

Optimizing user experience in online payments: the relationship between wait time and psychological uneasiness

Wu, Haopeng^{*a}; Cheon, Ryeongna^a; Yang, Wonseok^a

^a Shibaura Institute of Technology, Tokyo, Japan

* md22501@shibaura-it.ac.jp

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This study endeavours to investigate the psychological discomfort experienced by users during online payment and aims to identify the contributing factors to this unease. The researchers conducted a survey targeting users with prior experience in credit card payments on e-commerce platforms. The findings revealed that many users encountered practical uneasiness when making payments, primarily due to the absence of the tactile sensation associated with spending money during online transactions. Moreover, the temporal disparity between physical time and the user's subjective time further intensified this feeling of uneasiness. Furthermore, the study examined the impact of indicator endpoints and display time on user uneasiness during high-value payments. The results demonstrated that implementing a linear indicator with an endpoint and a display time ranging from 3 to 5 seconds proved to be effective in alleviating the psychological discomfort associated with large-value payments. These insights can significantly contribute to enhancing users' overall online payment experience.

Keywords: *online payment; user experience; progress indicators; psychological uneasiness*

1 Introduction

The utilization of credit cards for online purchases has observed a substantial increase in recent years, with the COVID-19 pandemic further accelerating this trend (Koch et al., 2020). Nevertheless, the absence of physical interaction during online payment transactions can elicit uneasiness among users, particularly when conducting high-value purchases. Although cashless payments have gained popularity, they have not yet been widely adopted for high-value transactions, partly due to the lack of physical interaction experienced in in-person transactions. Additionally, research suggests a growing need for effective feedback mechanisms to instill confidence in users during high-value online payments, especially among young male consumers (Dutta et al., 2003).

To address this gap, developers have devised feedback mechanisms that provide real-time feedback to users during the payment process. However, the effectiveness of these mechanisms in reducing



psychological uneasiness remains uncertain. Therefore, the objective of this study is to investigate the efficacy of various feedback mechanisms, particularly linear and circular progress indicators, in reducing psychological uneasiness during high-value online credit card payments.

In this study, a series of experiments were conducted to compare the effectiveness of different feedback mechanisms in alleviating psychological distress during high-value online credit card payments. Participants with prior experience in making online credit card payments were recruited, and their levels of psychological unease were assessed through exposure to several sample animations, followed by a questionnaire survey.

2 Literature review

Perception of waiting time is a crucial aspect of optimizing user experience in Human-Computer Interaction (HCI)(Chen & Li, 2020), Previous studies have explored factors influencing waiting time perception. (Kurusathianpong & Tangmanee, 2018) found that the size of progress bars affects perceived waiting time, while ribbed animation does not. Similarly, (Wilson & Cotgrave, 2016) aimed to enhance user satisfaction by utilizing visual perception methods to design effective progress bars. These studies underscore the importance of thoughtful design and implementation of loading symbols and feedback screens to enhance user satisfaction.

Furthermore, (Jones & Peppiatt, 1996) investigated the discrepancy between customers' perceived waiting time and actual waiting time, offering valuable insights into managing user expectations and mitigating the negative impact of perceived waiting time on user experience. (Wilson & Cotgrave, 2016) conducted a review of the literature on computer response time and assessed Web users' tolerable waiting time for information retrieval, finding that the tolerable waiting time is approximately 2 seconds and is prolonged by the presence of feedback.

Additionally, research by (Conti, 2001; Sackett et al., 2010) revealed that subjective time distortion serves as a metacognitive cue implicitly associated with enjoyment, while research by (Macar et al., 1994a) demonstrated a positive correlation between subjective duration and the amount of attention devoted to temporal processing. These findings highlight the importance of considering users' perception and experience of time when designing software interfaces and interaction methods (Lallemand & Gronier, 2012; Liikkanen & Gómez, 2013).

However, little research exists on how these factors affect users' subjective time perception during the payment process in online shopping, a critical phase that necessitates the input of sensitive information, such as credit card details and personal data (Wu & Wang, 2004; Zhu et al., 2020). Investigating the connection between subjective time perception of progress indicators and the uneasiness experienced during online payment in shopping can contribute to optimizing user experience(Amer & Johnson, 2016).

