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What kind of doctor looks more popular? A multi-dimensional study on online healthcare consultation

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Short Paper

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Abstract

With the development of Web 2.0 technology, the healthcare industry is undergoing a digital transformation that has led to the emergence of online healthcare consulting, revolutionizing the patient consulting experience in several ways. Despite substantial literature on patient behavior, there is limited understanding of how the appearance of physicians, as conveyed by their portraits, affects patients' online decision-making. To bridge this gap, this study aims to develop a four-dimensional facial impression model to systematically analyze physicians' faces. Three stages of patient decision-making, including search, selection, and evaluation decisions, were examined using data collected from Haodf.com. Preliminary results indicate that seeing the true appearance of the physician positively influences patient experience, leading to increased consulting willingness and satisfaction. Diverse moderating role of service price suggesting the substitution and enhancement between price and real person portraits. Our study contributes to the literature on user behavior and facial impression in digitalized healthcare.

Keywords: Digital transformation, facial impressions, online healthcare, decision making, price

Introduction

Digital transformation aims to enhance properties of business process by employing information, computing, communication, and connectivity technologies (Vial 2021 P.118). It has brought significant changes in many industries, including ones that relies heavily on offline communication traditionally, such as healthcare. Nowadays, it is quite common to consult a doctor online especially after the pandemic. Online healthcare consultation enables patients to schedule appointments and consult with doctors via text, telephone, or video on online healthcare platforms. This mode of consultation eliminates the need for patients to travel to the hospital and wait in waiting rooms, thereby saving time (Goh et al. 2016). Through online platforms, patients can access doctors from all over the country at any time, breaking the barriers of space and time (Yang et al. 2015), which is particularly beneficial for those in rural and isolated locations (Goh et al. 2016). Due to the convenience and efficiency brought about by digital transformation, the proportion of doctors offering virtual visits has increased from 5% in 2015 to 22% in 2018. This trend has been further accelerated by the COVID-19 pandemic, and currently, 83% of surveyed patients expect to continue using telemedicine after the pandemic.

With the advent of digital healthcare, the importance of physician portraits has emerged as a crucial factor in patient decision making. Unlike traditional offline hospitals, where patients cannot observe the appearance of a physician before coming to their office, online consultations enable patients to preview much information of a physician, including portraits, before initiating the consultation. It is notable that people are not always rational, and unconscious biases may influence their decision-making process (De Martino et al. 2006). Compared with medical skill information that is difficult to learn, especially for non-professional patients, the characteristics of good-looking are extremely easy for anyone to catch. Previous research has revealed that a good-looking appearance could bring nonnegligible benefits in many business activities (Dion et al. 1972). It has much stronger influence on people's decision–making process than we realized in a latent way. Regarding this, patients may pay more attention to physicians' portraits than they realize, and this can impact their entire consultation experience. Therefore, despite its seemingly trivial nature, the physician portrait can play a significant role in shaping patient perception and satisfaction in digital healthcare. Nevertheless, not much research has been done to investigate this problem in healthcare.

Although scholars have identified several factors influencing patient experience in online healthcare, such as physician and hospital reputation, and service attitudes (Liu et al. 2018), few have paid attention to the role of physicians' portraits. Furthermore, instead of treating decision-making as an independent event as previous research (Ouyang and Wang 2022), we consider it as a three stages processes to go deep. To address this research gap, we propose the following research question: (1) *How do physicians' real-person portraits impact patients' entire decision-making process during online healthcare consultations?*

Due to the credence characteristics of healthcare services, patients often rely on price to evaluate a physician or service due to the information asymmetry (Dulleck and Kerschbamer 2006). As a result, price is an essential feature in online healthcare that significantly influences patient decision making. Consequently, we propose our second research question: (2) *How do physicians' real-person portraits and service prices interact to impact patients' decision making in online healthcare consultations?*

To solve the above two research questions, we developed a four-dimension facial impression model based on the facial model of Sutherland et al. (2013). The social presence theory has been incorporated into the construction. This model allowed us to systematically analyze different aspects of physicians' appearances and explore their effects on patient experience.

