

The study of the effect of online review on purchase behavior

Comparing the two research methods

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Online review
on purchase
behavior

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Abstract

Purpose – The purpose of this paper is to explain the difference and connection between the network big data analysis technology and the psychological empirical research method.

Design/methodology/approach – This study analyzed the data from laboratory setting first, then the online sales data from Taobao.com to explore how the influential factors, such as online reviews (positive vs negative mainly), risk perception (higher vs lower) and product types (experiencing vs searching), interacted on the online purchase intention or online purchase behavior.

Findings – Compared with traditional research methods, such as questionnaire and behavioral experiment, network big data analysis has significant advantages in terms of sample size, data objectivity, timeliness and ecological validity.

Originality/value – Future study may consider the strategy of using complementary methods and combining both data-driven and theory-driven approaches in research design to provide suggestions for the development of e-commerce in the era of big data.

Keywords Big data, Crowd science, Online purchase behavior, Psychology method

Paper type Research paper

1. Introduction

The development of e-commerce and the popularity of the internet, more and more people are accustomed to online shopping, they choose to buy commodities and services what they need on online. According to a report on January 2019, 74.8 per cent of netizens use online shopping. Online purchasing has become the main form of daily consumption. In this context, the study of online consumers' purchase behavior has become the main field of consumer behavior. According to a survey report, 97.7 per cent of consumers refer to relevant reviews before online purchase. These reviews, as feed-backs of buyers, largely affect the purchase intention or purchase behavior of potential consumers. Thus, online reviews can serve as a promising data source to predict online purchase behavior. In addition, the risk perception of online purchase (when faced a buying situation, a consumer perceives a certain degree of risk involved in choice of a particular brand and how to buy it) also affects the purchase intention or decision (Sun *et al.*, 2006). Therefore, risk perception is also a psychological variable that affects consumer purchase behavior (Lawrence and O'Connor, 2000). Of course, the impact of this information on purchase intentions will be



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different which also depending on the type of commodities. Consumption of some commodities is common, while others have personal characteristics, making the impact of online reviews and perceived risk different.

Psychologists often use behavioral experiments in the laboratory setting to study the influential factors of consumers' consumption decisions. Most of the methods adopted to first propose research hypotheses under the guidance of theories or based on existing studies, and then test these hypotheses under strictly controlled experimental conditions in the laboratory. For example, manipulate the proportion of positive online reviews, risk level and commodity types to explore the purchase intentions under these conditions, and then draw causal research conclusions. The biggest advantage of psychological behavioral research in the laboratory is repeatability, can withstand repeated tests and can get causal inferences.

In recent years, with the popularity of online purchase and the rapid development of computer computing capabilities, people can use digital traces of online purchase to analyze online purchase behaviors to infer the factors that affect people's purchasing decisions – analysis based on big data. However, it tracks commodities. For example, the actual sales volume of different types of commodities can be seen by the proportion of positive online reviews and risk perception level of commodities. The advantages of this method are:

- this kind of studies can use people's actual purchase rather than purchase intention; and
- Researchers can obtain a large amount of consumption data, without having to collect it with great effort.

At the same time, these data are real, real-time, and can be verified repeatedly. However, the conclusion is based on correlation analysis and is about the correlation between the variables. The reasons behind the inference are not clear. Meanwhile, this kind of studies are the research about the commodity rather than the persons who do the purchase.

This study attempts to use two research methods and compare the differences between them from the perspective of methodology, and hope to put forward a new method to combine theory-driven with data-driven to study crowd science, with the aim of improving efficiency of the transaction, making all parties involved in the transaction taking full advantage of the online information to meet their needs.

1.1 Behavioral experiment method in psychology

The goal of scientific psychology is to understand human behavior. Behavioral experiment method is mainly used by researchers to manipulate or design different experimental conditions and observe the differences of behavioral results of subjects under different experimental conditions, so as to test whether the experimental conditions have significant influence on the results. The main advantages of this method are:

- Causality can be discussed. As the experimental method controls the influence of other irrelevant factors, it can be reasonably trusted to determine whether the difference in behavior results is caused by experimental conditions (i.e. independent variables), so as to make causal inference. In view of the importance of causality in research, experimental method also occupies an important position in scientific methodology,
- Repeatability and verifiability. Experimental conditions of experimental method are designed by researchers in advance, so researchers have strong initiative and control. In particular, behavioral experiments have strict experimental design

requirements and implementation procedures, and detailed disclosure is also made about the selection of experimental subjects, measurement tools and methods of all indicators or variables, and specific operational procedures. Therefore, the experimental method has good repeatability and testability.

