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Gender Differences in Selective Attention and Shopping Intention in the case of Taobao Live-show: An Eye-Tracking Study

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Abstract: Live-show video was introduced into electronic marketing place two years ago. However, it still remains unknown how such new communication ways between buyers and sellers influence individual online shopping intention. How the limited attention resource would be assigned to the main information of endogenous and exogenous cues in the video, and then lead to shopping intention become interesting and important research questions. This study examines these questions from the view of gender difference and social influence with eye-tracking tool. An experiment is designed to capture the visual pattern of selective attention to endogenous and exogenous cues when participants watching Taobao live-show video. Data from Eye-tracking index and questionnaire will be collected to validate the proposed model. Potential contributions and implications for future research are discussed.

Keywords: gender differences; selective attention; live-show; eye-tracking; NeuroIS

1. INTRODUCTION

Individual got used to shopping online everyday with the rapid development of e-commerce. With the available of WIFI everywhere and the popularity of smart phone, video became an important way of online communication. Some platforms in China, such as Taobao and JD, adopted a new business model of live-show to provide better service for mobile customers in 2016. A new role of anchor was introduced between seller and buyer. The anchor will try on clothes, show the detail of design, and explain the possible match of collection before video. At the same time, customers can ask any questions about the product by type text in an interaction window. Such live-show effectively increase telepresence of consumer with vivid product presentation and instant communication. Consumers showed great passion for this new e-business mode since 2016.

The main interface features of the Taobao live-shows video screen (Figure 1) include four parts. No.1 area give basic information the seller name and location, the number of viewers, the live-show room ID, and updates information about the customer ID who enter the live-show room. No.2 area outlines the appearance of anchor and product. No.3 area presents social influence information including herding cues of “XXX is on the way to buy”, as well as text that consumers type in to interaction with anchor and other consumers. No.4 area is in the bottom screen. It includes a shopping bag with all the hyperlink of products showed in the video, an box window for consumer input text. Three buttons in the left are set to share with others, send gifts to the anchor, and show preference to this live-show.



Figure 1. Information in Taobao live-show

When people watch a movie or a video, they pay attention on where their eyes fix on. Since attention is a selective process, and the selective attention has two types: ‘endogenous’ and ‘exogenous’^[1]. In the traditional

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theory, endogenous attention competes with exogenous attention on the control over attention (Godijn and Theeuwes, 2002; Yantis, 1998, 2000; Yantis and Jonides, 1990). In the case of Taobao live-show, the interaction window displays the information of consumer who is on the way to purchase, which act as a herding cue on shopping intention of potential consumer. Therefore, both the endogenous attention on the main parts of video (including product and anchor) and the exogenous attention on the interaction window should have the effect on consumer's understanding of product and intention to click on shopping bag. In addition, previous research reported the different influence of social influence on individual between male and female. The social influences, such as herding cues, showed greater effect of exogenous attention on females than males. It's interesting to know the exact effect of endogenous and exogenous attention on shopping intention in such case of live-show.

Therefore, in this study, we try to figure out the gender differences in selective attention and shopping intention in Taobao live-show and propose the following research questions:

RQ1: What's the difference of selective attention between gender when individual watch Taobao live-show?

RQ2: How does the selective attention on endogenous and exogenous cues influence following shopping intention?

RQ3: What's the differences between gender in the influence of selective attention on shopping intention?

