Knowledge Co-creation Through Eye-Tracking in Tourism

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Abstract The intention of this manuscript will be to discuss the role of eye-tracking studies in knowledge co-creation for tourism experiences. The designation of touristic information services is dependent on the feedback coming from tourists, and currently, the most objective method for deriving tourist information can be argued as eye-tracking. By comparing past literature with a critical analysis, this chapter will underline the importance of eye-tracking method as an integral part of tourism studies, on the basis of knowledge co-creation out of the experiences of tourists. The main focus of this study will be on how to analyze the phenomenon of knowledge co-creation in tourism in the face of visual stimuli around tourists in touristic destinations. In conclusion, the chapter will contribute to the literature by discussing the role of eye-tracking method in knowledge co-creation of tourists through objectively reflecting their experiences with visual stimuli around them. In doing so, knowledge co-creation studies in tourism can be carried out in a quantitatively measurable manner by adopting eye-tracking method.

Keywords Eye-tracking · Tourism · Co-creation

1 Introduction

Consumer evaluations are usually drawn from self-reports including questionnaires and interviews in the field of tourism, although they are limited as well as susceptible to potential biases such as difficulties in recalling (Wang and Sparks 2016). In order to measure the consumer evaluations objectively, a number of techniques have been used where the benefit, interest, or satisfaction of tourists are transformed into quantitatively measurable form.

Among these techniques, eye-tracking appears as an important technique for measurement in tourism studies, since, for instance, it has been known to provide

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a rich data source for attentive user interfaces (Vertegaal 2003), it has been used to predict the moment when tourists lose their interests and begin to get bored (Kiefer et al. 2014), or even it has been used to determine the differences between ethnic groups with respect to tourism photography (Wang and Sparks 2016).

Eye-tracking appears to be the only method for measuring gaze points or eye movements in a quantitative manner. It allows researchers to understand the subconscious processes and decisions of their participants as well as which type of visual stimulus triggers the fundamental brain circuits responsible for attention, cognition, and emotion. Then, these insights may be used for understanding individual preferences and decision strategies properly in order to develop marketing strategies in the related fields accordingly. By enabling the contribution of users as objective feedbacks instead of biased self-reports, knowledge co-creation, which denotes the creation of information in a collective manner, will be obtained. In the next section, the past literature regarding to eye-tracking research will be briefly introduced, then the use of eye-tracking methods in tourism research will be discussed in detail.

2 Eye-Tracking Research

Historically, the research on human eye moves has begun in the early 1900s. Over time, these techniques started to be used in marketing research, such as determining the consumer responses. Research has been conducted in order to investigate the visual processing behavior of consumers, including visual attention toward advertisements or packages with pictures (Li et al. 2016). In a visual marketing stimulus, consumers move their eyes to process a certain object or location (Manthiou et al. 2017). Although the human senses are capable of collecting the bulk of information, the brain can only process a small percentage of the stimuli received by the environment, using selective attention technique to deal with the information overload (Xu et al. 2017).

In the last decade, eye-tracking equipment has been developed in order to record the eye movements of consumers while they are viewing large amounts of stimuli under quasi-natural conditions (Wedel and Pieters 2008). The main characteristics of the eye-tracking method are fixations and gaze points, representing the movements of eyes and later they are visualized on heat maps to show the general distribution (Manhartsberger and Zellhofer 2005). Eye fixation is defined as a point where the eye fixates on an object in order to acquire information (Duchowski 2007). Additionally, area of interest (AOI) is a useful tool for selecting subregions of a displayed stimulus and extracting metrics, particularly for these regions. The AOI analysis deals with defining the areas within a page and comparison of the eye-tracking data on the basis of some aspects such as number of fixations, duration of fixations, and so forth (Manhartsberger and Zellhofer 2005).

Pursuing these further, previous studies showed the effectiveness of the eye-tracking method for data collection. For example, studying eye movements

through eye-tracking systems is capable of providing insight into visual information acquisition behavior (Hyökki 2012; Hernández-Méndez and Muñoz-Leiva 2015; Wang and Sparks 2016). According to Duchowski (2002), the effectiveness of advertisements can be studied in copy testing, images, video, and graphics by using eye-tracking methodology along with providing useful data in other domains including neuroscience, psychology, industrial engineering, and computer science. Furthermore, there is a growing trend for using eye-tracking technology in commercial applications specifically in the United States and Europe, parallel to the developments in marketing, cognitive sciences, and human–computer interaction (Pieters et al. 1999; Xu et al. 2017). Eye-tracking is also capable of capturing objective and real-time data about the elements of a specified stimulus which individuals are attending to (Wang and Sparks 2016). In general, eye-tracking provides objective information (Sundstedt 2012), as well as an extended understanding of people's reading behavior and reactions to words and pictures by tracking the eye movements and replaying them in real time or in slow motion (Rayner et al. 2001). Most importantly, by measuring the visual attention of tourists, real-time gaze patterns can be obtained (Isaacowitz et al. 2006) which later can be used in the design of touristic information services (Kiefer et al. 2014) since tourism offers a platform to understand visual attention (Rakić and Chambers 2010) as well as putting emphasize on visual components including pictorials reflecting the image of destination in the market (Feighey 2003). In short, eye-tracking appears as a reliable method both for academic and commercial purposes in the existing literature.

