

A Bibliometric Study on Eye-Tracking Research in Tourism

Abstract

The purpose of this paper is to determine the position of eye-tracking studies in the tourism literature and to provide a panoramic perspective of social and intellectual structures of eye-tracking studies in tourism. Bibliometric methods have been used to analyze 64 studies published from 2013 – 2019. Descriptive, network, and cluster analyses were applied in the R statistics program. The annual growth rate on eye-tracking research in tourism was 38.31%. Most of the authors preferred to cite articles from tourism journals. Effective researchers preferred to use "eye-tracking" and "visual attention" as author keywords in their research. Most of the studies took place in a laboratory environment. The studies discussed many dimensions such as culture, language, website design, advertising strategies, satisfaction, and usability. However, the effect of marketing and behavior studies is remarkable. Institutions and countries with close geographical links tended to publish together, but countries such as the USA, the UK, China, and Australia come to the fore in the collaboration network. Scopus-indexed English publications, most of which are articles, and proceedings were analyzed. Future studies may use different academic databases and publication types. This study is one of the first bibliometric analyses of eye-tracking studies in tourism.

Keywords: eye-tracking, tourism, bibliometric analysis, literature review

1. Introduction

Eye-tracking has been a topic of interest for researchers since the 19th century (Mascati, 1952). The first studies that analyzed the eye with the help of a device took place at the beginning of the 20th century. Huey (1968) analyzed the eye movements of his students by using a type of holed contact lens. The lens was connected to an aluminum indicator that moved in response to eye movement (Yang & Wang, 2015). Thus, a primitive eye-tracking device emerged. Similar eye-tracking research and methods to today's research and methods can be seen in the literature from the 1960s (Deutsch & Deutsch, 1963; Noton & Stark, 1971; Yarbush, 1967). Computer analysis of human behavior, and therefore eye movement, dates back to 1980 while presenting media content with computer technologies dates back to the 1990s. Within this time frame, eye-tracking studies also took place in many other academic fields such as medicine, psychology, sociology, marketing, and computer science, depending on the historical process of how these studies were undertaken (Omur & Aydoğdu, 2017).

The use of eye-tracking techniques in tourism is more recent. In this field, the first experimental eye-tracking studies appeared in the literature at the beginning of the 2000s (Chua et al., 2005; Pan et al., 2004) and generally analyzed a wide range of subjects such as landscape, museology, image, website design, intercultural differences, marketing research (Scott et al., 2019). It is believed that using bibliometric methods to analyze the intellectual structure of eye-tracking techniques that offer an innovative perspective in tourism would be beneficial (Benckendorff & Zehrer, 2013; Güzeller & Çeliker, 2018). The diffusion of eye-tracking studies in tourism to the fields with different practices (Scott et al. 2019) increased the importance of bibliometric studies that enable panoramic monitoring of the literature. Additionally, a systematic literature review by

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Scott et al. (2019) considered experimental surveys using the eye-tracking technique; however, conceptual studies or studies of other disciplines that consider tourism as a study field were not included in the analysis. In this paper, eye-tracking studies in tourism are considered from a broader perspective, and they offer views about the fields in which the analyzed studies are clustered, what type of changes occurred over the years, and collaborations in the field with the help of bibliometric techniques (Hall, 2011). The bibliometric analysis provides longitudinal information about the studies based on past studies. By taking an x-ray of the past, these studies offer clues about how to structure the future (Aksu & Güzeller, 2019). Further, bibliometric studies enable analyzing a high number of studies in a short time with newly developed programs (Aria & Cuccurullo, 2017; Van Eck & Waltman, 2010). Additionally, since tourism studies in the globalized world have necessarily complex structures (Darbellay & Stock, 2012; Hall & Williams, 2019), bibliometric studies have the potential to offer unique opportunities to identify the position of specific fields, such as eye-tracking, in tourism. Based on these facts, this study aims to answer the following questions to determine the position of eye-tracking studies in the tourism literature and to provide a panoramic perspective of eye-tracking in the tourism field:

- (1.) What are the descriptive data of eye-tracking studies in tourism?
 - (1.1.) What are the findings regarding the number of studies?
 - (1.2.) What are the findings regarding the number of researchers?
- (2.) What is the social and intellectual structure of eye-tracking studies in tourism?
 - (2.1.) What are the most effective articles, sources, and keywords in the literature?
 - (2.2.) What do the social network structure and trends of keywords show?
 - (2.3.) What is the structure of country and university collaboration networks?