2. LITERATURE REVIEW

2.1 Endogenous attention and exogenous attention

Attention is limited resource especially in information explosion age. Selective attention enables us to tune out unimportant details and focus on what really matters to guides our behavior. Posner cueing paradigm was a basic paradigm to examine selective attention. Posner (1980) divided selective attention into 2 types of attention: 'endogenous' and 'exogenous'^[1]. The former is a voluntary system that corresponds to our ability to willfully monitor information at a given location; the latter is an involuntary system that corresponds to an automatic orienting response to a location where sudden stimulation has occurred^[2]. Lots of neurophysiological studies focused on whether common neurophysiological substrates underlie endogenous and exogenous attention and the relationship between them (Gandhi et al., 1999; Corbetta et al., 2000; Giesbrecht et al., 2003; Peelen et al., 2004; Hopfinger & West, 2006; Serences et al., 2005, 2007; Busse et al., 2008; Lovejoy & Krauzlis, 2010; Chica et al., 2013; Mysore and Knudsen, 2013). For example, Busse et al. (2008) suggested that endogenous and exogenous attention existed in two distinct attention systems but in the same capacity-limited system, where they compete with each other for the control over attention.

The performance mechanisms of endogenous and exogenous cues have been studied in a variety of tasks, e.g., texture segmentation (Yeshurun et al., 2008), letter identification (Talgar, Pelli, & Carrasco, 2004), and temporal resolution (Yeshurun, 2004). However, few studies applied real-life tasks instead of simplified experiment tasks with variants of Posner's paradigm. Recently, Tang et al. (2015) proposed a framework in which attention modulates multisensory processing in both endogenous (goal-driven) and exogenous (stimulus-driven) ways^[4]. They argued that an audiovisual cue may elicit a larger spatial cueing effect than corresponding visual cue, and endogenous and exogenous attention differentially but mutually modulate multisensory processing. In the context of Taobao live-show, buyers got to know more about clothes by using all available cues in the video. The endogenous cues (goal-driven) are anchor and product, which appear in the main middle area of the video window; the exogenous cues (stimulus-driven) are interactive communication, which appear in the left corner. It is worthwhile to note that exogenous cues include the flickering barrages of herding and textual interaction which may strengthen the endogenous response due to herding influence.

2.2 Gender differences in information processing

Traditionally, males showed a superior performance at visual-spatial tasks (Collins & Kimura, 1997), while females demonstrated an advantage in verbal and episodic memory tasks (Herlitz et al., 1997). Gender schema theory states that males and females differ in the extent to which they take advantage of schema to conduct cognitive processing (Martin et al., 2002). According to the theory, the male schema is associated with success and achievement to a greater degree than is the female schema (Noble et al., 2006), while females' schemas are oriented to a greater extent toward communal activities and goals (Putrevu, 2001). Merritt et al. (2007) found that females show larger validity effects in endogenously cued tasks, but not with a peripheral cue or exogenous cue in a basic Posner cueing paradigm^[5]. In this way, online consumers' gender schema influences the information sources used for purchase decision (Ilie et al., 2005).

Some neurophysiological studies argued that males and females used different brain hemispheres to conduct their information-processing strategies and differed in information-processing thresholds. Males mainly rely on selective right hemisphere processing that involving a subset of highly available and salient cues. And females often depend on comprehensive left hemisphere processing to perform sequential and detailed analyses (Tsichla et al., 2014; Goodrich, 2014; Meyers-Levy & Loken, 2015). Hewig et al. (2008) explored the gender differences in gaze patterns when participants looking at the body of men and women with eye-tracking equipment^[6]. The own-gender bias appears to be present in women regardless of the difficulty of the experimental task or how much of a face is presented (Lewin & Herlitz 2002; Lykins et al., 2008; Lovén et al., 2011; Man & Hills, 2016). In real-life situations, Shen and Itti (2012) found the eye-tracking evidence of orient attention difference between male and female during conversational listening^[7]. Baptista et al. (2015) reported gender difference on eye-tracking patterns in an ironic statement and literal situations with focus on facial expression, written commentary and pictorial cues^[8]. McIntyre and Graziano (2016) measured gender differences in selective visual attention toward person- and thing-related image content and examined how selective attention to people and things manifests in language use^[9]. Coutrot et al. (2016) shown that female gazers follow a much more exploratory scanning strategy than males in eye-tracking data from participants watching videos of another person^[10]. However, few empirical studies have used eye-tracking experiments to address gender differences in selective attention in the video watching task and online shopping context.