Nevertheless, there are some drawbacks on using eye-tracking method. For instance, the eye movements and metrics of participants may not reflect the underlying cognitive processes in eye-tracking evaluations. Besides that, further research on the field of AOI suggested that AOI production methods and subjective choice of AOIs by researchers in shape, size, and location have a significant impact on attention-attracting and attention-maintaining capacities of AOIs, and this reflects on the statistical analysis (Hessels et al. 2016). Therefore eye-tracking research is claimed to be answering "what" and "how" questions about the ocular behavior of participants, but does not reveal the reason behind it. For that reason, scholars claim that the results of eye-tracking studies are insufficient for a proper analysis, and they are required to be combined with other evaluation methods such as self-report questionnaires or interviews to get full information about the participants (Samiee and Jeong 1994; Walters et al. 2007; Xu et al. 2017).

3 Eye-Tracking and Tourism

Recently, tourist experience of cultural difference has gained growing interests as tourists from different linguistic, ethnic, religious, and cultural backgrounds come together in a certain tourism destination, requiring to be served differently while improving intercultural communication on the basis of shared universal values (Luka et al. 2010). Visual cues are also important sources to measure these cultural

differences among tourists in an objective manner. As a crucial part of human's information processing, visual appeal is capable of adding meaning to something which is natural in itself (Xu et al. 2017).

Tourism marketers and advertisements also rely heavily on visual stimuli like imagery, visual associations, drawings, painting, visual memory devices, symbols, etc. (Li et al. 2016; Scott et al. 2016; Wang and Sparks 2016). For instance, in their study, Scott et al. (2016) showed the usefulness of the eye-tracking method for evaluation of tourism advertising compared to self-report measures which can be distorted by biased data. Considering the fact that the eye-tracking method has already being used in the tourism sector, researchers may work on using the method in other possible fields in the tourism market, such as the development of new products and services. The literature on the tourism sector is mostly based on subjective measures rather than objectively.

Although self-reports are frequently used for the evaluation of tourist experiences since it is easily interpretable, practical, provides rich information, causal force, and motivation to report (Paulhus and Vazire 2009), this method lacks some fundamental properties. Standard written copy tests are proven to be unsuccessful for grasping emotional aspects in tourism marketing (Hazlett and Hazlett 1999). Verbal or written response measures are claimed to be limited, as they require respondents to think back to remember what they felt and fail to capture a person's emotional experiences instantly. Besides, these measures are also susceptible to social demand influences since respondents may give responses that are suitable to social norms rather than what they actually feel or think of (Xu et al. 2017).

On the other hand, the findings derived from eye-tracking study are useful sources for knowledge co-creation for the tourism sector. As Karpouzoglou et al. (2016) discuss, the technology allows the realization of knowledge co-creation and resilience. Therefore, evaluations of newly developed products and services in the tourism sector can be carried out by the eye-tracking method and tourists may express whether they like new applications or not with their eye movements. As a result, tourists contribute to the development of new products and services in the tourism market. Parallel to the discussion above, this contribution is less biased and more reliable compared to other techniques such as self-report.

Considering the different backgrounds of tourists from different parts of the world, studies suggest that a more nuanced approach recognizing the multidimensional aspects of geographical distances would be more appropriate instead of the long adopted "one-fit-all" tactic (Ambos and Håkanson 2014). Hence, evaluations should be carried out separately when taking tourists of two physically and culturally distant countries into consideration. Unless the geographical distance among the countries of different tourist groups is small, the results of the eye-tracking study will be culturally biased given the fact that perceptual development is shaped by culture (Pezdek et al. 2003).

In the next section, a model will be suggested in order to measure the impact of the eye-tracking method in the co-creation of tourism experiences.

