the adjustment effect of shopping cart opening frequency on purchase intention under different sorting rules. The results showed that the moderating effect was not established, thus H3 was rejected (LLCI = -0.0158 , ULCI = 0.0119 , 95% level of confidence, 2000 number of bootstrap samples).

A 2 (Tasks: target vs. non-target) \times 2 (sorted ascendingly and descendingly), ANOVA revealed that compared with the non-target group, the ascending order of the target group was significantly higher than the descending order ($M_{\text{ascending}} = 5.56$, $M_{\text{descending}} = 4.15$, $F = 87.02$, $p < 0.001$, $\eta^2 = 0.053$), which supported the H4. This shows that in the context of

no-target shopping, there is no difference in the purchase intention of the shopping cart in ascending order or descending order. In the context of targeted shopping, compared to the list in descending order, the product list in ascending order has a higher willingness to buy.

Study 3 used different stimuli as the experimental objects, increased the number of selected products, and randomly recruited participants from different regions and different age groups through a large-scale website to conduct a between-subject experiment. The matching effect of the target task and the ranking significantly affects purchase intention. Regardless of whether there is a target shopping task, the participants are more inclined to the ascending order of the shopping cart items. In the case of goalless shopping, consumers are more likely to forget the products they added to the shopping cart. In actual shopping, descending order is the sorting method more commonly used by e-commerce platforms. However, our research shows that if the rules are changed appropriately, it will bring unexpected purchase intentions. This conclusion does not support those websites or shopping software that jump directly to the checkout page. We speculate that this sorting rule is more suitable for customers who like to compare and hesitate.

5. Discussion

During the epidemic period, to avoid interpersonal contact, online shopping grew rapidly. All major e-commerce platforms have developed new product strategies to respond to the explosive consumer demand. For example, CCTV News cooperated with Gome Retail to broadcast live on Gome Store, Pinduoduo, Gome Electric, and JD.com. Within 3 h, product sales exceeded 500 million yuan, and the number of visitors exceeded 10 million [76]. This study continues the research of Kukar-Kinney, M and Close, A. G. (2010) and Huang, Guei-Hua et al. (2018) on the abandonment behavior of online shopping carts. Based on Song, J. D. (2019), Luo, Xueming et al. (2019), and Rubin, Daniel et al. (2020), combined with the current development of e-commerce shopping carts, we put forward a new concept definition and distinguishes the occurrence stages of abandonment behavior of online shopping carts: Goods are added to the shopping cart, but they exit the shopping cart webpage without purchasing any goods until the goods are automatically deleted.

Online shopping cart abandonment behavior has always been a concern among enterprises and scholars alike, although multiple factors affecting the abandonment behavior have been studied. This research will become increasingly important with the development of e-commerce, and understanding consumers' "exit behavior" will be a key concern for enterprises and scholars. However, experimental research methods have not been used to explore the underlying intermediary mechanism. Through a qualitative interview and a laboratory study, Results from three studies demonstrate that Shopping cart abandonment behavior exists between different age groups and genders. Overall, this research proposes controllable, independent variables from the perspective of online shopping cart product sorting and choice overload as one of them. The explanation mechanism effectively reduces the abandonment of shopping carts and increases the number of shopping cart purchases. There is a significant difference in the number of shopping intentions before and after manipulation.

5.1. Theoretical Contribution

This study determined that the chronological ordering of items in online shopping carts will reduce cart abandonment behavior. Previous studies have focused on the first stage of online shopping—that is, the browsing stage that provides additional stimulation to consumers, such as issuing shopping vouchers, promotions, increasing the attractiveness and safety of web pages, and so on. Although the above factors are factors that companies can manipulate, they have a certain effect on the abandonment of shopping carts. However, once the products are added to the shopping cart, if they are not purchased, the attention in the first stage of shopping is reduced. In other words, they are no longer a new stimulus for consumers. Thus, how to solve the problem of shopping cart abandonment based on the sorting of the existing products in the shopping cart has become the focus of

research. Through this research, we have expanded the research on online decision-making with limited attention and supplemented the evidence of the sequential effect of online commodity presentation. Using a mixed research method, the empirical conclusion is that manipulating time sorting (ascending and descending order of adding time) will reduce shopping cart abandonment behavior, while excluding explanations of forgetfulness and psychological ownership. At the same time, we verified the marginal and significant mediating effect of selection overload in online shopping carts. Although in Study 2, the 95% confidence interval was not used, due to the small sample size and population, we still pointed out how to reduce the effect of choice overload in the back-end of online shopping purchase decision-making in future research directions. In the study, we found a significant mediating effect of selection overload and expanded the external validity of the conclusion by matching the target task with the ordering rules.