2.3 Gender differences in social influence

Humans beings are social animals. Individual mind and behavior may easily be influenced by others in the society. Social influence had been reported in conformity, socialization, peer pressure, obedience, leadership, persuasion, sales, and marketing. Herd behavior describes how individuals in a group can act collectively without centralized direction, such as the behavior of humans in demonstrations, riots and general strikes (Braha, 2012), decision-making, judgment and opinion-forming.

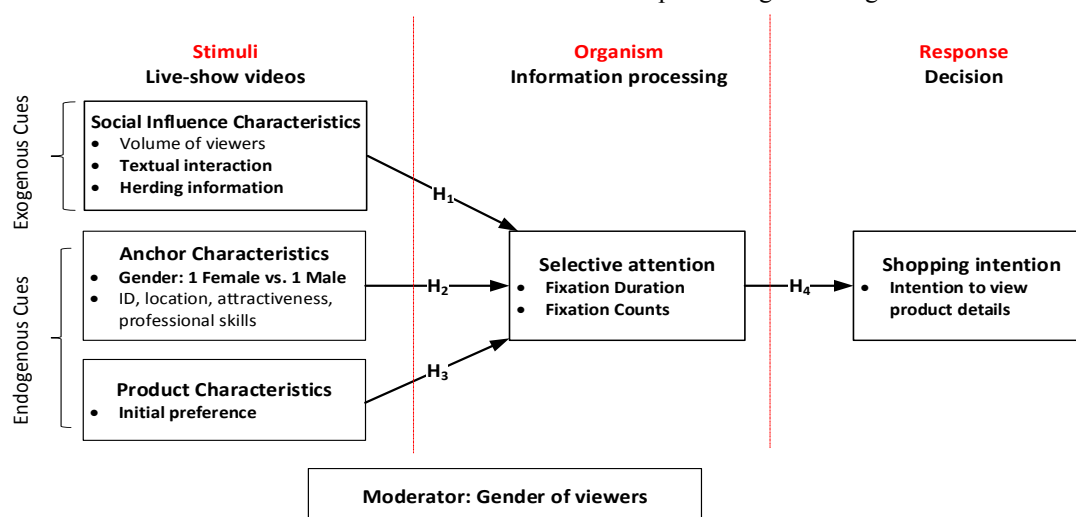
Existing studies showed that different gender had different response to the social influence. For example, Men showed more confidence when interacting via computer-mediated communication (CMC) with authority cues^[11]. Besides the authority cues, there are other types of social influence such as herding cues, information cues and persuasions. Women often score higher values on factors related to communication (or information flow), security, and functionality than did their male counterpart^[12]. Another study on online engagement through websites and social media showed that peer recommendations had a significantly stronger influence on attitudes of females than on attitudes of males^[13]. Women will be more appealed when there appears a herding cue. This study aims to explore the herding cues on shopping intention in the context of live-show by using the eye-tracking tool. With the advantage of eye-tracking tool, such study will extend our understanding of social influence on fundamental level with physiology data.

2.4 Gender differences in shopping intention

Gender differences may lead to different shopping intention. There are strong evidences that females have indeed significantly less positive associations with the homo economics concept than men (Awad, 2008; Garbarino, 2004; Dittmar, 2004; Van Slyke, 2002). Females were more anxious about privacy in online shopping than males do ^[14]. An eye-tracking study showed that participants with high product involvement paid more attention to product and information cues ^[15]. Consumers with high product involvement show longer fixation duration to a positive advertisement cue of product ^[16]. Males showed higher enjoyment when they shopping utilitarian products online, while females preferred to shopping hedonic products online ^[17]. A fMRI experiments found that females activated more brain areas than males did in the context of online shopping ^[18]. Different genders process information differently in addressing cognitive problems, and lead to different purchase decisions ^[19]. Feminine activities are more focused in the pursuit of attachment, empathy, and playing a nursing and caring role ^[20]. So, existing evidences showed that women were more sensitivity to “sensory stimuli” than men. However, there are few studies examine the gender differences on shopping intention from the difference of visual pattern between male and female. How such visual attention difference influence shopping intention remain unknown.

