



# Convergence of Consumers' Views in Decentralized E-Commerce Based on HK Model

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**Abstract.** In order to study the evolution process and influencing factors of consumers' views in decentralized e-commerce, Based on the traditional view of evolving HK model, this paper puts forward some improvements: Starting from the individual heterogeneity of consumers, This paper studies the game process and viewpoint updating rules among interactive individuals with different prestige, Through empirical analysis, it is found that: Consumers can achieve consumption convergence in different ranges after continuous evolution, and the maintenance of reputation and trust established daily is helpful to achieve a higher degree of viewpoint convergence, which has certain guiding significance for merchants in choosing talent cooperation, customer mining, enhancing consumer stickiness and improving corporate image and competitiveness.

**Keywords:** Trust · Evolutionary game · Prestige · Convergence of views

## 1 Introduction

### 1.1 Research Background

Nowadays, the popular decentralized e-commerce network provides the public with opportunities for social activities such as information sharing, product trading and business collaboration anytime and anywhere. At the same time, this large-scale online open social network is complex, dynamic and virtual. Therefore, users face many risks when choosing target nodes to follow in the network. Only when consumers gain the trust and recognition of other consumers can they realize the convergence of consumers' views.

### 1.2 Related Research

In the socialized e-commerce network, there are many factors that affect consumers' trust. Walczuch R and others [1] divide the factors affecting trust into individual factors, cognitive factors, experience factors and knowledge factors. Gefen D) [2] believes that trust between people is influenced by the degree of relationship with each other and personal trust tendency, Midlarsky shows that older people are more willing to choose trust than younger people [3]; Cox takes people with different financial resources as

experimental objects, and the results show that people with large financial resources are more willing to choose trust [4, 5]. Nancy R showed through experiments that women are more likely to choose trust than men [6]. The influencing factors still include the reputation of merchants, and the important indicator of website quality is added to the website factors, and it is also recognized for the first time that third-party authentication is also an influencing factor [7]. Alessandra Cassar and others analyzed for the first time the impact of network structure and information possession degree formed at three nodes on participants' trust and trust [8].

### 1.3 Research Objectives and Work

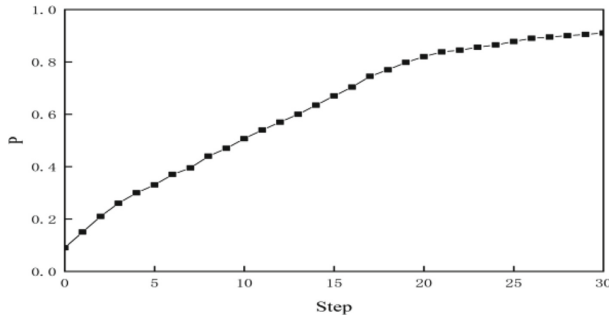
The principle of evolutionary dynamics not only provides help for the study of coordination and control, but also promotes the study of evolutionary game on complex networks at home and abroad [9–11]. In order to enrich the research content, this paper constructs a consumer evolutionary game model based on system dynamics, regards consumers as the main body of the game, takes bounded rationality hypothesis and local interaction as the premise, and describes and predicts the changing trend of group views of bounded rationality individuals and their convergence degree when the system reaches equilibrium and stability based on HK model.

However, the traditional HK model does not consider the difference of real consumers' prestige, it is considered that everyone within the threshold of opinions has equal influence weight on their opinions, However, from the perspective of individual consumers in the decentralized e-commerce network, Some consumers have opinion leader trait. Based on the above analysis, this paper will propose improvements on the basis of the traditional HK model.

## 2 Rules for Updating Consumer Views

Considering that some people in the real consumer group have high prestige  $P$ , Its views are more authoritative in the eyes of other consumers, Assuming that the more neighbors a node has in the network, the higher its reputation, That is, the greater the degree, the higher the reputation, so the degree is used to measure the reputation of consumer  $i$  at time  $t$  is  $P_i^t = \frac{k_i^t}{N}$ ,  $P_i^t \in (0, 1)$ , where  $N$  is the number of consumers who meet the interaction conditions with consumer  $i$  in the consumer network that buys the same commodity, that is, within the viewpoint threshold, and  $k_i$  is the number of neighbors connected to consumer  $i$  in this network is degrees.