It is believed that the research process and findings are important, as these have the potential to open up new pathways to collaborations, authors, journals, and subjects about eye-tracking studies in tourism.

2. Literature review

2.1. Eye-tracking and its metrics

Eye-tracking is a term that identifies a tracking process of the gaze of individuals. Within this context, measuring the movements of the eyes, the head (which guides the gaze), and the neck are important. These measurements are made by an eye-tracker that records eye position and eye movement (Özdoğan, 2008). Various methods have been developed over the years to analyze and track eye movements. Fixation and saccade measurement-based eye movement analysis are among the preferred methods (Tao et al., 2020). The fovea, which is found in the human eye, is typically the clearest vision point at the center of the retina in various living beings. A living being with a fovea in the eye has fixation capability. Maintaining the gaze on a single location is called fixation (Sharafi et al., 2015). A saccade is defined as the fast and intervallic movements directing the gaze (Sharafi et al., 2015). Saccades include only eye movement and head movement. In the simplest sense, saccades aim at the retina's center at the point where the gaze is directed. In eye movement analysis, some metric data based on fixation and saccade measurements are gathered. "Gaze points" derived from fixations and saccades are the collection of data that describe where the eye is gazing (Sun et al., 2016). A metric similar to gaze points is "heat maps," which present an intensity map of where and at what intensity the eyes look (Pfeiffer & Memili, 2016). The scenes covered by the metric measurements, such as gaze points and heat maps, are identified via "areas of interest" (AOI). Identifying an area of interest enables calculating how many of the participants in the eye-tracking process are looking at a specific area of interest. Time to first fixation (TTFF) is extremely important in providing information about how certain aspects of the visual

scene are prioritized (DeWitt, 2010). Although TTFF data is important, such data might not be sufficient to describe what in the scene is of interest. Additionally, using a combination of data obtained from both first fixation duration (FFD) and average fixation duration (AFD) helps to get more meaningful data (Sharif & Maletic, 2010). For instance, it is possible that a scene with a low TTFF value and a high FFD value is preferred by the participants.

2.2. Eye-tracking in tourism

The fact that eye-tracking offers new and innovative perspectives on the field is one of the reasons it excites tourism researchers. Since some eye-tracking tools are suitable for mobile use, it can be observed that the studies are conducted in two ways: field and laboratory research. It is understood that subjects such as website usability, advertising, and marketing studies and online tourist behavior patterns were investigated in laboratory studies (Babakhani et al., 2017; Green et al., 2011; Marchiori & Cantoni, 2015; Muñoz-Leiva et al., 2018; Pan et al., 2004, 2011, 2013). Participants were asked to use wearable mobile eye-tracking tools to determine the visual interests of moving tourists. However, the number of studies conducted in the "real world" with portable eye-tracking devices is very small. Kiefer et al. (2012a) stated that the most important reason for researchers not to choose mobile eye-tracking tools in the field is linked with possible technical problems. Yet, few studies observed what participants pay attention to while walking in the city center (Pinelo da Silva, 2011), how the gaze behaviors of participants change with the help of a map (Kiefer et al., 2012a, 2012b, 2014), the visual attention of visitors in museums (Eghbal-Azar & Widlok, 2013; Mokatren et al., 2018; Toyama et al., 2011), or the gaze behavior of participants who try to find directions with the help of landmarks in a train station (Pashkevich et al., 2020). Most studies analyzed how demographic and cultural variables affect eye movement (Chua et al., 2005; Green et al., 2011; Hao et al., 2015; Pan et al., 2011; Raptis et al., 2018; Wang & Sparks, 2016).

Scott et al. (2019)'s review of tourism studies discussed the advantages and disadvantages of eye-tracking research, data collection procedures, methods of analysis, and their applications in tourism. Other than choosing eye tracking as an application method in tourism literature, the eye-tracking concept was analyzed from a theoretical perspective. Determinations regarding the usage areas of eye-tracking in tourism were included, especially as they relate to neuromarketing research (Boz et al., 2017).