Moreover, a recent study by(Willermark et al., 2021) explored the correlation between progress indicators' degree of feedback, subjectively experienced time, and user satisfaction in mobile applications. Their focus was on how the degree of feedback provided influences SXT (subjectively experienced time) and user satisfaction. However, this current study concentrates specifically on online shopping, particularly the potential uneasiness generated during credit card payments. While both studies examine user experience in relation to progress indicators, our research aims to enhance

user satisfaction and experience by identifying and addressing potential sources of uneasiness in the online shopping process.

3 Background survey

This study aims to investigate whether individuals who frequently use credit card payments for online purchases experience psychological uneasiness. To achieve this objective, we conducted a preliminary experiment involving 111 individuals in their twenties who had prior experience using e-commerce sites. Data was collected through a questionnaire assessing factors contributing to feelings of unease during online payments. The results indicated that credit card payment is a prevalent method of online payment, with 80% of respondents reporting its usage. Among credit card users, the primary reason for using this payment method was the ease of ordering products. However, a significant proportion of respondents (72.5% or 66 individuals) reported experiencing psychological uneasiness when making online purchases using credit cards. The main reasons for this uneasiness were fear of entering personal information and the lack of physical sensation when spending money during online payments. These findings suggest that despite the convenience and widespread acceptance of credit card payments, users still experience psychological uneasiness during online transactions. To address these concerns (Lowry et al., 2006), e-commerce sites should take measures to reassure users about the security of their payment information and protection from fraud.

4 Experiments design

Building on these preliminary results, we propose a hypothesis concerning the use of indicators in online payment systems for transactions involving large sums of money. Our observation is that indeterminate-type indicators, commonly used for simple processing, may not be suitable for conveying the gravity of high-value payments. Specifically, we hypothesize that the presence or absence of an endpoint on an indicator influences the psychological uneasiness associated with large-value settlements. Our hypothesis posits that the longer an indicator is displayed during the settlement process, the more significance is attributed to the transaction, resulting in reduced psychological uneasiness for the user (Allan, 1979). This theoretical framework draws on Allan's work on the temporal features of visual stimuli, which can influence their perceived magnitude. By exploring the use of indicators in online payment systems, our study seeks to contribute to a better understanding of how design features can be leveraged to mitigate psychological uneasiness in high-value online transactions.

To test our hypothesis, we propose conducting an empirical study where we manipulate the display time of indicators during the settlement process and measure resulting psychological uneasiness levels among participants. Our study aims to provide insights into the design of feedback mechanisms that can alleviate psychological uneasiness associated with large-value payments. By understanding the factors contributing to this uneasiness, we can design more effective feedback mechanisms that convey the weight of the transaction while minimizing psychological distress.

4.1 Method of experiments

Participants will view a movie sample created by Figma, and their sense of psychological uneasiness will be evaluated using a 5-point scale.

4.2 Subjects of experiments

The study will include 8 male participants in their 20s and 12 female participants in their 20s.

4.3 Contents of experiment

Feedback that provides accurate waiting time predictions can be effective in reducing dissatisfaction (Sackett et al., 2010). Therefore, in this experiment, we used a "linear indicator" that can be easily recognized with a single glance and clearly distinguishes the beginning and end.

4.3.1 Relationship between the presence or absence of indicator endpoints and psychological uneasiness.

Hypothesis 1: The presence or absence of an indicator endpoint influences psychological uneasiness during large-value settlements. To test this hypothesis, we conducted an experiment using two short videos (Figure 1). One video used a fixed-type indicator that clearly indicated the endpoint, while the other used an indeterminate-type indicator that did not indicate the endpoint.

