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Working Together with Conversational Agents: The Relationship of Perceived Cooperation with Service Performance Evaluations

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Abstract. Conversational agents are gradually being deployed by organizations in service settings to communicate with and solve problems together with consumers. The current study investigates how consumers' perceptions of cooperation with conversational agents in a service context are associated with their perceptions about agents' anthropomorphism, social presence, the quality of the information provided by an agent, and the agent service performance. An online experiment was conducted in which participants performed a service-oriented task with the assistance of conversational agents developed specifically for the study and evaluated the performance and attributes of the agents. The results suggest a direct positive link between perceiving a conversational agent as cooperative and perceiving it to be more anthropomorphic, with higher levels of social presence and providing better information quality. Moreover, the results also show that the link between perceiving an agent as cooperative and the agent's service performance is mediated by perceptions of the agent's anthropomorphic cues and the quality of the information provided by the agent.

Keywords: Chatbots, Conversational Agents, Anthropomorphism, Social Presence, Human Agent Interaction, Human-Machine Cooperation, Web Service.

1 Introduction

Conversational agents are artificially intelligent computer programs that interact with users by using natural language [3][21][28]. Given ongoing advances in natural language processing and artificial intelligence, it is often suggested that these agents will become increasingly important in communicating and building relationships with consumers [10][30], especially considering the ongoing shift of services to online platforms [31]. While these agents begin to be deployed by organizations in service settings to solve problems together with consumers, less is known from a theoretical perspective about how consumers themselves perceive the interactions and cooperation with these

agents, and how these interactions influence consumer evaluations about the agent, the task, and the organization. The current study aims to help address this gap and investigates how consumer perceptions about the cooperative behavior of a conversational agent associated with perceptions of anthropomorphism, social presence and of information quality, and how these, in turn, relates to service evaluations. In line with the Joint Intention Theory [12][13], which defines cooperation as working together, establishing common grounds, and coordinatively defining roles and actions to achieve a task [22][33], this study investigates cooperation among conversational agents and consumers in the context of customer service. In summary, we propose the following research question:

RQ: How are consumer perceptions about the cooperative behavior of a conversational agent associated with evaluations regarding service performance, and to what extent do perceived anthropomorphism, social presence, and information quality mediate this relationship?

2 Theory

2.1 Cooperating with Agents in Service Settings

Relationship marketing proposes that establishing and maintaining mutually beneficial long-term relationships with consumers leads to customer satisfaction and provides long-term value to an organization [5][35]. According to the Commitment-Trust Theory [34], commitment and trust are fundamental for achieving customer satisfaction. One of the ways in which commitment and trust can be elicited is via cooperation, be it with the organization (in general), its representatives, or, we propose, with conversational agents acting on behalf of the organization.

Earlier research highlights the importance of cooperating with embodied or disembodied conversational agents. Hoffman and Breazeal [25], for example, demonstrated that interacting with collaborative robots can lead to satisfying experiences when users perceive that they established cooperative relations with the agent. Their application for cooperative relations, influenced by the Joint Intention Theory [12][13], includes having a goal-centric approach, establishing common ground, working together and coordinating the work, providing mutual support and understanding, having awareness for each other's abilities and in turn allocate tasks accordingly [25]. These features demonstrate the attributions of commitment and trust by the user, which are central to establishing cooperative relationships [25]. Following similar principles, Farooq and Grudin [17] stress that the nature of interactions between humans and computers constantly evolve into human-computer integration – cooperative relations that imply a partnership between the two. Establishing cooperation and partnership between the two provides meaning to each other's activities, in contrast, to simply taking orders. Both the human and the computer or the agent are correspondent to the situation, drawing meaning from each other's presence.

In line with the Commitment-Trust Theory [34], the Joint Intention Theory [12][13], and Hoffman's and Breazeal's [25] findings, we expect that these properties embody

the sense of cooperation as cues for cooperative behavior. Considering that cooperative behavior was found to promote efficiency, productivity, and effectiveness [12][13][34], we propose the first hypothesis:

H1: Perceiving the conversational agent as more cooperative will be positively associated with perceiving the service performance better.