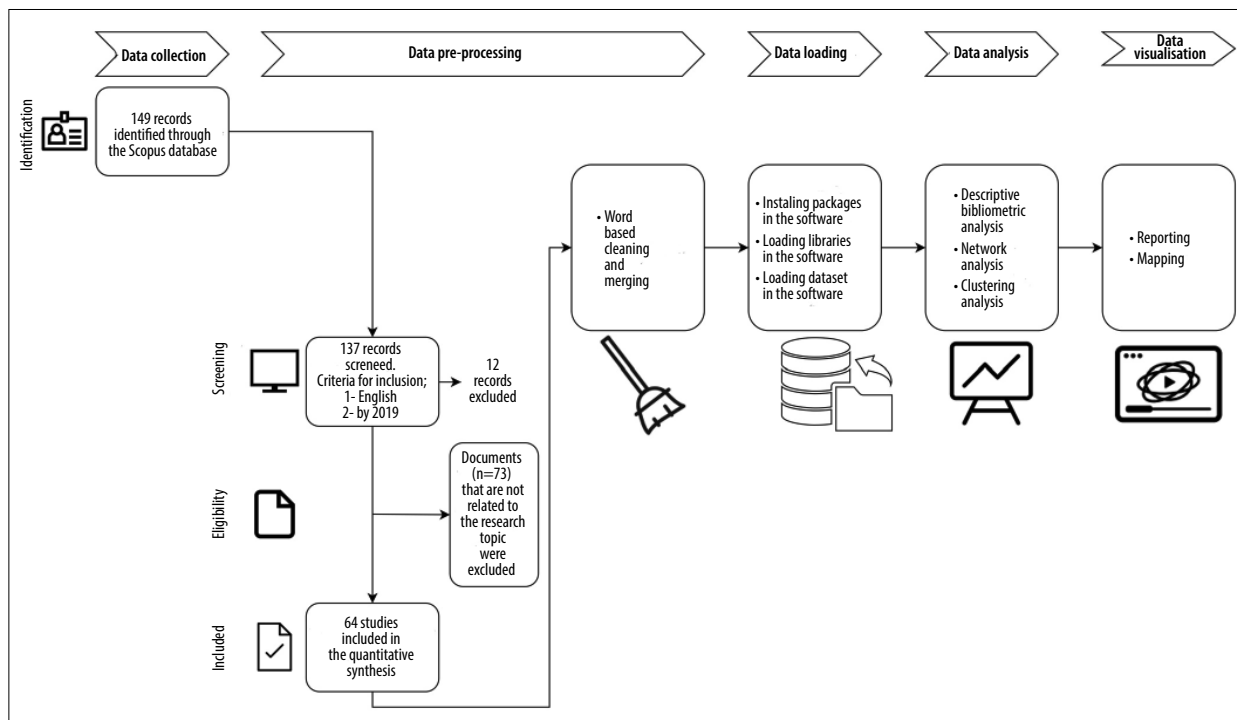
3. Method

With traditional methods, it may take time to formulate an opinion about literature. However, over time, the development of research tools and the availability of databases for researchers have led to the emergence of innovative methods (Aria et al., 2020). In this context, the importance of innovative bibliometric research has increased. Bibliometric methods examined the descriptive, social, and intellectual structures of data in this study.

An open-source bibliometrix (Aria & Cuccurullo, 2017) R package and R software were used in all bibliometric analyses. Within the scope of this study, 149 studies on "eye-tracking" or "eye tracking" and tourism topics (travel, tourism, tourist, hospitality, leisure) were obtained from the Scopus database. The following parameter was determined for searching the database: (TITLE-ABS-KEY ("eye tracking" OR "eye-tracking")) AND (tourism OR tourist OR travel OR hospitality OR leisure) AND (LIMIT-TO (LANGUAGE, "English")). With the help of this search parameter, studies available on Scopus that include "eye-tracking" or "eye tracking" concepts in their title, abstract, and keywords were listed. This search list was further refined to obtain studies with the keywords tourism, tourist, travel, hospitality, and leisure. Thus, 137 studies were obtained from the search on 01/03/2020. The selection of databases such as WoS, Google Scholar, Scopus, PubMed often depends on the researcher's preference due to a lack of general consensus. However, in social sciences,

the WoS and Scopus databases with accessible statistical data have their advantages. In this paper, the Scopus database was used instead of the WoS database, as Scopus offered more comprehensive scanning (Ferjanić Hodak, & Krajinović, 2020; Martín-Martín et al., 2018). A flowchart for the bibliometric research is shown in

Figure 1
Bibliometric workflow



As shown in Figure 1, the organized dataset was limited to studies in 2019 and before. Finally, 64 studies were included in the research. "Eye-tracking" and "eye tracking" were merged in the corpus data. After loading the dataset into the R statistics program, descriptive analyses, network analyses, and cluster analyses were applied.