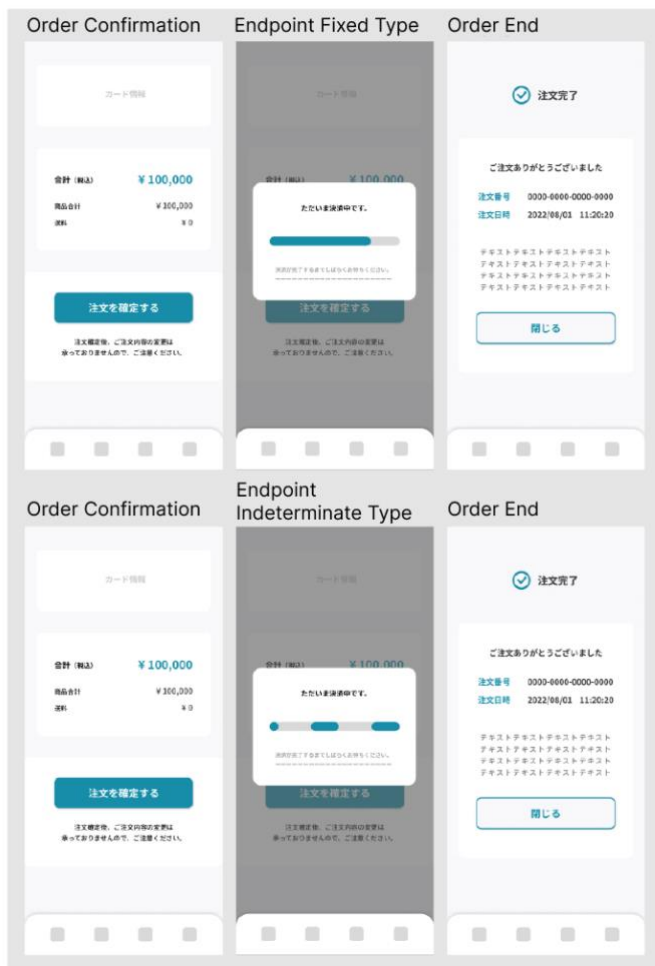


Figure 1. Video Samples 1

4.3.2 Relationship between differences in indicator display time and easing feelings of psychological uneasiness.

Hypothesis 2: The display time of the indicator impacts the level of psychological uneasiness. To test this hypothesis, we conducted an experiment with different indicator display times categorized as "short time," "medium time," and "long time." We also classified the indicator progress pattern into "constant speed," "ease-in," and "ease-out" for each item (Figure 2/Figure 3). This resulted in a total of 9 video patterns, and participants rated their psychological uneasiness on a 5-point scale (1 for "not anxious at all" to 5 for "very anxious").