Literature Review and Theoretical Foundation

Impacts of Physicians' Appearance on Patient Perceptions

Studies on the impacts of physicians' appearance on patient perceptions have primarily focused on the effects of physicians' attire, with a particular emphasis on the white coat (Chung et al. 2012). Many researchers have found positive effects of physicians wearing white coats. For instance, the results of Brase and Richmond (2004) showed that white coats and formal attire convey a stronger sense of medical

authority and openness compared to casual attire. Other researchers reported the occurrence of the "white coat syndrome", which refers to an increase in blood pressure in a clinical setting in comparison with other environments, such as at home (Hochberg 2007). However, there has been limited research on the impact of physicians' facial expressions on their patients, with most studies focusing solely on physical attractiveness (Cash and Kehr 1978; Young 1979). Extending their study, Ouyang and Wang (2022) also explored the effects of a physician's smile, and skin appearance on patient choices in outpatient health clinics. There is still a lack of systematic analysis of physicians' facial expressions in current literature, making it difficult to understand their impact on patient decision-making. To address this gap, we propose a four-dimension facial impression model to analyze physicians' appearances and investigate their role in patient behavior.

Existing Facial Evaluating Models

Facial impression models are used to construct and evaluate the impressions formed by facial appearance, which can be presented in objects or photographs. The first facial impression model was put forward by Oosterhof and Todorov (2008), which consisted of two orthogonal dimensions: valence and dominance. Valence describes the person's intentions, whether harmful or harmless, and is also known as trustworthiness. Dominance describes the person's ability to implement these intentions, which equates to competence or capability. Oosterhof and Todorov (2008) found that trustworthiness is highly correlated with facial emotions, with annoyance scoring the lowest and happiness scoring the highest. Perceived dominance is undermined by fear but strengthened by maturity and masculinity inferred from faces. Building upon this, Sutherland et al. (2013) extended the model to three dimensions by adding a new dimension of youthful-attractiveness.

The number of facial dimensions to be considered and which dimension is more critical depends on the context (Jaeger et al. 2018). For instance, facial dominance has been shown to be crucial in political elections and has been used to predict election outcomes (Ballew and Todorov 2007; Todorov et al. 2005), while facial attractiveness is considered more significant in mate selection (Sutherland et al. 2013). It is important to adapt these models to better fit the research context. In line with this, we will introduce reality as a new dimension in following parts to describe the impacts of real person portraits as a whole in the first place, which is a critical aspect in the scenario of online healthcare consultations.

Indicators for Different Facial Impression Dimensions

Approachability It is also known as trustworthiness, a general perception of a person's facial cues that signals whether to approach or avoid them (Oosterhof and Todorov 2008). These cues give rise to inferences about the person's behavioral intentions, determining whether they are harmful or harmless. One key indicator for approachability is the emotion of *happiness*, which is often conveyed through smiling. Smiling is considered an essential cue for positive intentionality judgments and perceived trustworthiness (Ert and Fleischer 2020). For example, Oosterhof and Todorov (2008) found that happy expressions scored the highest compared to neutral and angry expressions in terms of approachability. Sutherland et al. (2013) also found a high related coefficient (0.86) between approachability and smiling.

Dominance The dimension of dominance refers to a person's ability to enforce their intentions, indicating their strength and power (Oosterhof and Todorov 2008). *Facial width-to-height ratio (fWHR)* is a metric calculated by dividing the width of the face's central portion by its upper facial height (Loehr and O'Hara 2013), and has been recognized as a reliable indicator of perceived dominance and aggression. Studies have shown a positive correlation between fWHR and perceived dominance in both men and women, and higher fWHR has been linked to higher consumer preferences and willingness to pay more in product design (Maeng and Aggarwal 2018). Research has also confirmed the link between fWHR and perceived aggression, with individuals with larger fWHR being rated as more threatening and dominant (Geniole et al. 2015). According to prior research, dominance is primarily inferred from two types of facial cues: aggression related emotional expressions and facial postures, such as eye gaze and head pitch angle (Chiao et al. 2008). Among them, *head pitching*, referred to the vertical orientation of a person's head, has been shown to greatly impact perceptions of dominance (Witkower and Tracy 2019). Facial accessories such as *glasses* also contribute to a person's facial characteristics and can influence the facial expression perceived by observers (Leder et al. 2011). People who wear glasses are viewed as more intelligent, competent, industrious, and successful, which is known as "glasses stereotype" (Leder et al. 2011).