3. RESEARCH MODEL

Based on the research questions and literature review, this study proposed a 2-phase model (Figure 2) to explain the gender differences on information processing and shopping intention in the context of live-show. This model is proposed on the stimulus-organism-response (S-O-R) framework. It was first introduced into marketing science to examine retail atmosphere from environmental psychology by Donovan and Rossiter (1982). Recently, it was often used to examine online store atmosphere (Eroglu et al., 2003; Dailey, 2004; McKinney, 2004; Wu, Cheng & Yen, 2008; Dong-Mo & Seon-Hee, 2010; Chen & Wu, 2016). In Taobao live-show, the video provides rich information for consumers. Among them, exogenous cues and endogenous cues were set as the “stimuli”. Selective attention of information processing was “organism”. And decision of



shopping intention was “response”.

Figure 2. The research model

3.1 Gender of viewers

To figure out the gender differences in selective attention and shopping intention in the live-show, gender of viewers was set as a moderator.

3.2 Exogenous cues and endogenous cues

In this study, endogenous cues are assumed to elicit voluntary shifts in attention while exogenous cues are thought to involve automatic processes ^[1]. In the context of Taobao live-show, endogenous cues occupying the largest part of screen are the direct related shopping information which viewers seek for actively, whereas exogenous cues occurring unexpectedly in the corner are the indirect information which may distract viewers' attention. Because we selected two types of Taobao live-show video as experiment stimuli: One was female anchor perform women's coat and the other was male anchor perform men's clothing. Both anchors are manipulated to have similar attractive and professional level. The two types of video differ in product characteristics, anchor characteristics and social characteristics. Therefore, in this experiment, the endogenous cues refer to the area of anchor and product and exogenous cues mainly refer to the flickering areas of social influence cues.

3.3 Selective attention

When viewers receive the video information as the "stimuli", their brain as the "organism", are working to process this message for further decision. In this phase, different information cues will induce different attention of viewers and we focus on the process of attracting attention by eye-tracking method. According to the theory of selective attention ^[1-4], there are 2 types of attention mechanism - endogenous and exogenous attention, which are attracted by different cues and may influence the final decision in different ways. To measure the selective attention of viewers, we focus on the fixation duration and count as the primary eye tracking metrics and also take other metrics like pupil size into consideration for correct judgement.

With the previous empirical evidences of gender differences in selective attention (Bayliss et al., 2005; Merritt et al., 2005, 2007; Spence & Pratt, 2007; Wang Liyan et al., 2010), it can be inferred that male and female viewers pay different attention to different cue types. And because fixation duration and count are related to consumers' cognitive processing and visual attention, longer fixation duration on area of interest (AOI) may indicate that the object on the AOI is more attractive (Ehmke & Wilson, 2007). Due to the "distraction effect" of social influence cues on female and male viewers, we hypothesize that:

H_{1a}: When herding information (or textual interaction) occurs more frequently, fixation duration on the AOI of exogenous cues will be significantly longer.

H_{1b}: Fixation counts on the AOI of exogenous cues with similar frequency will exist significant difference between male and female.

According to the previous evidence ^[6-10], gender of both the participant (viewer) and the anchor showed influence on gaze patterns during watching live-show video. Viewers will primarily gaze at anchor's face. However, they will use different face-scanning strategy when processing different gender faces. Female viewer may follow an exploratory scanning strategy than males with longer and more fixations to the eyes, and both gender of viewers may look earlier and longer at opposite-sex anchors. Therefore, we hypothesize that:

H_{2a}: Fixation durations on the AOI of female and male anchor's face will exist significant difference between female and male viewer.

H_{2b}: Fixation counts on the AOI of female and male anchor's face will exist significant difference between female and male viewer.