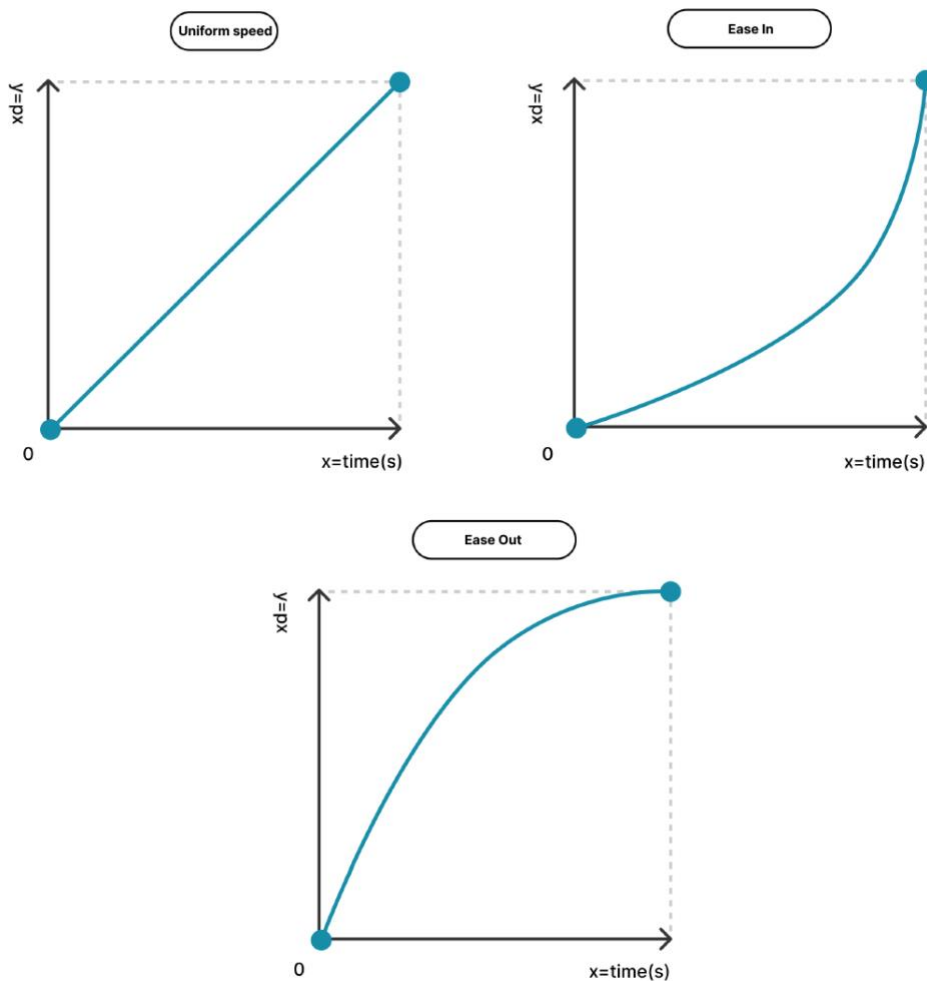


Figure 2. Easing 3 patterns 'Speed Graph

The term "ease-in" refers to a movement that starts slowly at the initial speed and gradually accelerates, while "ease-out" refers to a movement that starts at high speed and gradually decelerates.