4. Findings

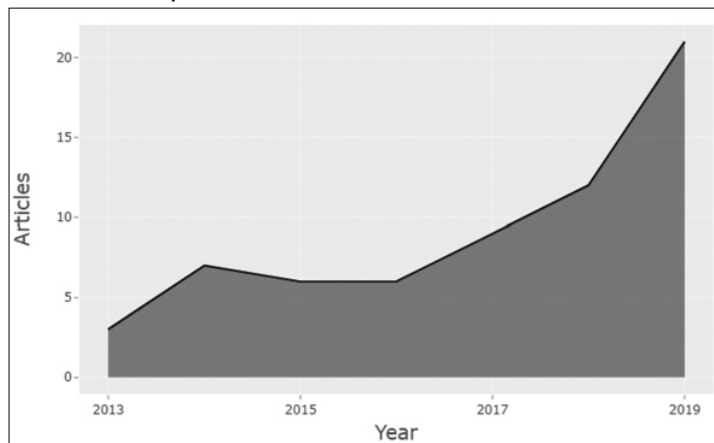
4.1. Descriptive findings

It can be seen that eye-tracking studies have entered the tourism literature in more recent years. In this context, when growth data for 7-year research history was analyzed, a rapid increase in the number of publications per year was noticed; there was an average of 6.31 papers per year in the literature over the seven years (Figure 2). The compound annual growth rate (CAGR) was 38.31%. CAGR is a term used for the geometric progression ratio, providing a constant ratio over some time. Among the reasons for this remarkable growth were an increased number of researchers, the facilitator effect of improved technology for research, and the effects in the advancements of eye-tracking area (Aria et al., 2020; Merigó et al., 2015).

There were 247 different keywords in studies published in 50 different sources (journal, conference paper, etc.), and these publications were referenced with an average of 6.64. In these studies, it was seen that 161 authors contributed, and the names of the authors were mentioned 191 times. The majority of the publications (89.66%) had multiple authors. AFI value was calculated as 0.16. Author Footprint Index (AFI) is a calculation method used to provide information about the researchers' viewing and browsing frequency in the publications (Atabay et al., 2019). When AFI is calculated, the relationship between the number of

contributing authors in an article and the frequency with which their respective names are mentioned is analyzed. The formula below is applied as a calculation method.

Figure 2
Annual scientific production



$$AFI = 1 - \frac{\text{Total number of authors in the field}}{\text{Total number of co - authors in the field}}$$

In other words, the number of authors in the field is divided by the total number of names that appear in the papers, and the result is subtracted from 1. Collaboration Index (CI) is another index value based on authors' collaboration. This index is related to multiple authors' publications in the field and calculated as below (Ajiferuke et al., 1988).

$$CI = \frac{\text{Authors of multi authored documents}}{\text{Multi authored documents}}$$

Thus, the effect of single-authored publications is eliminated, and the number of authors per publication in multi-authored publications can be seen. In this sense, the CI value for eye-tracking studies in the tourism literature was determined as 2.69 (Table 1).

Table 1
General descriptive information

Description	Results:
Documents	64
Documents per year	9.14
Sources (journals, books, etc.)	50
Keywords	247
Years	2013-2019
Average citations per document	6.64
Authors	161
Author appearances	191
Authors of single-authored documents	5
Authors of multi-authored documents	156
Single-authored documents	6
Multi-authored documents	58