1.2 Studies about online purchase behavior in psychology

An online review is a positive, neutral or negative statement, which is created by a future, actual or former consumer about a commodity or a company, and made available to the public through the internet. A growing number of researchers begin to focus on the relationship between quality of online reviews and the purchase intention. However, existing studies have found that the purchase intention of consumers is influenced by the online reviews' quantity, which is positively correlated with the purchase intention (Lawrence and O'Connor, 2000). Consumers tend to observe the proportion of positive and negative online reviews as well. The more positive reviews lead to the stronger purchase intention (Zheng, 2008). However, consumers place greater emphasis on negative information in deciding to purchase (Senecal and Nantel, 2004). Negative impulses attract more attention and act as stronger stimuli than positive ones. The work shows that consumers' intention declines when the proportion of negative online reviews about a given commodity rises. When a potential consumer is exposed to a large number of negative online reviews, a negative expectation of the commodity is formed (Chen *et al.*, 2012). Based on the existing studies, this work will further explore the impact of online reviews (positive/neutral/negative) on purchase behavior.

There is copious commodity classifications associated with online reviews. A frequently used classification is that of search and experience commodities, which is used by researchers to evaluate consumer purchase intention (Nelson, 1974). A search commodity is one where information on commodity attributes is easily obtained by consumers without having to make a purchase in advance (Hao *et al.*, 2009). Therefore, the information obtained in a search commodity is usually objective and easily compared with other similar commodities, cameras, cell phones and computers being common examples (Li and Ren, 2017). On the other hand, an experience commodity is a commodity whose attributes are difficult to obtain. Consumers frequently want to feel and experience the commodity prior to any assessment. Thus, information pertaining to these commodities is mostly subjective, and evaluations conducted are based on previous experience (Hao *et al.*, 2009). Typical examples of experience commodities are hotels, airlines, restaurants and other services (Lim *et al.*, 2016). Consumers behave quite differently when looking for information on these two types of commodities: they tend to seek more information on other reviews concerning an experience commodity than on a search commodity (Schlosser, 2011). However, some studies have pointed out that consumers are more dependent on the information provided by online reviews when purchasing search commodities (Brodie *et al.*, 2013). The results of previous studies on the relationship between commodity types and purchase intention are not consistent. Therefore, this study would explore how commodity types affect purchase behavior in the real online shopping context.

When faced a buying situation, a consumer perceives a certain degree of risk involved in choice of a particular brand and how to buy it. Bauer first introduced the perceived risk concept to consumer behavior research to explain such phenomena as information seeking, brand loyalty, opinion leaders, reference groups and pre-purchase deliberations (Bei *et al.*, 2004). Perceived risk is a fundamental concept in consumer behavior that implies that consumers experience pre-purchase uncertainty as to the type and degree of expected loss

resulting from the purchase and use of a commodity (Ma, 2011). According to the S-O-R theory, consumers will be stimulated externally when they shop on the internet, which will change consumers' psychology and perception and then affect their purchase behavior. Among them, risk perception is the most influential factor. Perceived risk determined the consumer's attitude toward online purchase, which subsequently affected willingness to purchase and actual purchase behavior (Zhao and Ji, 2010). Previous studies have found that risk perception is negatively correlated with purchase intention (Zhao and Ji, 2010). The traditional inventory used to measure perceived risk will not be applicable to measuring internet consumer's perceived risk. Studies have pointed out that shopping risk perception of consumer network refers to consumers' perception and judgment of possible adverse consequences brought by their shopping behaviors in the process of shopping network. Online shopping consumer's perceived risks consist of five dimensions:

- (1) perceived store-opportunism risk;
- (2) perceived commodity-performance risk;
- (3) perceived financial risk;
- (4) perceived delivery risk; and
- (5) perceived privacy risk (Yu, 2016).

Online risk perception of consuming refers to consumers' perception and judgment of possible adverse consequences brought by their shopping behaviors in the process of shopping (Yu, 2016). Therefore, this study aims to explore how network risk perception influences purchase behavior in the network shopping context.