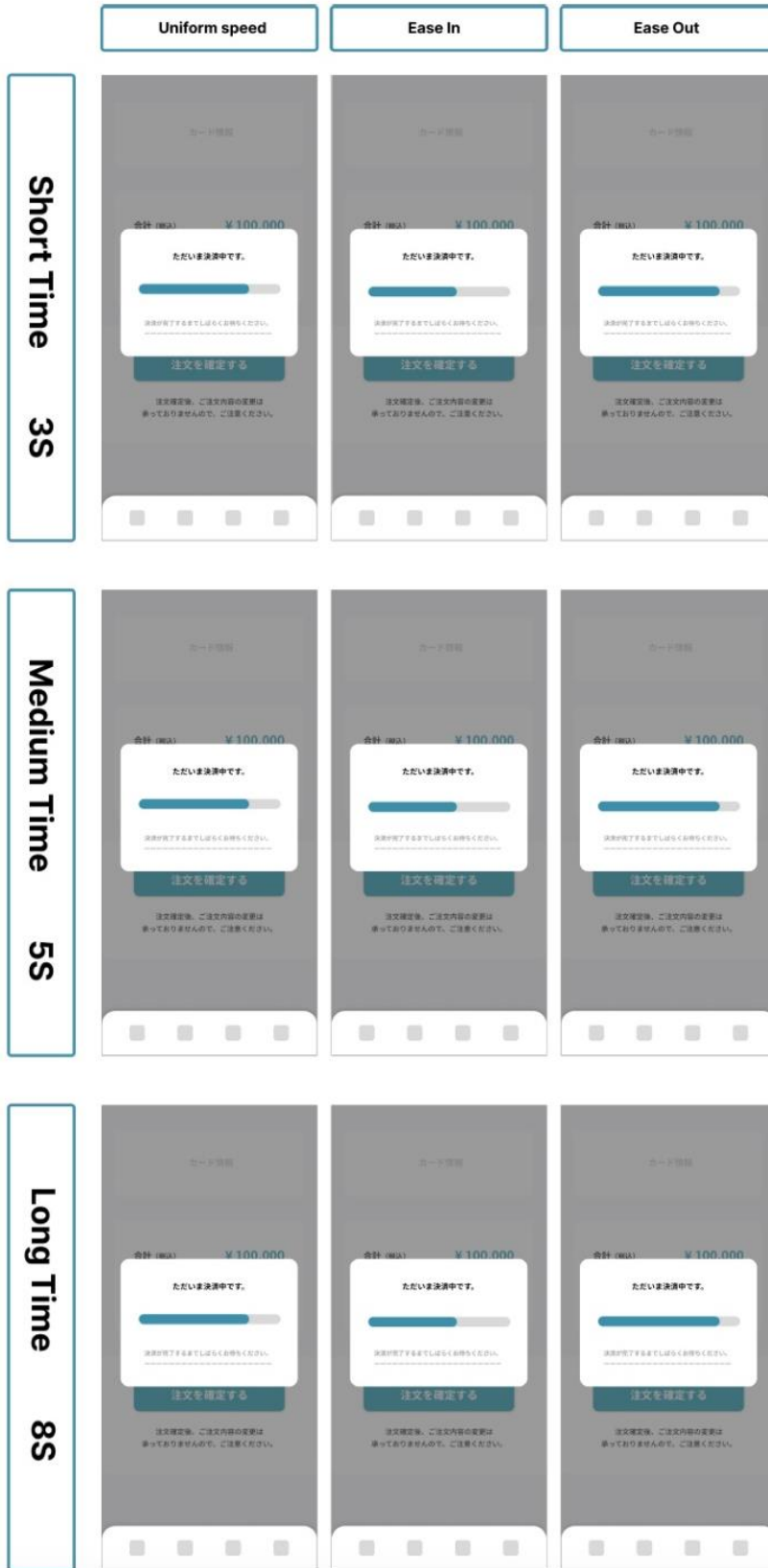


Figure 3. Video Samples 2

5 Analysis

5.1 Relationship between indicator endpoints and psychological uneasiness

Participants were presented with Figure 4 and asked about their psychological discomfort when dealing with large-value transactions. The data showed two types of indicators: linear indicators with endpoints (fixed type) and linear indicators without endpoints (indeterminate type). Out of the participants, 7 felt "not at all" anxious with the fixed type, while 11 felt "somewhat" anxious. In contrast, with the indeterminate type, 3 respondents were "not at all anxious", 2 were "somewhat anxious", and 5 were both "somewhat anxious" and "very anxious" (Figure 5-6). The findings suggest that indicators without endpoints tend to cause greater psychological uneasiness among respondents compared to those with endpoints.

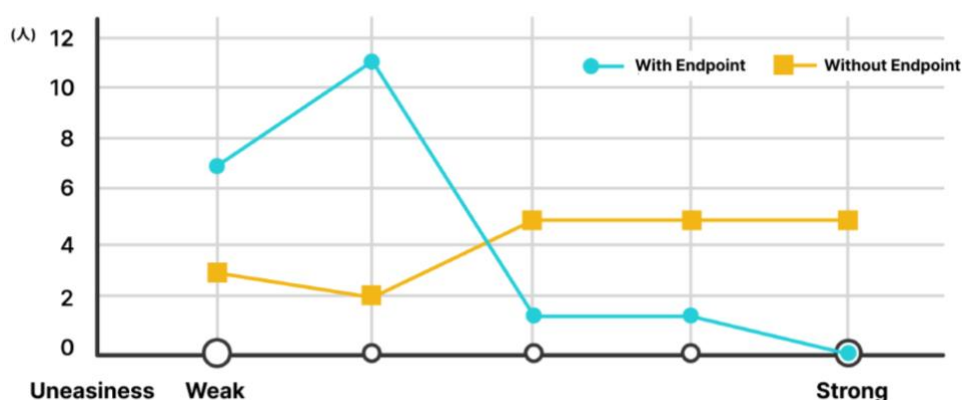


Figure 4. Indicator With/Without Endpoint and Uneasiness

This data contradicts the survey results discussed in 4.3.1, where the linear indicator with an endpoint caused more uneasiness in terms of subjective time. The discrepancy may be attributed to the inclusion of "dynamic elements" and "high settlement" factors. The previous questionnaire utilized static images, whereas this sample employed a video showing the entire process, from order confirmation to order completion, for a more realistic experience. It is possible that concentrating on large amounts of money led to the differing outcomes and psychological effects.

As a result, it is not advisable to use an indicator without an endpoint for large-value transactions due to the increased tension it creates. The lack of a clear endpoint during the waiting time negatively affects user psychology. Providing transparent feedback on the transaction's duration could alleviate users' psychological discomfort.

5.2 Relationship between differences in the display time/easing of indicators and psychological uneasiness

An analysis of variance was conducted on the 5-point scale data to explore the relationship between differences in the display time and easing of indicators, and the psychological uneasiness experienced during online payments (Figure 5). The results indicate a significant difference in the "length of time on display" category, suggesting that the duration for which the indicator is displayed can impact the level of psychological uneasiness experienced during online transactions. Specifically, shorter display durations were associated with reduced psychological uneasiness. This finding suggests that minimizing the indicator's display time can alleviate uneasiness during online transactions.