Here, the acceptance function  $e$  is introduced to express the degree of acceptance of each other's views. Because of different prestige, the acceptance degree of consumer  $i$  to consumer  $j$  is different from that of consumer  $j$  to consumer  $i$ . That is  $e_{ij} \neq e_{ji}$ , combined with the actual interaction influence of consumers in decentralized e-commerce consumer network, the acceptance degree of consumer  $i$  to consumer  $j$  is  $e_{ij} = \frac{|P_i - P_j|}{P_i}$ , and the acceptance degree of consumer  $j$  to consumer  $i$  is  $e_{ji} = \frac{|P_i - P_j|}{P_j}$ , Then, the influence weight  $w_{ij} = \frac{e_{ij}}{\sum_{j \in Q(i,s)} e_{ij}}$  of consumer  $j$  on consumer  $i$ 's viewpoint is obtained. Therefore, the update rule of consumer  $i$ 's viewpoint at  $t + 1$  is as follows:  $S_i^{t+1} = \sum_{j \in Q(i,s)} w_{ij} S_j^t$ , In



**Fig. 1.** The influence of prestige on the step size of viewpoint evolution

which,  $w_{ij}$  indicates the influence weight of consumer  $j$  on the change of consumer  $i$ 's opinion, and  $S_j^t$  indicates the opinion value of consumer  $j$  at time  $t$ .

### 3 Convergence Analysis of the Improved Model

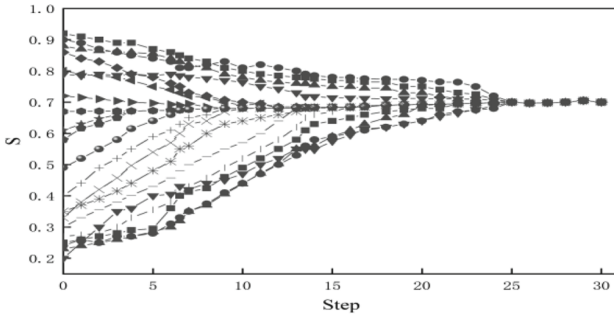
Compared with the traditional HK model, the above-mentioned optimized model has stronger convergence under the influence of consumer prestige. The experiment is carried out with  $\varepsilon=0.1$  and  $N=300$ . In order to ensure the credibility of the experiment, 50 groups of experiments are carried out to get Fig. 1.

The Fig. 1 shows that people with high prestige  $P$  have small acceptance  $e$  of other people's opinions when playing games, which shows that the existence of prestige shortens the evolution step of the system's opinions and contributes to the convergence of opinions. People with high prestige have low acceptance of other people's opinions, so the evolution step is long; However, people with low prestige tend to accept other people's views, and the evolution time of convergence is short.

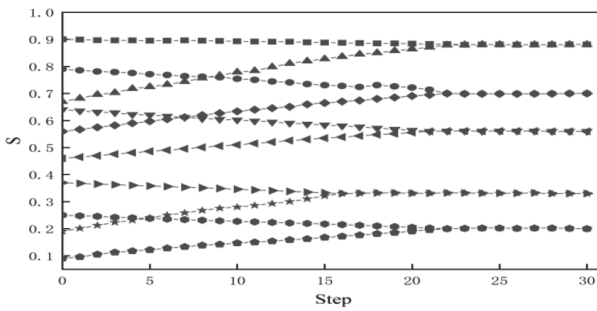
### 4 Empirical Study

The larger the individual prestige difference in the viewpoint game in the real consumer network, the easier it is for the party with relatively low prestige to accept the other party's viewpoint. By sorting out the collected data, in order to make the demonstration simpler, set the prestige difference greater than 0.5 as the difference is larger, and the prestige difference less than 0.5 as the difference is larger, taking  $\varepsilon=0.1$  and then explore the influence of prestige on consumers' views in the consumer network (Fig. 2).

Figure a shows the experimental results with large difference in consumer prestige, and multiple groups of game opponents finally form a viewpoint cluster. Consumer interaction is the basic channel to influence consumers' opinions. In the process of opinion game, most consumers will choose to follow the opinions of people with high prestige. Taking the Douyin platform as an example, online celebrity Big V has attracted much attention, and its fans are very large. Therefore, the opinions and opinions of Big V are more likely to affect the choices of other consumers.



(a)



(b)

**Fig. 2.** The Influence of Reputation Difference on the Step Size of Viewpoint Evolution

Figure b shows the experimental results with small difference in consumer reputation. There is no convergence between the views of both sides in multiple groups of games. It's just the convergence of views within the group. Considering the small reputation difference in the real consumer network, Consumers with similar prestige, For example, between big Vs with equal prestige or ordinary consumers with equal prestige, Acceptance of each other is far less than adherence to one's own views. The step length of view convergence between the players with higher prestige and the players with lower prestige is longer than that of the players with medium prestige.

## 5 Conclusions

Based on Combining the decentralized e-commerce consumer network described above, In the process of interacting with other consumers, In order to make the best decision for yourself, Will constantly update their views through games from the aspects of prestige and relationship, It causes the convergence of consumers' views on the same commodity and realizes the convergence evolution of consumers' views driven by trust choice. The evolution process will be affected by many factors. The final decision-making process is closely related to the above-mentioned consumer reputation, acceptance of other people's views and adherence to their own views.

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