1.3 Big data analyze

More than ever before, the amount of data about consumers, suppliers and commodities has been exploding in today consumer world referred as "Big Data". In addition, more data is available for the consumers from multiple sources including social network platforms. To deal with such amount of data, a new emerging technology "Big Data Analyze" is explored and employed for analyzing consumer behaviors and searching their information needs. Consumer behavior analysis is concerned with the study of inter actions among the consumers, commodities and operations such as purchasing, saving, brand choice, etc. Moreover, consumers are no longer what they used to be. Today's consumers have evolved beyond being merely "buyers". So, more insights information is necessary for analyzing a consumer behavior. In this aspect, Big Data has become a central role for making data driven decision making processes. However, there is no recognized concept to define the big data (Dodds, 1991). Big data is usually considered as the data set that cannot be transmitted, accessed, processed and served in an endurable time period by existing communication and network systems (Li *et al.*, 2018). Some researchers considered big data was generated by the interaction and integration of "human, machine and object". The typical steps involved in studying big data sets: data preprocessing, dimensionality reduction and construction of predictive models.

There is an abundance of methods that can be used to build prediction models based on large data sets, ranging from relatively sophisticated approaches, such as deep learning, neural networks, probabilistic graphical models or support vector machines, to much simpler approaches, such as linear and logistic regressions. In the explanatory approach to science, the ultimate goal is to develop a mechanistic model of the data-generating process that gives rise to the observed data.

Then, combined with psychological empirical methods, how should we view psychological research based on big data analysis technology? Unfortunately, there is still very little systematic thinking on the methodology perspective of network big data psychology.

To explain the difference and connection between the network big data analysis technology and the psychological empirical research method, this study analyzed the data from laboratory setting first, then the online sales data from Taobao.com to explore how the influential factors, such as online reviews (positive vs negative mainly), risk perception (higher vs lower) and commodity types (experiencing vs searching), interacted on the online purchase intention or online purchase behavior.

2. Empirical study

2.1 Study 1. The influence of consumer reviews and commodity types on online purchase intention

2.1.1 Purpose. The purpose of this research is to analyze the role of consumer online reviews and commodity types on purchase intention by simulating online purchase behavior from the laboratory setting.

2.1.2 Methods.

2.1.2.1 Participants. We randomly sampled 120 students from Shandong Normal University and 76.7 per cent were females. The mean age of the participants was 22.03 years ($SD = 1.65$).

2.1.2.2 Design. We used 2 (Online reviews: high ratio of positive reviews/high ratio of negative reviews) \times 2 (commodity types: search commodity/experience commodity) in a between-subjects design. The dependent variable is consumer purchase intention.

2.1.2.3 Material. Four psychological researchers selected USB flash disk, earphone and sound as search commodities, and clothing, facial cleanser and shoes as experience commodities. To avoid the influence of brand, price and other factors on subjects' perception, the experimental materials only present the positive and negative proportion of commodity reviews. Among them, the material of high ratio of positive reviews' group presented that: supposing you want to buy a commodity, 73 per cent of consumers gave the commodity positive reviews and 27 per cent gave negative reviews, and please make your decision according to the actual situation. The material of high ratio of negative online reviews' group presented that: supposing you want to buy a commodity, 73 per cent of consumers gave the commodity negative reviews and 27 per cent gave the commodity positive reviews, and please make your decision according to the actual situation.

2.1.2.4 Research process. This study was carried out in a quiet context. The subjects were asked to imagine themselves in the network shopping situation and assumed that they are going to buy a commodity. Then the subjects were presented the information of commodity pictures and online reviews. After they read the experimental materials, they were asked to fill in the purchase intention scale.

We adopted the purchase intention scale modified by [Ma \(2011\)](#). Participants rated the way they felt on a seven-point Likert scale ranging from 1 = very little to 7 = a great extent. Cronbach's alpha for this scale was 0.95.

2.1.3 Results. We performed statistical analyses with online reviews and commodity types as the independent variables, the dependent variable as consumer purchase intention. The results are shown in [Table I](#).

The results of non-repeated measures Anova ([Table II](#)) shows that the main effect of online reviews was significant ($F(1,116) = 238.14, p < 0.001, \eta_p^2 = 0.67$); and the main effect of commodity types is not significant, ($F(1,116) = 0.91, p > 0.05, \eta_p^2 = 0.01$). The interaction

between online reviews and commodity types is significant positively influence purchase intention. ($F(1,116) = 5.93, p < 0.05, \eta_p^2 = 0.05$).