2.2 Cooperation as an Anthropomorphic Quality

The media equation hypothesis explains that computers function as social actors, in the sense that people tend to apply social rules when interacting with computers (as well as agents), and to have social expectations from them [36][38][42]. Anthropomorphism, the extent to which an agent exhibits and or is perceived to have human characteristics, is an important factor influencing how a user establishes relations with an agent [15]. Moreover, cooperation is a human personality trait that is embodying qualities as social tolerance, empathy, helpfulness, and compassion [11]. We expect, therefore, that, the more that a consumer perceives their relationship with an agent as being cooperative, the higher the level of anthropomorphism that the consumer will attribute to the agent, and propose the following hypothesis:

H2: Perceiving the conversational agent as more cooperative will positively be associated with perceiving it as more anthropomorphic.

2.3 The Role of Anthropomorphism in Services

Anthropomorphic features or perceptions were found to influence consumer emotional responses to robots in service encounters [46]. Customers constantly express their need for personal interactions and for “human touch” in service procedures. Personal interaction is an essential part of human nature; therefore, it plays an extensive role in the context of services where customers address their need to receive a personal contact. The human interpersonal contact is an emotional aspect of the service procedure that includes an emotional exchange, which can be crucial for defining its quality [40]. We expect that perceiving the agent as anthropomorphic will positively influence service evaluations and, therefore, mediate the relationship between perceived cooperativeness and service performance. This leads to the following hypothesis:

H3: Perceived anthropomorphism will mediate the relationship between perceiving the agent as more cooperative and the perceived service performance.

2.4 Cooperation as a Source of Information

Cooperation also entails allocating tasks and being aware of one’s abilities [12][13]. When an agent is perceived as cooperative, it tends to be associated with the ability to provide guidance and allocate tasks, establishing mutual understanding through the information exchange [12][13][22][33]. Consequently, we expect that perceived cooperativeness will be associated with evaluations about the quality of information provided by the agent, and propose the following hypothesis:

H4: Perceiving the conversational agent as more cooperative will be positively associated with perceived information quality.

As information quality has a strong influence on consumer evaluation of service procedure performance [40], we propose that it will mediate the influence of perceived cooperativeness on service performance, and propose the following hypothesis:

H5: Perceived information quality will mediate the relationship between perceiving the agent as more cooperative and the perceived service performance.

2.5 Cooperation as a Meaningful Form of Social Interaction

Finally, as a human personality trait [11], cooperation is a meaningful form of social interaction and an integral component of team relations and human nature, as it signifies the act of working with others [6][22]. When demonstrating social presence, the feeling that another being “(living or synthetic) also exist in the world and appear to react to you” ([24] p. 265), computers are perceived as social actors, on whom people tend to impose social rules [36][38][42]. Accordingly, social presence is typically associated as human-like behavior, and agents and robots are typically perceived to be human-like when being perceived as having a prominent social presence [39]. Social robots (agents) are intended to interact with humans in socially meaningful ways [7][18][39], and since cooperation is a social behavior [6][22], we propose the following hypothesis:

H6: Perceiving the conversational agent as more cooperative will be positively associated with the perception of social presence attributed to the agent.

Social presence is often described as a positive and meaningful quality in traditional online service systems [14][19]. Lee, Jung, Kim, and Kim [32] indicate that social presence influences how users evaluate an agent in general. Other researchers [27][44] provided evidence for the role of social presence when evaluating agents in the context of service interactions, explaining that social presence is often perceived as a meaningful factor for determining positive evaluations. Accordingly, we propose that, in the context of customer services, social presence will also mediate the relationship between perceived cooperativeness and service evaluations, leading to the following hypothesis:

H7: The perceived social presence of the agent will mediate the relationship between perceiving the agent as more cooperative and the perceived service performance.

3 Methods

3.1 Design

The current study used an online experiment with conversational agents to answer the research question. Initially, a two (demonstration of cooperation: cooperative agent vs. non-cooperative agent) by two (task complexity: complicated task vs. simple task) between-subjects design has been conducted. Accordingly, four conversational agents were designed for this study according to the joint intention theory definitions [12][13] and following Hoffman and Breazeal [25] practical guidelines to demonstrate varying levels of cooperative intentions. Furthermore, manipulated tasks were designed to emphasize different levels of task complexity. As there were no significant differences

between agents in perceptions regarding task complexity and cooperation cues, we analyzed the results of all agents combined controlling for the condition to which each participant was assigned. Therefore, the study was treated as an observational study to further understand the nature of perceptions that are associated with perceiving an agent as more or less cooperative.