Attractiveness According to Sutherland et al. (2013), the dimension of attractiveness is positively correlated with physical attractiveness and health, and negatively correlated with age. Research shows that people often associate positive personality traits with physically attractive individuals, known as the "beauty premium" stereotype (Dion et al. 1972). This has been observed in various fields, such as healthcare, employment, job performance evaluation, charity donation, and the sharing economy. However, the impact of physical attractiveness on their patients, which belongs to the professional industry of healthcare, remains unclear due to the opposite effects found in highly professional areas (Fidrmuc et al. 2017).

Social Presence in Online Communication

Computer-mediated communication (CMC) is often criticized for its perceived social distance and impersonality compared to face-to-face communication (Morand and Ocker 2003). This phenomenon can be explained by the social presence theory, which was proposed by Short et al. (1976) and defined as the degree to which a person is perceived as a "real person" in mediated communication (Gunawardena 1995). Social presence lies on a continuum, with one end being users' perceptions of a person being "present", "there", or "real", and the other end focusing on positive interpersonal and emotional connections between communicators (Lowenthal 2010). The social presence theory argues that different media have varying capabilities in conveying the psychological perception of other people's physical presence, as they have distinct abilities to transmit visual and verbal cues such as facial expressions, physical distance, gaze, postures, etc. (Short et al. 1976). The positive impact of social presence has been well-studied in CMC, such as the fields of online learning and e-commerce (Richardson et al. 2017), while its role in online healthcare has not been examined. Our study aims to fill this gap by investigating the physician's real face publishing behavior in online healthcare platforms.

Research model and hypotheses

The Model of Facial Impressions on Patient Decision Makings

The research model shown in Figure 1 describes how the physician's portrait impacts each decision-making stage of patients. Patient decision making process can be divided into three stages: search, selection and evaluation of physicians. In the search stage, patients are shown a list of physicians relating to their diseases or symptom, which contains some fundamental information of the physicians such as their portraits. Patients have to decide which physician to click on to browse the physician' homepage further. After entering the physician's homepage, patients can have access to more detailed information about the physicians, such as their consulting history and evaluations given by other patients. In this stage, patients have to decide whether to choose the physician for consultation based on the exiting information. In the evaluation stage, patients have already experienced the service and can represent their satisfaction online.

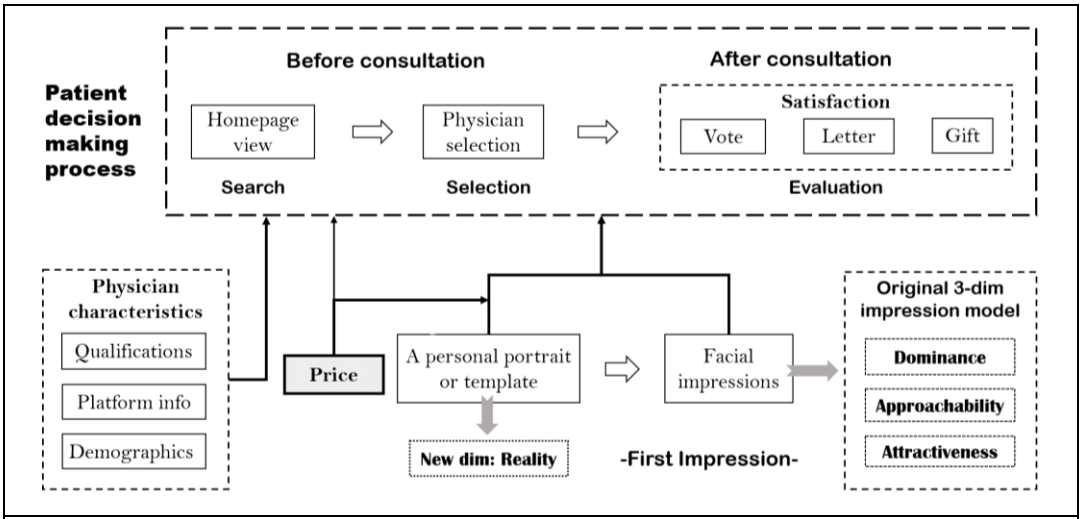

Figure 1. Illustration of our research model

The impacts of facial impressions can be divided into two parts. On the one hand, whether patients can access physicians' facial appearance through their real person portraits will have impacts on patients' consulting experience and behaviors. If so, then we go a step further to investigate how their appearance impacts patients' decision-making behaviors. The two stages of effects will be demonstrated by introducing our four-dimensional facial model, including reality, approachability, dominance, and youthful-attractiveness based on the widely recognized model of Sutherland et al. (2013).