According to the results of simple effect analysis (Figure 1), there is a significant difference between the online purchase intention of search commodities and experience commodities in the context of high ratio of positive online reviews ($p < 0.05$), and the purchase intention of experience commodities is significantly higher than that of search commodities. No significant difference was found in purchase intention between search commodities and experience commodities ($p > 0.05$) in high ratio of negative online reviews.

Study 1 found that online reviews and commodity types provided a significant association with online purchase intention. In the context of high ratio of positive review, the

Table I.
Descriptive statistics
($M \pm SD$)

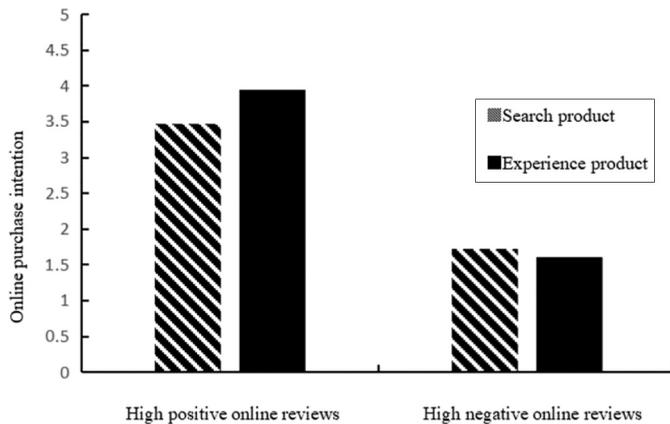
	Search commodity	Experience commodity	Total
High ratio of positive online reviews	3.53 ± 0.6 ($n = 30$)	4.01 ± 0.74 ($n = 30$)	60
High ratio of negative online reviews	1.72 ± 0.8 ($n = 30$)	1.51 ± 0.79 ($n = 30$)	60
Total	60	60	120

Table II.
Analysis of variance
of online reviews x
commodity types on
purchase intention

Source of variation	III Sum of square	df	MS	F
Correction model	143.91	3	47.97	81.66***
Interception	869.57	1	869.57	1,480.27***
Online reviews	139.89	1	139.89	238.14***
Commodity types	0.53	1	0.53	0.91
Online reviews × Commodity types	3.48	1	3.48	5.93*
Error	68.14	116	0.58	
Total	1081.62	120		
Adjusted total	212.05	119		

Note: * $p < 0.05$

Figure 1.
The interaction
among of online
reviews and
commodity types on
consumer purchase
intention



online purchase intention of experience commodities is significantly higher than that of search commodities. There is no significant difference in purchase intention between search commodities and experience commodities in the context of high ratio of negative reviews. Studies have found that risk perception is negatively correlated with consumer online purchase intention, and the higher consumer risk perception is, the lower their purchase intention will be (Chatterjee, 2001; Zheng, 2008). Risk perception as an important psychological variable that affects consumer purchase behavior, has been widely concerned by researchers (Lawrence and O'Connor, 2000). Therefore, Study 2 will focus on the impact of risk perception on online purchase intention of experience commodities.

2.2 Study 2. The influence of risk perception on online purchase intention of experience commodities

2.2.1 Purpose. Firstly, the purpose of this research was to examine the influence of online reviews on purchase intention of experience commodities by simulating online purchase behavior in a laboratory setting. Secondly, this study investigated the influence of risk perception on the relationship between online reviews and purchase intention of experience commodities.

2.2.2 Methods.

2.2.2.1 Participants. The sample consisted of 120 unrelated healthy Chinese college students from Shandong Normal University, and 69.2 per cent were females. The mean age of the participants was 21.14 years (SD = 1.69).

2.2.2.2 Design. We used 2 (Online reviews: high ratio of positive online reviews/high ratio of negative online reviews) \times 2 (Risk perception: low risk perception level/high risk perception level) in a between-subjects design. The dependent variable is consumer purchase intention.