4 The Model

Two important aspects take place while measuring the impact of eye-tracking on knowledge co-creation in the tourism sector. Starting with the cross-cultural differences, tourists from different cultural backgrounds have different visual attention patterns. For instance, the study conducted by Marcon et al. (2008) on cross-cultural differences reveals that Western people cannot easily differentiate Asian people (Chinese, Japanese, Korean, etc.) since they are inclined to perceive slant-eyed people as similar. In general, Western people identify faces with eyes (shape, color, and so on) but when there are fewer cues for identifying eyes, they fail to recognize faces altogether. On the other hand, Asian people do not have a problem while identifying Asian faces, because they are looking for different cues from different points of the face while recognizing a face. The phenomenon is known as cross-race effect (Marcon et al. 2008). Similar to this cultural variety in face identification, other studies claim that some cultural impacts may lead to differences in eye movements, gaze points, and fixations (Chua et al. 2005), which are fundamental for the eye-tracking study. The main element creating cultural difference can be considered as geographical distance since as the geographical distance between two destinations increases, cultural difference is expected to increase due to the presence of different ethnicities, languages, religions, and social norms (Takayama 2013). In other words, neighbor destinations can show more cultural similarities and share more common cultural practices. Hence, the model will include geographical distance as an indicator of cultural difference, transforming cultural differences in a quantitatively measurable form.

In addition to cultural differences between tourists based on geographical distance, technological advancement is also a determinant factor for the eye-tracking study. Technological progress leads to advancements in the eye-tracking technology, such as more sensitive heat maps or new equipment for measuring durations of gazes and fixations. Since eye-tracking is a method that transforms visual attention or eye movements in a quantitatively measurable form. As it has been discussed, current eye-tracking technology is capable of explaining what and how questions about the ocular behavior but not the reason behind the gaze or fixation. By time technology may allow researchers to understand why people have specific ocular patterns through brain-imaging tools by which they can visualize the neural activity in the function-specific locations of the brain.

Furthermore, technology can be considered as a time-dependent variable. In other terms, technology develops exponentially over time such that it has acceleration for doubling itself, as Gordon Moore (1965) has argued this phenomenon in one of his works on integrated circuits, and the phenomenon is named after him as Moore's Law. Therefore, the model will include a time variable in order to reflect the impact of technological progress over time.

Hence our model can be considered as:

$$ET = \beta 0 - \beta 1GD + \beta 2TAt + \varepsilon$$

where,

ET implies the impact of eye-tracking
GD implies geographical distance
TA implies the technological advancement
t implies time (or periods/seasons in which tourism markets work)
β0, β1, and β2 imply coefficients
ε implies residual

According to the model, geographical distance and technological progress subject to time are two main variables by which the impact of eye-tracking method can be explained. The geographical distance variable is suggested as negatively related with the impact of eye-tracking, given the fact that physical proximity ensures the minimization of differences in gaze points, fixation times, and eye movements due to the differences in cultural background. Additionally, there may be other variables that are capable of explaining the variance in the level of the impact of eye-tracking that the suggested model has not captured. Therefore, a residual is presented in the model, denoting the variance that cannot be explained by the two variables.

The suggested model can be used for any type of numerical data since the main target of the model is to provide a tool for the measurement of the impact of the eye-tracking method on tourism in a quantitative form. Furthermore, the research enables the measurement of the effect through statistical analysis based on two main variables in a mathematical framework rather than relying on subjective methods which would decrease the reliability and objectivity of the findings.

5 Concluding Remarks

In general, the eye-tracking study is an objective measurement for quantitative analysis of tourist perceptions and their evaluations regarding newly developed touristic products and services. The model presented in this manuscript is a useful tool since it captures cross-cultural differences in perceptual inclinations as well as technological improvements for detailed investigations. Although differences in gaze points and fixation time may be influenced by other variables such as heuristics and resource depletion (Wästlund et al. 2015), long-term and macro-level analysis will provide more consistent results across contexts and situations.

Nevertheless, there are still weak points with respect to the model. For example, the impact of the model has not been supported by practical results. Hence, the model suggested in this manuscript has some drawbacks regarding real-world phenomena. Moreover, the cultural difference may not be directly influenced by geographical distance and the assumption for transforming cultural difference into

physical proximity should be investigated by further research in the future of tourism-related eye-tracking studies. The limitations of this study generally stem from insufficient scientific investigation in the field of tourism on the basis of cross-cultural differences in eye-tracking measurement. However, the model is still useful considering the fact that there has been no previous attempt for modeling the impact of the eye-tracking model in the field of tourism which will enable the measurement of the effect in a quantitatively measurable form.

In short, as it has been discussed, eye-tracking is less influenced by response bias than self-reporting, and its method is more standardized for investigating cognitive processes compared to the memory-based measures (Krajewski et al. 2011). For this reason, eye-tracking appears to be a useful method for carrying out knowledge co-creation studies in tourism in a quantitatively measurable form meanwhile it provides a reliable source for creating the knowledge about touristic preferences. All in all, science requires numbers, and transforming qualitative findings into numeric data lies at the heart of scientific inquiry.

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