Hypotheses development

Drawing upon the social presence theory, we introduced the fourth dimension "reality" to describe the social presence perceived from the real-person portraits, serving as the basis for excessive facial cues analysis. As the theory suggests, patients can perceive more reality from physicians' personal portraits as they can access various facial cues compared with text-based communication. The role of social presence has been established as a strong indicator of perceivers' satisfaction and perceived knowledge service quality in CMC (Richardson et al. 2017). In the context of healthcare, seeing the appearance of physicians gives patients a sense of safety and reliability, particularly in the context of online websites where participants cannot physically touch one another. We consider portraits containing real persons to be more realistic than those without, which can be thought of as a binary dimension. Thus, we offer the following hypotheses:

H1: *Perceived reality from physicians' personal portraits, indicated by whether the portrait containing a real person, positively impacts patients' search, selection, and evaluation of physicians.*

Facial approachability represents the intention of the individual, based on which people decide whether to approach or avoid the person (Oosterhof and Todorov 2008). In communication, approachability is rather essential in establishing and maintaining cordial relationships, especially in the first meeting (Dagenais et al. 2006). The perception of approachability can be indicated by the display of happiness, conveyed through smiling, which is often associated with being friendly, pleasant, sociable, and trustworthy (Bugental 1986). In light of the above analysis, we draw the hypotheses that:

H2: *Perceived approachability of physicians, indicated by facial happiness, impacts patients' search, selection, and evaluation of physicians.*

The dimension of dominance represents the individual's perceived capacity to carry out their intentions and communicate competence, intelligence, confidence, and even assertiveness. Previous research has shown that fWHR can reflect both dominance and aggression, depending on the context (Geniole et al. 2015). In fact, dominance and aggression are often closely linked and may be viewed as two sides of the same coin. In certain specialized fields, such as corporate management and healthcare, dominance can be viewed as a crucial aspect that conveys professional power, instilling confidence and safety in patients (Alrajih and Ward 2014). However, when dominance becomes excessive, it can also evoke feelings of aggression and intimidation of the individual (Geniole et al. 2015). We hypothesize that:

H3a: *The perception of modest dominance conveyed through physicians' faces, indicated by glasses, fWHR, and head pitching has a positive effect on patients' search, selection, and evaluation processes.*

H3b: *The perception of excessive dominance conveyed through physicians' faces, indicated by fWHR, has a negative impact on patients' search, selection, and evaluation processes.*

Research has shown that people tend to attribute more socially desirable personality traits to physically attractive individuals compared to unattractive individuals, a phenomenon referred to as the "beauty premium" or "what is beautiful is good" stereotype in psychology (Dion et al. 1972). The impact of a physician's physical attractiveness on their patients is still unclear, as the medical field is considered a highly professional one. On the basis of the aforementioned analysis, we formulate the following hypothesis:

H4: *The perceived level of physical attractiveness in the physician's face, indicated by facial beauty, has a significant effect on patients' search, selection, and evaluation of the physician.*

The credence characteristic of healthcare prioritizes price as an essential factor influencing patient decisions. In this part, we further discuss the interactions of price and portraits. Since patients have limited information about listed physicians during the search stage, they often rely on simple, direct or visual information such as price and portraits to make decisions. As a result, the impacts of price and portraits may be interchangeable on patients' search behaviors. Hence, we hypothesize that:

H5: *Service price and portraits have a substitute relationship in affecting patient's searching decisions.*