2.2.2.3 Material. This study chose the same clothing, facial cleanser and shoes as experience commodities as in Study 1. Three decision-making tasks are used in this study. They are described in the following four different situations: high ratio of positive online reviews \times high risk perception, high ratio of positive online reviews \times low risk perception, high ratio of negative online reviews \times high risk perception, and high ratio of negative online reviews \times low risk perception. For example:

[. . .] high ratio of positive online reviews \times low risk perception: assuming that you want to buy this kind of facial cleanser in Taobao.com, and 73 per cent of the consumers gave high ratio of positive online reviews to this commodity. Meanwhile, they think that this store provides a good service, clear logistics tracking, which are considered as a low risk perception. Please fill in the purchase intention scale according to your actual situation.

2.2.2.4 Research process. This study was carried out in a quiet context. The participants were randomly assigned to four different situations. The subjects were asked to imagine themselves in the network shopping situation and assumed that they were going to buy a commodity. Then the subjects were presented the information. After they read the experimental materials, they were asked to fill in the purchase intention scale.

2.2.3 Results. This paper conducted descriptive statistical analysis with online reviews and risk perception as the independent variables, and online purchase intention as the dependent variable. The results are shown in Table III.

The results of analysis of variance for non-repeated measures (Table IV) shows that the main effect of online reviews was significant ($F(1,116) = 399.78, p < 0.001, \eta_p^2 = 0.78$). The online purchase intention of the subjects under the condition of high ratio of positive online reviews was significantly higher than that under the condition of high ratio of negative online reviews. Then, the main effect of risk perception is significant, ($F(1,116) =$

25.18, $p < 0.001$, $\eta_p^2 = 0.18$). The online purchase intention of subjects in the low risk perception group was significantly higher than that in the higher risk perception group.

According to the results of simple effect analysis, to investigate the influence of online reviews on the online purchase intention of experimental commodities under different risk perception situations. The result shows that (Figure 2), under the high ratio of positive online reviews circumstances, the online purchase intention of subjects in the low risk perception context was significantly higher than that in the higher risk perception context ($p < 0.001$). Under the situation of high ratio of negative online reviews, there is no significant difference between the online purchase intention of subjects under the low risk perception context and the purchase intention of subjects under the higher risk perception context ($p = 0.30$).

The results of Study 2 show that the online purchase intention of subjects in the low risk perception context is significantly higher than that in the higher risk perception context. Compared with the high ratio of negative online reviews, the risk perception has a greater impact on the purchase intention of the subjects in the high ratio of positive online review situation. When faced

Table III.
Descriptive statistics
(M ± SD)

	Low risk perception	How risk perception	Total
High ratio of positive online reviews	4.80 ± 0.59 (n = 30)	3.76 ± 0.44 (n = 30)	60
High ratio of negative online reviews	1.94 ± 0.87 (n = 30)	1.76 ± 0.67 (n = 30)	60
Total	60	60	120

Table IV.
Analysis of variance
of online reviews,
risk perception on
purchase intention

Source of variation	III Sum of square	df	MS	F
Correction model	193.54	3	64.51	145.86***
Interception	1127.85	1	1127.85	2,549.94***
Online reviews	176.82	1	176.82	399.78***
Commodity types	11.13	1	11.14	25.18***
Online reviews × Commodity types	5.585	1	5.58	12.63**
Error	51.31	116	0.44	
Total	1,372.70	120		
Adjusted total	244.85	119		

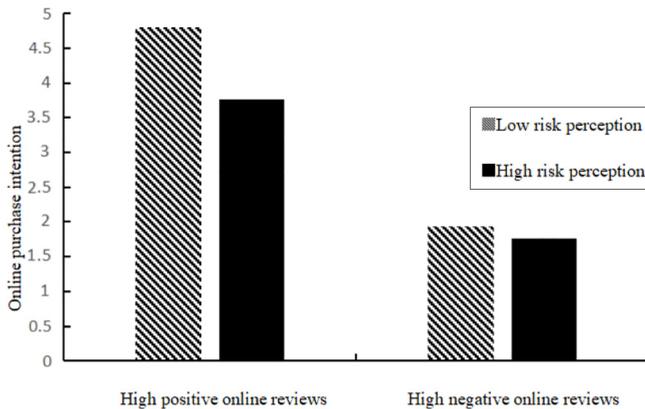


Figure 2.
The interaction
among of online
reviews and risk
perception on
consumer purchase
intention

with commodities with high ratio of positive online reviews, the lower risk perception level also accompany by the stronger online purchase intention, which is consistent with the research hypothesis. With the increase of the risk perception level, the online purchase intention will decrease. At the same time, there is no significant difference in the influence of risk perception level on purchase intention in the high ratio of negative online review situation. This conclusion indicates that risk perception cannot adjust the relationship between the high ratio of negative online reviews and purchase intention. When the subjects are faced with the commodities of high ratio of negative online reviews, the purchase intention will be directly affected by the high ratio of negative online reviews, but not affected by the level of risk perception.