Fixation reflected as attention can indicate interests in products (Jacob & Karn, 2003; Chae & Lee, 2013; Jing Luan et al., 2016). Product (referred as coat in this study) has itself characteristics like design style, quality and price, which leads to different first impression among viewers. When we focus on the perceived interests of products showed by viewers' initial preference of each product, products are divided into different attracting level. As for different gender of viewers and product characteristics, different attracted products also attracted

different attention with moderating effect of female and male viewers. And hence we hypothesize that:

H_{3a}: Fixation duration on the AOI of product will be significantly longer When viewers have higher initial preference of the product.

H_{3b}: Fixation counts on the AOI of product with similar initial preference will exist significant difference between female and male viewer.

3.4 Shopping intention

After processing video information, viewers are asked to decide whether they are willing to view the details of coat by clicking the product in shopping bag, which is the “response” of the “organism”. This study defines viewers’ willingness to view product details as shopping intention, as well as the dependent variable. It’s known that observed data of viewers’ attention with eye-tracking tool can be used to predict their intention (Milosavljevic & Cerf, 2008). On the basis of previous studies on gender differences in online shopping attitude [17-19], we argued that different selective attention of female and male viewers will lead to different shopping intention. In the context of watching Taobao live-show to select clothing, if viewers are interested in the presented clothing, they will fixate more on product and herding cues, which can be reflected by eye-tracking metrics – fixation duration and counts. Specifically, endogenous attention will improve shopping intention, while exogenous attention with social cues will compete for limited cognitive resources but possibly strengthen the positive influence of endogenous attention for herding influence on intention. In addition, we take account of gender difference in the influence of selective attention on final decision as the moderating role. Therefore, we hypothesize that:

H_{4a}: Longer fixation duration on the AOI of endogenous area will increase shopping intention.

H_{4b}: More fixation counts on the AOI of exogenous area will increase shopping intention.

H_{4c}: Fixation on exogenous area will have positive interaction influence with endogenous attention on shopping intention.

H_{4d}: Fixation of female and male viewers will have significantly different influence on shopping intention.

4. EXPERIMENT DESIGN

4.1 Stimulus and pretest

This study captured 12 videos in the Taobao live-show on mobile. There are 2 anchors, one is male and the other is female, and 6 videos for each anchor. To control the overlap between AOIs as possible as less, medium-sized coat was set as the clothing type. Each piece of videos lasted 40s. In each video, the anchor tried on coat themselves, showed the details of coat, and suggested the possible collection package of coat. For further studying about the social influence that the herding cues and comments brought, the amounts and frequencies of the herding cues and comments in the videos are counted.

This study argues that there will be different visual pattern occur when the gender is different among the participates and the different gender of live-show anchors. As for live-show anchors, there is different styles of anchors in Taobao website, they have different levels of professional skills, mandarin standards, sounds and faces. In order to focus on the influence of anchors’ gender on attention, there is a pretest designed for testing what the participates think the different levels of live-show anchors before the experiment. Now we have done such a pretest to test which live-show anchors will attract participates most and select one male and one female anchor with similar quality on these characteristics. There are 6 pieces of videos that had different live-show anchors including 3 male anchors and 3 female anchors. Participants are asked to answer several questions about attractiveness of appearance, sound characteristics and professional skills after watching each piece of video.

4.2 Measurement and manipulation control

This study explored the distribution of attention when viewers watching Taobao live-show video with an eye-tracking experiment. Eye movements typically are analyzed with respect to fixations measured normally in counts and duration. Numbers and duration of visual fixations, respectively, indicate how many and how long customers' eyes remain focused on a particular AOI on the target screen.