3.2 Population

A total of 100 participants were recruited using Amazon Mechanical Turk. To minimize the influence of culture and language, the sample was composed by U.S.-based participants who speak English as their first language. Nine participants were dropped because of technical issues when connecting to the agents, resulting in a final sample of 91 participants, with ages ranging between 20 and 63 years old ($M = 33.15$, $SD = 8.74$), 45.1% females, and with most participants having started (19.8%) or completed a 2- (14.3%) or 4-year (44%) college degree.

3.3 Stimulus

The chatbots were created using the Conversational Agent Research Toolkit [1]. The agents were designed to demonstrate the act of working together. This was established by the conversational agent using particular statements that emphasize the act of working together and personal attachment to the common goal (e.g., “To change the address we should work together”, “Let me know that you managed to complete this step”). Also, the agents demonstrated the act of allocating tasks by coordinatively defining roles and actions, according to one’s abilities, to achieve a goal [22][33]. This was established by stating that the conversational agent understands its own and the customer abilities, and allocate the different needed steps for completing the task between itself and the customer (i.e. “Since your approval is needed for changing the address, please provide the new address in the following system so that I will be able to authorize the new delivery time frame”).

The complexity of the tasks was operationalized according to the level of the task’s dynamic requirements, where complicated tasks demand higher dynamic requirements [45]. The simple task condition required participants to change the delivery address for online order with no consideration of the order status while the complicated task condition required participants to consider that the order already left the shipping center.

3.4 Measurements

Independent Variables. *Perceived Cooperation.* The variable aims to measure the extent to which the subjects perceived the agent to be cooperative according to the joint intention theory definitions [12][13] and in accordance with Hoffman and Breazeal [25] practical guidelines. Four items of perceived cooperation were adopted from Hoffman’s [26] quality metrics for human-robot collaboration. In order to fit the scope of the paper, the items were adjusted to be addressed on an agent instead of a robot. All the items were evaluated on a seven-point Likert scale. The scale of perceived cooperation was

formed using the mean index of the items and was found reliable, with Cronbach's α of .94 ($M = 5.87$, $SD = .16$).

Mediators. Perceived Anthropomorphism. Anthropomorphism stands for the extent to which an agent exhibit and imitates human characteristics [15]. It includes the attribution of a human form, human features, or human behavior to nonhuman such as robots, computers, and animals [4]. Hence, for measuring the agent's perceived anthropomorphism, the aim is to evaluate the extent of humanlike qualities presented by the agent, as perceived by the subjects. A perceived anthropomorphism scale introduced by Bartneck et al. [4] was applied. The scale includes five semantic-differential items with human and machine-related characteristics as the opposite dimensions. A higher score in this scale indicates a humanlike agent behavior, and a lower score represents a mechanical, machine-like behavior. In this study, this was measured on a seven-point scale. In order to fit this research topic, the last item "Moving rigidly/Moving elegantly" was changed from "moving" to "communicating". The scale was found reliable, with Cronbach's α of .94 ($M = 4.93$, $SD = .21$).

Social Presence. For measuring how the subjects perceived the social presence of the agent, a perceived social presence scale with five items was adapted from Lee, Jung, Kim, and Kim [32]. The items were adjusted for the scope of the study addressing them to the agent. The scale was found reliable, with Cronbach's α of .91 ($M = 5.81$, $SD = .27$).

Principal axis factoring analysis was conducted to validate that the items of the variable 'perceived anthropomorphism' and the items of the variable 'perceived social presence' load under two unique factors and do not converge. The results entail two unique factors with an eigen value of above one. Following the results of an oblique rotation, the five items of perceived anthropomorphism were loaded under the first factor, explaining 63.34% of the variance in the factor with an eigen value of 6.33. The five items of perceived social presence were loaded under the second factor, explaining 15.22% of the variance in the factor with an eigen value of 1.52. Accordingly, we can confirm that the items of both of the variables, 'perceived anthropomorphism' and 'perceived social presence' were loaded under two unique factors and do not demonstrate evidence of strong convergence.