However, in network shopping context, a new risk perception is generated, which is not appearing in traditional shopping context. The perceived risk in traditional purchase context obviously is not exactly represent the perceived risk in network shopping context. Moreover, the anonymity of shopping online evaluation also makes consumers more authentic. Therefore, it is necessary to check whether the three variables have the same results in the actual online shopping situation.

2.3 Study 3. The influence of online reviews, risk perception and commodity types on purchase behavior

2.3.1 Purpose. This study explores the influence of online reviews on purchase behavior, and the role of risk perception in the real online shopping context. It intends to analyze the main factors that affect consumer purchase behavior to better improve the sales of online commodities.

2.3.2 Methods.

2.3.2.1 Procedure. In this study, Python language was used to grasp the monthly sales volume, total number of reviews, positive online reviews, neutral online reviews, negative online reviews, logistics scores and customer service scores. All data come from 300 search commodities and 300 experience commodities on Taobao.com in December 2018. The selection of commodity types and specific content is the same as Study 1. The collected data set was sorted out, and the incomplete feedback data were deleted to obtain the data collection of 590 commodities. After assigning values to online reviews, commodity sales volume and risk perception, SPSS and MPLUS were used to analyze the data.

2.3.2.2 Variable measurement. *Online reviews:* we use the proportion of positive/neutral/negative reviews to analyze the relationship among purchase behavior and each kind of online reviews. The proportion of three kinds online reviews of 590 commodities was calculated, and the full distance of three types of online reviews of all commodities was obtained. Then, values were assigned to the three types of online reviews of each commodity. The proportion of positive online reviews was assigned with 92.55 per cent-94.04 per cent as 1, 94.04-95.53 per cent as 2, 95.53 per cent-97.02 per cent as 3, 97.02 per cent-98.51 per cent as 4 and 98.51 per cent-100 per cent as 5. The proportion of neutral online reviews was assigned with 0-0.692 per cent as 1, 0.692 per cent-1.384 per cent as 2, 1.384 per cent-2.076 per cent as 3, 2.076 per cent-2.768 per cent as 4, 2.768-3.46 per cent as 5. The proportion of negative online reviews was assigned with 0-0.914 per cent as 1, 0.914 per cent-1.828 per cent as 2, 1.828 per cent-2.742 per cent as 3, 2.742 per cent-3.656 per cent as 4, 2.656 per cent-4.57 per cent as 5.

Risk perception: we use the star ratings about logistics and services as risk perception. Star rating range from one to five stars. Low to high values are assigned 1-5 points. The risk perception score of the commodity is the average of logistics and service score of each commodity. The higher score means the lower the risk perception of the consumer.

Online purchase behavior: we use the monthly sales volume of Taobao.com at the end of December 2018 as the measurement of consumer online purchase behavior of the commodity. Then, the sales volume of the commodity is scored according to five points:

assigning 1-700 to “1”, assigning 700-1400 to “2”, assigning 1400-2100 to “3”, assigning 2100-2800 to “4”, assigning 2800-3500 to “5”.

2.3.3 Result.

2.3.3.1 Descriptive statistics and bivariate correlations The results are shown in Table V. The positive online review is not related to the purchase behavior and risk perception. The neutral online reviews had significant negative correlation with purchase behavior and risk perception. The negative online reviews were negatively correlated with purchase behavior and risk perception. As the positive online reviews are not related to purchase behavior and risk perception, the relationship between the positive online reviews and purchase behavior will not be discussed.