Table 1. Video information included in the AOIs

AOI	Cue type	Information
1	endogenous	a. anchor's face
		b. product (e.g. coat)
2	exogenous	a. herding information
		b. textual interaction

Each screen included 2AOIs which are consisted of supplementary information according to Table 1. The endogenous AOI includes two subareas with model's face and the product. The exogenous AOI includes two subareas with herding information and textual interaction. As outcomes from the eye-tracking experiments, this study tends to use two main metrics – total fixation duration (TFD) and fixation count (FC) which reflect participants' visual attention and cognitive processing when they are interested in a particular AOI (Lee & Ahn, 2012; Resnick & Albert, 2014). TFD represents the duration of fixation and FC represents number of fixations to a specific AOI. Furthermore, we will analyze other indexes to robust the conclusions, such as the fixation dwell times within each AOI, mean fixation and saccade durations, sequence and duration of AOI visits (Joseph, 2002).

To observe the social influence cues of female and male viewers, we need to take the number and frequency of flickering cues of each video into the consideration (total viewing volume nearly fixed is also included but not paid attention to). To investigate the influence of product characteristics on fixation, the selected products are all coats with similar types and unknown price and the perceived interests of products is measured by participants' initial preference scale of each product before videos. To check whether participants are actively listen to the anchors, we ask them to answer a follow-up question about some conversation detail in the video after each trial.

4.3 Participants and procedure

The main experiment will recruit 60 individuals from Zhejiang University. The experimental lab is equipped with a 5.5-in mobile phone, an adjustable chair and a table for the participants, and another table for the researcher. The participants' visual attention patterns were tracked and recorded with the Red-5 eye-tracking system, which uses a 250-Hz sampling rate. The experimental procedures will be as follows:

When a participant arrived, s/he was asked to complete the demographic questionnaire. They will be told that this research is going to test the efficiency of Taobao live-show. Their task is to actively watch videos and select proper coats for their friend. And after watching each video, they need to answer a follow-up question about video detail and decide whether to click the product detail hyperlink or not. At last, there's a post-experiment questionnaire about attitudes to live-show and evaluation of anchor when they finished the eye-tracking experiment. The whole experiment lasts for approximately 20 min for each participant.

5. DISCUSSION AND FURTHER RESEARCH AGENDA

Although this research is currently underway and initial results are being analyzed, it's expected to have important theoretical contributions and practical implications. First, it will improve our understanding on selective attention in the context of live-show, by using eye-tracking experiment which provides units of

analysis with the identification of multiple AOIs rather than simply discrimination on overall performance between subjects. Compared to traditional empirical methodologies such as self-report survey, neuroscience methods such as eye-tracking and electroencephalography (EEG) are more accurate and efficient to reflect individuals' subconscious cognitive processing (Luan et al., 2016). We employed eye-tracking method to testify our hypotheses with self-report and behavioral data to robust our conclusions, which will deepen our understanding about complex consumers' behavior and advance NeuroIS research promoted by many IS researchers (Dimoka, Pavlou, & Davis, 2011). Second, it will offer insight into selective attention influence on shopping intention and even herding behavior in live-show with gender as interaction terms. Third, it will help Taobao live-show platform to improve user-interface design and empower anchors with professional skills to achieve attractive promotion and patient communication with customers, which will lead to better customers' satisfaction with their decisions.

However, the proposed research still has some limitations that require future work to overcome. To simplify the experiment paradigm, several influencing factors of shopping intention in live-show were not investigated despite their potential relevance, (e.g., product involvement and individual characteristics) for pragmatic reasons related to complex reality and sample size. Further, only one cognitive variable (i.e., attention by eye-tracking) is observed clearly, and other bio-data can be obtained by other neurophysiological tools (e.g., EEG or fMRI) in future studies. Therefore, after get first knowledge on how viewers allocate their attention for different cues and produce shopping intention during live-show watching, we plan to figure out deep neural changes in viewer's brain and explain more detailed cognitive process from live-show stimulus to decision response. More specifically, we will combine with EEG measurement approach for assessing viewer's cognitive and affective change at stimulus onset time to investigate the role of herding cues in a follow-up live-show research.

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