	Uniform Speed/Ease In	Uniform Speed/Ease Out	Ease In/Ease Out
Progress Easing	n.s.	n.s.	n.s.
Length of Time on Display	p>0.05	p>0.05	p>0.05
Progress Easing Length of Time on Display	n.s.	n.s.	n.s.

Figure 5. Result of Variance Analysis

In contrast, no significant differences were found in the "progress easing" and "progress easing X length of time on display" categories. These results suggest that making adjustments to such dynamic factors in this context may not effectively mitigate psychological uneasiness. These findings contradict "Hypothesis 2," which posited that the weight of settlement is influenced by the length of time the indicator is displayed. The hypothesis initially stated that longer display times would place more weight on the payment process, contributing to psychological uneasiness. However, the results of this study suggest otherwise, indicating that overly extended display times may not cause psychological uneasiness, even for high-value payments.

Considering the lack of significant differences in the "progress easing" and "progress easing X length of time on display" categories, it can be inferred that minor adjustments to dynamic factors, similar to those in this study's sample, may not effectively alleviate psychological uneasiness. Therefore, the most promising strategy for reducing psychological uneasiness during online payments appears to be minimizing the display time of the indicator. Future research could explore alternative display techniques or methods to further decrease uneasiness during online transactions.

6 Discussion

This study aimed to investigate how variations in indicators affect users' psychological uneasiness during online transactions. The impact of two key indicators, namely the "length of time on display" and "whether or not the indicator has an end point" was examined. The findings revealed that the length of time an indicator is displayed significantly affects users' sense of uneasiness. Shorter display times were found to be less uneasiness-provoking. However, for high-value transactions, users preferred a medium display time of around five seconds to evoke a mindful sense of "paying with money." This suggests that a slight degree of uneasiness or nervousness may be necessary for users to feel a greater sense of responsibility when making large payments online.

Furthermore, the presence of an indicator endpoint was identified as a crucial factor in reducing psychological uneasiness during online transactions. Users with a definite-type indicator that had an endpoint reported feeling less anxious when settling large amounts than those with an indefinite-type indicator that lacked an endpoint. Therefore, being able to see the endpoint may significantly reduce psychological uneasiness when waiting for a substantial amount of money to be settled.

In conclusion, progress indicators play a crucial role in reducing users' sense of psychological uneasiness during online transactions. Shorter display times and definite-end indicators were found to be more effective in reducing uneasiness levels. By understanding the impact of indicators on user uneasiness, businesses and developers can create more user-friendly interfaces and better facilitate a safer and more secure online shopping experience.

7 Conclusion

This study aimed to investigate factors causing uneasiness during online payments and explore ways to mitigate uneasiness. The experiments involved video samples and analysis of interactions with existing services to identify the sources of users' uneasiness. The findings revealed that users who are accustomed to credit card payments tend to feel uneasiness when making online payments, mainly due to the lack of physical sensation associated with spending money. Additionally, longer interaction display times for online payments than expected tend to induce a sense of uneasiness. The type of indicator also plays a role, with the indeterminate type causing more uneasiness than the determinate type.

To test our hypotheses based on the analysis and group classification data, we conducted an experiment using a video sample that compared the presence or absence of an indicator endpoint and the difference in the indicator display time and easing. The "fixed type indicator" was preferred for large-value settlements. Moreover, shorter display times of the indicator were associated with reduced uneasiness among users. However, the largest number of participants chose a display time of 5 seconds, suggesting a psychological need for a certain level of tension when settling large amounts of money. Therefore, we recommend incorporating a linear indicator with an endpoint and a display time of 3 to 5 seconds into the online payment interaction to reduce psychological uneasiness.

In conclusion, this study offers valuable insights into enhancing users' online shopping experience, which is a critical and expanding domain of e-commerce. Exploring the correlation between subjective time perception of progress indicators and uneasiness during the payment phase of online shopping holds significance for optimizing user experience in Human-Computer Interaction (HCI). Moreover, our research can aid developers and designers in identifying factors that could prolong the perceived waiting time during payment and devising effective strategies to mitigate such influences.

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