2.3.3.2 The relationship between the neutral online reviews, negative online reviews and purchase behavior: the moderating effect of risk perception and commodity type. Firstly, MPLUS is used to analyze the moderating effect of risk perception and commodity type. The results (Table VI) showed that risk perception significantly negatively predict purchase behavior ($\beta = -1.08$, SE = 0.10, $p < 0.001$). The neutral online reviews significantly negatively predict purchase behavior ($\beta = -0.76$, SE = 0.35, $p < 0.05$). Our results did not show the significant relationship between the negative online reviews and purchase behavior ($\beta = -1.04$, SE = 0.56, $p > 0.05$), and the relationship between commodity type and purchase behavior was not significant ($\beta = -0.35$, SE = 1.57, $p >$

Table V.
Descriptive statistics
and bivariate
correlations
($N = 590$)

Variable	1	2	3	4	5	6
1 Commodity types	-					
2 Positive online reviews	-0.06					
3 Neutral online reviews	-0.25**	-0.06				
4 Negative online reviews	-0.20**	-0.08	0.78***			
5 Risk perception	-0.11**	-0.01	0.22***	0.21***	-0.74***	1
6 Purchase behavior	-0.23**	-0.07	-0.13**	-0.12**		
M	-	3.94	1.14	1.07	1.92	3.11
SD	-	1.14	0.51	0.34	1.03	0.96

Table VI.
The moderating
effect of risk
perception,
commodity types

	Purchase behavior		
	B	SE	p
<i>Neutral online reviews Model</i>			
Risk perception	-1.08	0.10	<0.001
Commodity types	-0.35	1.57	>0.05
Neutral online reviews	-0.76	0.35	<0.05
Neutral online reviews × Risk perception	0.22	0.08	<0.01
Neutral online reviews × Commodity types	0.33	1.55	>0.05
Neutral online reviews × Risk perception × Commodity types	0.04	0.48	>0.05
<i>Negative online reviews Model</i>			
Risk perception	-1.07	0.13	<0.001
Commodity types	-0.02	3.92	>0.05
Negative online reviews	-1.04	0.56	>0.05
Risk perception × Negative online reviews	0.26	0.13	<0.05
Commodity types × Negative online reviews	0.02	3.92	>0.05
Risk perception × Commodity types × Negative online reviews	0.04	1.18	>0.05

0.05). The interaction of risk perception, the neutral online reviews and the negative online reviews significantly predict purchase behavior, that is, risk perception plays a positive moderating role in the relationship between the neutral online reviews, the negative online reviews and purchase behavior ($\beta = 0.22, SE = 0.08, p < 0.01; \beta = 0.26, SE = 0.13, p < 0.05$). However, the influence of interaction items of risk perception, commodity type and the negative online reviews, the neutral online reviews on purchase behavior is not significant, so the moderating variable of commodity type is no longer analyzed.

To investigate the influence of risk perception on the relationship between the neutral online reviews, the negative online reviews and purchase behavior, our study divide risk perception into high risk perception group and low risk perception group, according to the principle of average plus or minus one standard deviation. A simple slope test was carried out to investigate the influence of the neutral online reviews, the negative online reviews on purchase behavior at different levels of risk perception. The results show (Figure 3) that in the case of high risk perception, the neutral online reviews and the negative online reviews has a significant predictive effect on the purchase behavior ($\beta = -1.81, p (0.001); \beta = -1.77, p (0.01)$) in the case of low risk perception, we did not find the significantly effect of the neutral online reviews and the negative online reviews on the prediction of purchase behavior ($\beta = 0.28, p > 0.05; \beta = 0.30, p > 0.05$).

The results of Study 3 show that the positive online reward was not significantly correlated with the purchase behavior, and the neutral and negative online reviews online negatively predicted the purchase behavior of consumers. It also found that risk perception plays a positive regulating role between neutral and negative online reviews and purchase behavior. In the case of higher risk perception, neutral and negative reviews had a significant effect on the prediction of buying behavior. In the case of low risk perception, neutral and negative online reviews had no significant effect on the prediction of purchase behavior.