Perceived Information Quality. The variable is aimed at measuring the perceptions of the customer over the quality of information and data exchange provided by the agent [43]. The scale was adopted from Suh, Greene, Israilov & Rho [43] using four items evaluated on a seven-point Likert scale. The items were slightly adjusted to fit the scope of this current research, addressing "service provider" as "agent". The scale was found reliable, with Cronbach's α of .91 ($M = 5.82$, $SD = .13$).

Dependent Variable. Perceived Service Performance. Perceived service performance is a single manifest self-reported measure that is intended to evaluate the level of service quality provided by the agent as perceived by the subject. Using a single question, the

subjects were requested to rate the service provided by the agent on a seven-point Likert scale.

Control Variables. The questionnaire included measures controlling for affinity with technology (adapted from Edison & Geissler, [16]), need for cognition (adapted from Cacioppo et al. [9]), and demographic variables including age and gender.

3.5 Procedure

The participants executed a service-oriented task, changing the address of an online order in an online flower shop by chatting with one of the four conversational agents designed for this study. For stimulating the act of cooperation, the agents allocated part of the task to the participants, instructing them to independently check and approve the change on a web-based platform. After the task, participants completed a questionnaire evaluating the agent in terms of perceived cooperation, perceived anthropomorphism, social presence, and the quality of information provided. Moreover, the participants evaluated the provided service performance. Finally, the participants evaluated their affinity with technology and need for cognition, and answered demographic-related questions disclosing their age, gender, occupation, nationality and current residing country. After finishing their participation in the online experiment, the participants were debriefed about the study.

4 Results

A mediation analysis was conducted using Model 4 of PROCESS Macro 3.2.01 to SPSS [23] to investigate the research hypotheses. The model included perceived cooperation as the independent variable, perceived service performance as the dependent variable, and perceived anthropomorphism, information quality, and social presence as mediators. Moreover, the model controlled for the confounding influence of the participants' age, gender, affinity for technology, need for cognition, and for the agent they used during the manipulation.

4.1 Direct Association Between Perceived Cooperation and Perceived Service Performance

The results indicate that in step 1 of the mediation model, perceived cooperation was significantly related to the outcome variable perceived service performance; $R=.76$, $F(7, 83)=16.40$, $p < .001$, with the model explaining 58% ($R^2 = .580$) of the variance in perceived service performance. The regression of perceived cooperation on perceived service performance was significant, $b=.75$, $t(83)=9.94$, $p < .001$, 95% CI [.60,.90] when cancelling the mediators' effect in the model.

4.2 Direct Association Between Perceived Cooperation and the Mediators

Step 2 showed that perceived cooperation was significantly related to the proposed mediators: perceived anthropomorphism ($R=.66$, $F(7, 83)=9.28$, $p<.001$), perceived information quality ($R=.85$, $F(7, 83)=31.69$, $p<.001$), and perceived social presence ($R=.90$, $F(7, 83) = 52.81$, $p<.001$). The model explains 43.9% ($R^2=.439$) of the variance in perceived anthropomorphism, 72.8% ($R^2=.728$) in perceived information quality, and 81.7% ($R^2=.817$) in perceived social presence. The regressions of perceived cooperation on the mediators, perceived anthropomorphism ($b=.75$, $t(83)=7.77$, $b^*=.65$, $p<.001$, 95% CI [.56,.94]), perceived social presence ($b=.83$, $t(83)=18.35$, $b^*=.88$, $p<.001$, 95% CI [.74,.93]), and perceived information quality ($b=.83$, $t(83)=14.39$, $b^*=.84$, $p<.001$, 95% CI [.71,.94]), were significant. Therefore, H2, H4, and H6 are supported.

4.3 Direct Association Between the Mediators and Perceived Service Performance

Step 3 showed that the overall model was significant; $R=.84$, $F(10, 80)=18.93$, $p<.001$, with the model explaining 70.3% ($R^2=.703$) of the variance in perceived service performance. Controlling for perceived cooperation, The mediators of perceived anthropomorphism ($b=.16$, $t(80)=2.06$, $b^*=.18$, $p=.043$, 95% CI [.01,.31]), and perceived information quality ($b=.67$, $t(80)=5.24$, $b^*=.63$, $p<.001$, 95% CI [.42,.92]) were found to be significant. The mediator perceived social presence ($b=-.27$, $t(80)=-1.60$, $b^*=-.24$, $p=.114$, 95% CI [-.60,.07]), controlling for perceived cooperation, was not significant. Hence, H7 is not supported.