5.2. Managerial Implications

Online shopping operation platforms can influence consumer purchase behavior by optimizing the order of the shopping cart products in the final stage of shopping decision-making. It is recommended that the platforms set the automatic sorting option of the shopping cart. At present, only the JD.com platform has the option to sort the products in the shopping cart. Other platforms still stay on the message prompt; that is, the machine automatically prompts that a product has a discount. For instance, in the shopping cart page gives consumers better sorting options, companies can try a variety of sorting options (clustering, time, promotions, type, etc.), and explore the frequency of use of the sorting options that consumers seek to find the best combination. It can even remind consumers of the number of items in the shopping cart and the time to add them to regain the limited attention of consumers. For example, when a consumer opens a shopping cart, they are prompted, "It has been 2 months since you added the XX product last time. Are you still interested in it?", "The shopping cart now has a new sorting option. Do you want to try it?" to reawaken consumers' memory. For selecting overload, simplifying the information of the product, and performing effective clustering may be an effective approach.

5.3. Limitation

Limitations of research methods. Study 1 is more of an exploratory study that proves the universality of abandonment behavior and provides some self-reported evidence for the mediation mechanism of Study 2. Study 2 uses a sample of college students. Although the main force of online shopping is millennials, the abandonment of online shopping carts by other age groups cannot be ignored. Limitations of the data. We regret that we have not verified the mediating effect of forgetfulness and psychological ownership, which may be related to our sample size, but some studies confirmed that the digitization of goods and services and the expansion of personal data will lead to a decrease in psychological ownership. As for forgetfulness, it may be that the time we took to recall the participants was too short, only 24 h.

Limitations of methodology. In Study 2, the sample size is too small ($N = 108$), even when bootstrap is used, it cannot reach the significance level of the 95% qualitative interval. Second, the number of products that we use to select overload is 20, which is too far from the actual number of shopping carts. Consumers may have adapted to the number of shopping carts with more than 50 products. For the choice of 20 products, there is no clear perception of overloading. Although the above results are not ideal, we chose to report this result from the perspective of data authenticity.

5.4. Future Research

Items in a shopping cart can be sorted in more ways than in the ascending and descending order of time. Regarding the research direction, we can consider the shopping cart abandonment behavior of online and offline integration. At present, all major platforms have launched offline smart shopping carts, such as Amazon. Smart shopping carts can be

used in conjunction with mobile application shopping carts. Although it is a useful attempt to boost the offline shopping boom, abandonment behavior seems to occur both offline and online [77]. Thus, what influences consumers to abandon smart shopping carts seems to be an interesting question worth studying. Second, some individual platforms have also canceled the use of the shopping cart. For example, the Pinduoduo application—the largest e-commerce company in China, except for Taobao and JD—has abandoned the shopping cart function [78]. The consumer jumps directly to the checkout page after selecting the product, the purpose of which is to facilitate the transaction more quickly. In other words, once a consumer chooses to buy a product, they will be redirected straight to the payment interface. This kind of attempt is not undesirable, but the shopping cart function is still less on mainstream platforms, and future research should continue to explore more sorting methods. Based on the development of existing e-commerce platforms, an A/B test can be carried out, due to reduce shopping cart functions. For example, with the rise of live streaming platforms, the proportion of consumers directly redirected to the shopping checkout page has been increased, which maybe suggest that the shopping cart function is redundant. Moreover, it can be combined with the actual situation to design flexibly the ordering rules of the shopping cart products, such as how to sort the shopping cart interface directly after browsing the products and close the application and reopen the shopping cart interface. These efforts will positively impact shopping cart abandonment behavior.

At present, the research and discussion on shopping cart abandonment behavior are insufficient. More intermediary and adjustment mechanisms are urgently needed for further in-depth research.

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