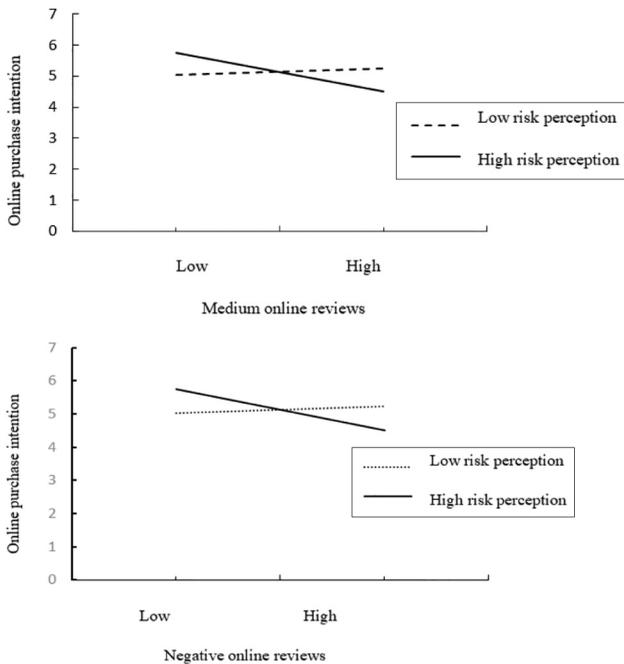


Figure 3.
The moderating
effect of risk
perception on the
neutral online
reviews, the negative
online reviews and
purchase behavior

3. Discussion

3.1 General discussion

In the simulation of online purchase behavior, it is found that the reviews had significant impact on the purchase intention, and the purchase intention of commodities with high ratio of positive online reviews is significantly higher than that with high ratio of negative online rewards. What is inconsistent is that the analysis of real big data information found that the positive online reward was not significantly correlated with the purchase behavior, and the neutral and negative online reviews online negatively predicted the purchase behavior of consumers. Because the default set of good reviews on the website and some measures taken by merchants to get good reviews from buyers, which leads to the low reference value of favorable comments increasingly. So, consumers focus more on the relatively true descriptions of neutral and negative reviews in the purchase process. Meanwhile, in the process of shopping online, consumers will form a preliminary impression on the commodity based on the online reviews of buyers. In the process of impression formation and evaluation, more attention is paid to the negative side (Jiang, 2015). Study indicates that negative ratings carry a much stronger effect than positive ones on a buyer's trust level (Sparks and Browning, 2011). Negative online reviews are viewed as an important source of information enabling online buyers to assess the quality of commodities/services. An important function of reviews is to reduce the risk and uncertainty that online buyers perceive relating to the commodity (Ye and Zhou, 2014). Therefore, negative information is more likely to receive more attention and purchase behavior will be directly affected by the neutral and negative online reviews. In psychological simulated situations, the purchase intention often as a substitute for purchasing behavior also needs to be explored. Although intentions are presumed to be an indicator of to what extent people willing to approach certain behavior and how many attempt they are trying to perform certain behavior. However, there is a considerable distance between the laboratory situation and the real online shopping context, and the laboratory atmosphere also affect the psychological performance of the subjects. Although intention has been determined as a salient predictor of actual behavior to shop online, it should be acknowledged that purchase intention does not translate into purchase action (Mo and Li, 2015). Researchers should explore the influencing factors of purchase behaviors in the real online context and provide reasonable suggestions for websites and sellers to generate more consumer purchase behaviors.

3.2 Crowd science

The results of behavioral research and network data are inconsistent, which causes us to rethink. Psychological research is based on theory. The fundamental hallmark of behavioral research is repeatable and can stand the test of time. Psychological research always find a causal relationship between variables. Network analysis based on big data tracks commodities rather than individuals and their psychological activities. It is based on the correlation between variables, and the underlying reasons are not clear. Both methods have their own advantages and disadvantages. So, we need to use the method of crowd science to analyze behavior.

Crowd science combines both substantive psychological science and relevant areas of the information and computer sciences. It is a complementary method and combines both data-driven and theory-driven approaches in research to provide suggestions for the development of e-commerce in the era of big data. In addition to standard training in statistics and experimental design, such training programs would require coursework in software development, online data collection, machine learning and large-scale data analytics. Only when online merchants fully analyze the features of online consumers and master the consumer psychology can they be targeted to determine the business direction and business objectives according to their respective areas of expertise. They formulate commodity strategies, pricing strategies and promotional strategies for network marketing provide online services. They can better carry out network

marketing activities so that it can achieve the desired purpose. It can comply with the development trend of the network economy, and make greater contributions to the development of the company. The development of crowd science really started. It can be said that all the original things may change dramatically in the context of crowd science. Similarly, the analysis of consumer buying behavior in the context of crowd science is only just beginning. Everything is still at an exploratory stage. It is still difficult to make a conclusion as to what the future looks like. A thousand people have a thousand Hamlets. Under the influence of crowd science, everyone's feelings are different. This is precisely what crowd science wants to achieve: the precise positioning of each consumer.

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