4.4 Indirect Relationship Between Perceived Cooperation and Perceived Service Performance

Step 4 of the analyses revealed that, when controlling for the mediators, perceived cooperation was not a significant predictor of perceived service performance, $b=.30$, $t(80)=1.85$, $b^*=.29$, $p=.069$, 95% CI [-.02,.63]. Hence, H1 is not supported. Mediation analyses based on 5000 bootstrapped samples using bias-corrected and accelerated 95% confidence intervals [41] showed that perceived cooperation had a significant total effect on the perceived service performance ($c=.75$, $SE=.08$, $p<.001$, 95% CI [.60,.90]), a not significant residual direct effect ($c'=.30$, $SE=.16$, $p=.069$, 95% CI [-.02,.62]), and significant indirect effects through perceived anthropomorphism ($ab=.12$, $SE=.05$, BCa CI [.01,.23]) and perceived information quality ($ab=.55$, $SE=.14$, BCa CI [.21,.74]). The indirect effects are significantly different from zero at $p<.05$. Perceived anthropomorphism ($ab_{cs}=.11$, $SE=.05$, BCa CI [.01,.21]) and perceived information quality ($ab_{cs}=.53$, $SE=.13$, BCa CI [.20,.73]) fully mediated the total effect between perceived cooperation and perceived service performance. Therefore, H3 and H5 are supported.

5 Discussion

This study was aimed at investigating how consumer perceptions about the cooperative behavior of a conversational agent associated with perceptions of anthropomorphism, social presence and of information quality, and how these, in turn, relates to service evaluations. The results of the study entailed a direct positive association between perceiving an agent as more cooperative and perceiving it as more anthropomorphic and to provide better information quality. Moreover, these were found to positively mediate consumers' service evaluations. A direct positive association was also found between perceiving an agent as more cooperative and perceiving it as more socially present. Nevertheless, contrasting to perceived anthropomorphism and perceived information quality, there was no evidence for an indirect association between perceiving an agent as more cooperative and consumers' service evaluations through perceived social presence. In addition to these, there was no evidence for a direct association between perceiving an agent as more cooperative and evaluating the service performance provided to be better.

Table 1. Summary of the results

Hypotheses	Type of relationship	Results
H1: Perceiving the conversational agent as more cooperative will be positively associated with perceiving the service performance better.	Direct	Rejected
H2: Perceiving the conversational agent as more cooperative will positively be associated with perceiving it as more anthropomorphic.	Direct	Supported
H3: Perceived anthropomorphism will mediate the relationship between perceiving the agent as more cooperative and the perceived service performance.	Indirect	Supported
H4: Perceiving the conversational agent as more cooperative will be positively associated with perceived information quality.	Direct	Supported
H5: Perceived information quality will mediate the relationship between perceiving the agent as more cooperative and the perceived service performance.	Indirect	Supported
H6: Perceiving the conversational agent as more cooperative will be positively associated with the perception of social presence attributed to the agent.	Direct	Supported
H7: The perceived social presence of the agent will mediate the relationship between perceiving the agent as more cooperative and the perceived service performance.	Indirect	Rejected

5.1 The Value of Information Quality in Service Interactions with Conversational Agents

The first key finding is that the quality of the information provided by the agent will be the most influential when evaluating an agent's service performance following perceptions regarding its cooperative behaviour. In line with the Joint Intention Theory features of cooperation [12][13], when an agent is perceived as more cooperative, consumers perceive it to provide a better quality of information. Consequently, the outcomes of the service procedure are evaluated to be better. These findings not only validate earlier research on the importance of information quality (e.g., [40]), but also highlight how experiences that elicit cooperation between consumers and conversational agents are relevant for customer service contexts, and our understanding of interactions with computers and technology in general.

As cooperative interactions are aimed at creating shared experiences [12][13], when customers perceive the interaction as more cooperative, they are possibly finding the information to be more accessible. Therefore, they evaluate the information provided more positively. This is substantial in the context of using conversational agents in service settings. Since the use of this technology is relatively novel [21], customers tend to perceive it as a “black box” [8] and experience a certain confusion. Eliciting more cooperative service interactions between online customers and agents can potentially overcome the confusion that is associated with the novelty of this technology. Even without understanding the mechanism of the agent, a customer can have a better service experience by having the feeling of being an active part of the solution, receiving valuable information, and not being passive in the interaction.