Moreover, patients tend to rely on price as a signal for high service qualities. Thus, after paying a higher price, they would have the expectation of receiving higher service quality during consultations. However, the existence of fraud crisis in online healthcare due to information asymmetry means that patients are more urgent for confirmation of physician reliability. In this regard, real personal portraits can bring out the feeling of safety, physicality, and reality, thus enhancing patients' trust in physicians. Patients would view physicians who post their real personal photos as more reliable and trustworthy, reducing the risk of being defrauded, which satisfies patients' confirming requirements. To put it simply, price and real person portraits confirm and strengthen each other in impacting patient decisions, except for the search stage. Based on this analysis, we posit the following hypothesis:

H6: *Service price positively interacts the relationship between perceived reality and patient decisions in search, selection and evaluation stages.*

Methodology

Data Description

We collected data from the largest and most popular Chinese healthcare website Haodf.com. As of June 2022, the platform has over 880,000 physicians from 9,650 regular hospitals, and more than 140,000 of them offer online consultation services. To gather interval data on physicians over a period, we filtered out inactive physicians with fewer than 30 consultations. We also excluded physicians who did not provide basic information, such as clinical levels. Finally, we obtained a dataset of 72,057 physicians, with 43,797 of them posting a real-person photo. This photo is displayed throughout the entire consultation process, including on the physician list, the physician's homepage, and in the chat box.

Variable Construction

All the variables are constructed and aggregated in the physician level. The definitions and summary statistics of all the variables can be found in Table 1. Time point A and B denote June 10th, 2022, and October 10th, 2022, respectively. The variables containing absolute numbers are transformed using natural logarithms to address the issue of non-normality, which is indicated by "logarithm" in brackets.

Table 1. The definition and summary statistics of all the variables.

Variable	Definition	Mean	S.D.	Min	Max
ViewsAB	The number of new views from the point of time A to time B of the physician (logarithm).	8.001	1.350	4.605	15.863
ViewsA2weeks	The number of new views during the last 2 weeks before time A (logarithm).	5.927	1.522	0	13.561
PatientsAB	The number of new patients from time A to B of the physician (logarithm).	1.705	1.791	0	9.143
PatientsA	The number of new views at the point of time A of the physician (logarithm).	5.820	1.515	1.792	11.297
PatientsB	The number of new views at the point of time B of the physician (logarithm).	5.856	1.511	1.792	11.363
ConsultsAB	The number of new consultations from time A to B of the physician (logarithm).	1.750	1.837	0	9.125
DurationA	How many years at the point of time A since the physician opened the online healthcare service.	7.586	3.565	0.184	14.359
ReviewsB	The number of total reviews of the physician at time B (logarithm).	2.840	1.667	0	8.440
VotesB	The number of total votes of the physician at time B (logarithm).	0.956	1.469	0	7.630
LettersB	The total number of thank you letters of the physician at time B (logarithm).	1.969	1.536	0	7.690
GiftsB	The number of total gifts of the physician at time B (logarithm).	2.440	1.759	0	9.230
Portrait	Whether the physician uploaded a photo containing a face of a real person.	1	0.004	0	1

Happiness	Happiness score of the physician.	0.362	0.420	0	1
Glasses	Whether the physician is wearing glasses in the photo.	0.508	0.498	0	1
Head_pitch	The pitching angle of the physician's head in the photo.	5.513	4.818	-23.28	48.270
FWHR	The facial width-to-height ratio of the physician.	1.834	0.130	1.313	2.471
Beauty	Beauty score of the physician, calculated by the average of the beauty score in the perspective of male and female.	0.567	0.111	0.166	0.932
Blur	The blur degree of the physicians' photo.	0.101	0.286	0	1
Illumination	The illumination degree of the physicians' photo.	0.620	0.121	0.068	1
White_coat	Whether the physician is dressed in a white coat in the photo.	0.506	0.455	0	1
Suit	Whether the physician is dressed in a suit in the photo.	0.162	0.3510	0	1
Price	The service price of the physician (logarithm).	2.755	0.950	0	9.210
Male	Whether the physician is perceived as a man from the photo.	0.690	0.463	0	1
Age	The age of the physician perceived from the photo.	32.265	7.284	20	75
Clinical_level	The clinical level of the physician.	0	1	-	-
Hospital_level	The level of the hospital that the physician belongs to.	0	1	-	-
City_level	The city level of the physician.	0	1	-	-

There are five dependent variables related to three stages of patients' online consulting behavior. In the search stage, we use *ViewsAB*, while we use *PatientsAB* during selection stage and use *VotesB*, *LetterB*, and *GiftsB* during evaluation. We adopted patient number instead of consultation number to capture the pure impacts of physicians' first impressions on patients' decision-making, as each patient may consult with the same physician multiple times. First, we investigated the impact of physicians' real personal portrait (*Portrait*) on patients' decision-making across three stages. Then we examined the effects of more detailed facial impressions, which are divided into three dimensions: approachability (*Happiness*), dominance (*Glasses*, *Head_pitch*, and *FWHR*), and attractiveness (*Beauty*). These facial indicators are extracted directly or indirectly from two leading face-based computer vision technologies, Face++ (faceplusplus.com) and BaiduAI (ai.baidu.com), which are specifically designed for Chinese faces. These two technologies have been successfully practiced in several researches (Ouyang and Wang 2022; Jaeger et al. 2019). We also include photo qualities and physician attires to control for other portrait related factors. Additionally, we control for physicians' basic features, including gender, age, and qualifications.

Preliminary Results

Our preliminary results are summarized in Table 2. To avoid an overlong table, we selected the feature of *VotesB* as the proxy for patient satisfaction. The results in Columns (1), (3), and (5) show the main effects of real personal portraits in the search, selection, and evaluation stages, respectively. The significantly positive coefficients of *Portrait* in all columns suggest that patients are more likely to browse and select physicians whose portraits contain a real person for consultations, and they are more satisfied with them as well, which confirms H1. Columns (2), (4), and (6) report the results of the moderating effects. The negative value of the cross-term in Column (1) shows that *Price* and *Portrait* have interchangeable roles in impacting patient searching decisions, which confirms H5. The positive values of interactions in Columns (4) and (6) indicate that physicians with a higher service price will benefit more when they upload a personal portrait, verifying H6. In addition, the positive coefficients of price in all six columns confirmed the credence essence of healthcare services, making the analysis in hypotheses development more reasonable.

Table 2. Preliminary Regression Results.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ViewsAB	ViewsAB	PatientsAB	PatientsAB	LettersB	LettersB
Portrait	0.150***	0.146***	0.169***	0.180***	0.148***	0.155***
	(0.004)	(0.004)	(0.010)	(0.010)	(0.008)	(0.008)
Price*Portrait		-0.038***		0.121***		0.067***
		(0.005)		(0.012)		(0.009)
Price	0.160***	0.188***	0.262***	0.174***	0.229***	0.180***
	(0.003)	(0.005)	(0.007)	(0.011)	(0.005)	(0.008)
Control variables	YES	YES	YES	YES	YES	YES

Observations	72,057	72,057	72,057	72,057	72,059	72,059
R-squared	0.836	0.836	0.484	0.485	0.371	0.372
Adjusted R-squared	0.836	0.836	0.484	0.485	0.371	0.372
VIF	2.52	2.80	2.33	2.65	2.31	2.63

*p<0.05, **p<0.01, ***p<0.001

Discussion and Conclusion

The study has significant implications both theoretically and academically. The theoretical implications are threefold. First, we extend the facial model of Sutherland et al. (2013) by introducing a new dimension of reality to describe the social presence perceived by users in online environments. Second, we contribute to the literature on patient behaviors by highlighting the significance of physicians' facial impressions on patient behaviors. Third, we contribute to the literature on impression management theory by extending its exploration in facial impressions of physicians. In terms of practical implications, for physicians, besides polishing medical skills, they should pay attention to their facial impressions to patients as well. In addition, physicians can also impress patients by improving the image quality, such as making it clearer and brighter since patients tend to make decisions perceptually.

This paper examines the influences of physicians' appearance on patients' whole decision-making process in online healthcare consultations. A four-dimension facial impression model has been constructed to analyze physicians' appearance on patients' three stages of decision-making processes. We find that physicians' with a real-person online portrait improves patients' views, purchasing willingness, and satisfaction through increased social presence perceived from faces. The dynamic moderating effects of service price revealed its substitutive and reinforced effects in different stages respectively. Future work will focus on the effects of detailed facial traits, including three dimensions of approachability, dominance, and attractiveness. Dynamic impacts of different facial dimensions on patients' three decision-making stages, and the dynamic moderating role of price is to be excavated.

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