5.2 Associating Cooperation with Anthropomorphism

The second key finding entails that perceiving the agent as more cooperative is associated with perceiving it as more anthropomorphic, and in turn, perceiving the service performance being better. This finding extends earlier research (e.g., [46]) and highlights the role that anthropomorphism, “the assignment of human traits and characteristics to computers” ([37], p. 82), has in services (see [40]). In line with the trajectory of human personality traits [11], this finding confirms that anthropomorphism is associated with perceptions of cooperation. As such, following the media equation hypothesis [36][38][42], this finding demonstrates how customers evaluations of the agents are associated with them experiencing the agents as more anthropomorphic or human-like.

5.3 To What Extent is Social Presence Relevant for Service Interactions with Conversational Agents?

The third key finding of this study was the lack of association between perceived service performance and social presence. This is striking as while one could expect that the influence of an agent's social presence would be complementary or similar to the agent's anthropomorphic presence [39], there was no evidence for this in the current

study. It should still be noted that perceiving the agent as more cooperative was indeed associated with higher levels of social presence. However, in contrast to previous studies (e.g., [27][44]), social presence perceptions were not seen to be reflected in customers' service evaluations, at least as a mediator for cooperation.

These results, on the one hand, provide another level of nuance to previous empirical evidence that highlights the importance of social presence positive in traditional online service systems (e.g., [14][19]). On the other hand, these results give evidence to the more recent propositions by Go and Sundar [20] that suggest that higher levels of message interactivity can compensate for an agent's impersonal nature (low on anthropomorphic cues). Hence, it could be said that certain factors as message interactivity or, - in the context of the current study - information quality, can play a more substantial role in customers' service evaluations. Moreover, these results raise questions about the boundary conditions for the relevance of social presence in service interactions and online service quality. These results also reinforce the suggestions made by earlier research (e.g., [2][29]) to explore in more detail how to best measure the concepts of anthropomorphism and social presence in these new contexts.

5.4 Limitations

Finally, this study has some limitations. The intended manipulations for cooperation and task complexity in the experimental conditions were not successful according to the manipulation checks. Cooperation is a complex concept that has many theoretical and pragmatic definitions. While this study conceptualizes cooperation with agents by addressing the joint intentions theory [12][13], future research should address other theories from various disciplines for better understanding the true nature of cooperation. The practical guidelines for cooperation that were applied from Hoffman and Breazeal [25] were unsuccessful in stimulating the act of cooperation when applied in a dialogue interface and not with a physical social robot. Accordingly, future research should explore and redefine the indicators for cooperation with agents in dialogue interface and address the attributes in language and conversation that promote acts of cooperation. Moreover, the issues with the manipulations, therefore, restrict the study from drawing any causal inferences, as it can merely show the associations of customers perceptions of the agents. These limitations notwithstanding, the findings presented in this study can serve as a baseline for future chatbot research, highlighting a promising role for information quality, anthropomorphism and cooperation for in human-machine communication in service contexts.

6 Conclusions

The findings of this study further explain how consumers themselves perceive the interactions and cooperation with these agents, and how these interactions influence consumer evaluations about the agent. It extends the Joint Intention Theory [12][13], providing evidence for the implications of eliciting cooperation among conversational agents and consumers in the context of customer service. Furthermore, the study

demonstrates the role of cooperation in online marketing interactions, especially when conversational agents are involved.

The study draws attention to the importance of information quality when integrating novel autonomous technologies in service settings and extends previous findings on the matter (e.g., [40]). In addition to it, the study demonstrated how eliciting cooperation can be associated with establishing common grounds for evaluating information better [12][13]. Moreover, it extends earlier research (e.g., [2][29]) regarding the role of social presence in interactions with conversational agents and reinforces the need for this concept to be further studied, especially in contrast and/or in combination with the notion of anthropomorphism. Finally, the study has managerial implications, providing support for a better understanding of how consumers perceive service interactions with conversational agents, and how these should be implemented accordingly.

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