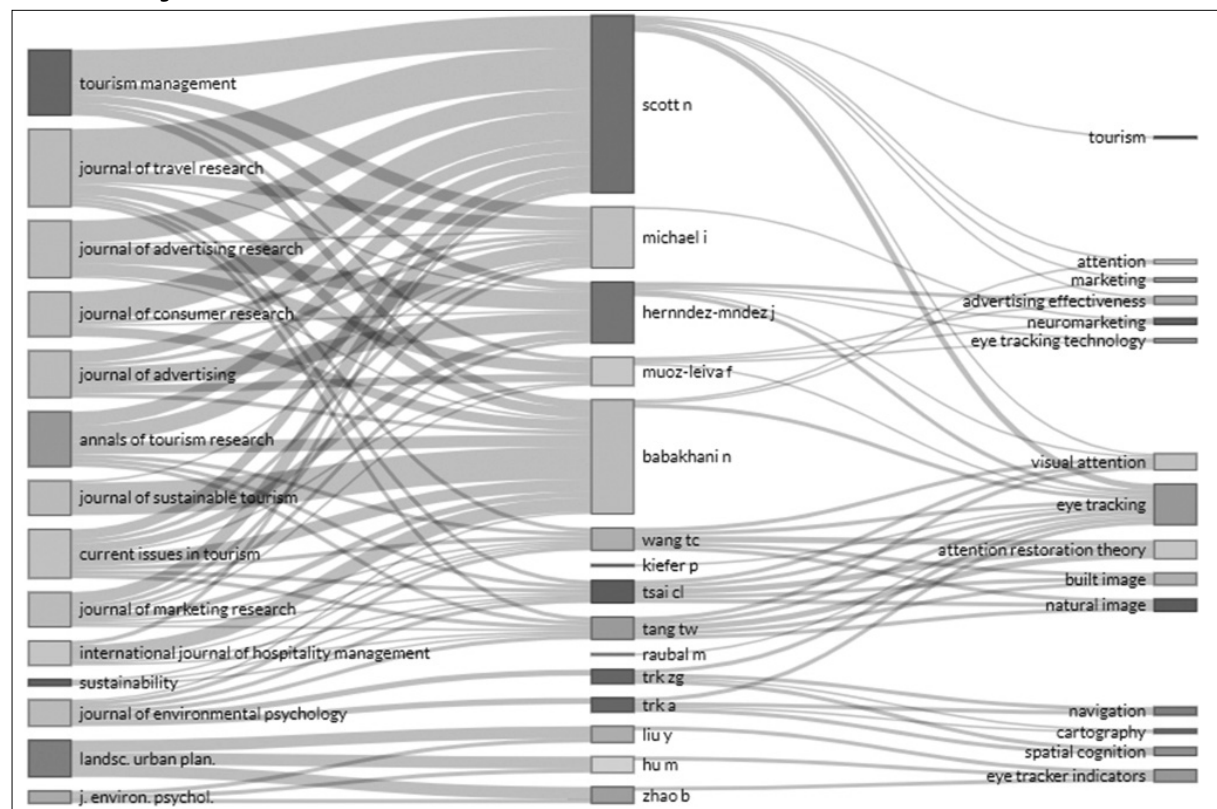
Table 1 Continued

Description	Results:
Documents per author	0.40
Authors per document	2.52
Co-authors per documents	2.98
Collaboration index	2.69
Author footprint index	0.16
Document types	
Article	32
Article in press	1
Conference paper	26
Editorial	1
Letter	2
Review	2

4.2. Social and intellectual findings

A Three-fields diagram was used to provide a general overview of eye-tracking publications in the tourism field between 2013 and 2019. Fundamentally, this diagram visualizes the relationship between three main elements (authors, keywords, journals, etc.). Visualization based on a Sankey diagram (Riehmman et al., 2005) presents the component relationships of the determined number of publications with the help of a single figure.

Figure 3
Three-fields diagram



In Figure 3, "sources" (journal, book, etc.) of the three-fields diagram are on the left-hand side, "authors" are in the middle and "keywords" are on the right-hand side. When the analysis for the most effective 15 units in every field was investigated, it was seen that majority of these studies refer directly to tourism journals. However, there were also journals in the marketing and advertising fields such as "Journal of Marketing Research", "Journal of Advertising Research", "Journal of Advertising", "Journal of Consumer Research" and journals in urban planning and science such as "Journal of Environmental Psychology", "Landscape and Urban Planning". Noel Scott was observed as one of the most effective authors in the field; he cited most of the effective tourism journals in the field and used the word "tourism" the most out of all the authors. The findings showed that Nazila Babakhani, Janet Hernández Méndez, Francisco Muñoz-Leiva, Ian Michael, as effective authors, also cited tourism publications significantly. As can be observed in Figure 3, the effective researchers in the field preferred to use "eye-tracking" and "visual attention" as author keywords in their research.

Unlike the Sunkey diagram, only the most cited publications are listed in Table 2. Thus, it aims to understand which publications attract more attention in the literature. It is understood that the research claiming that eye-tracking methods can discover tourists' emotions is the most cited research. In addition, it has been observed that most of the studies were organized in a laboratory environment. Many factors such as culture, language, website design, advertising strategies, satisfaction, and usability have been discussed in the studies.

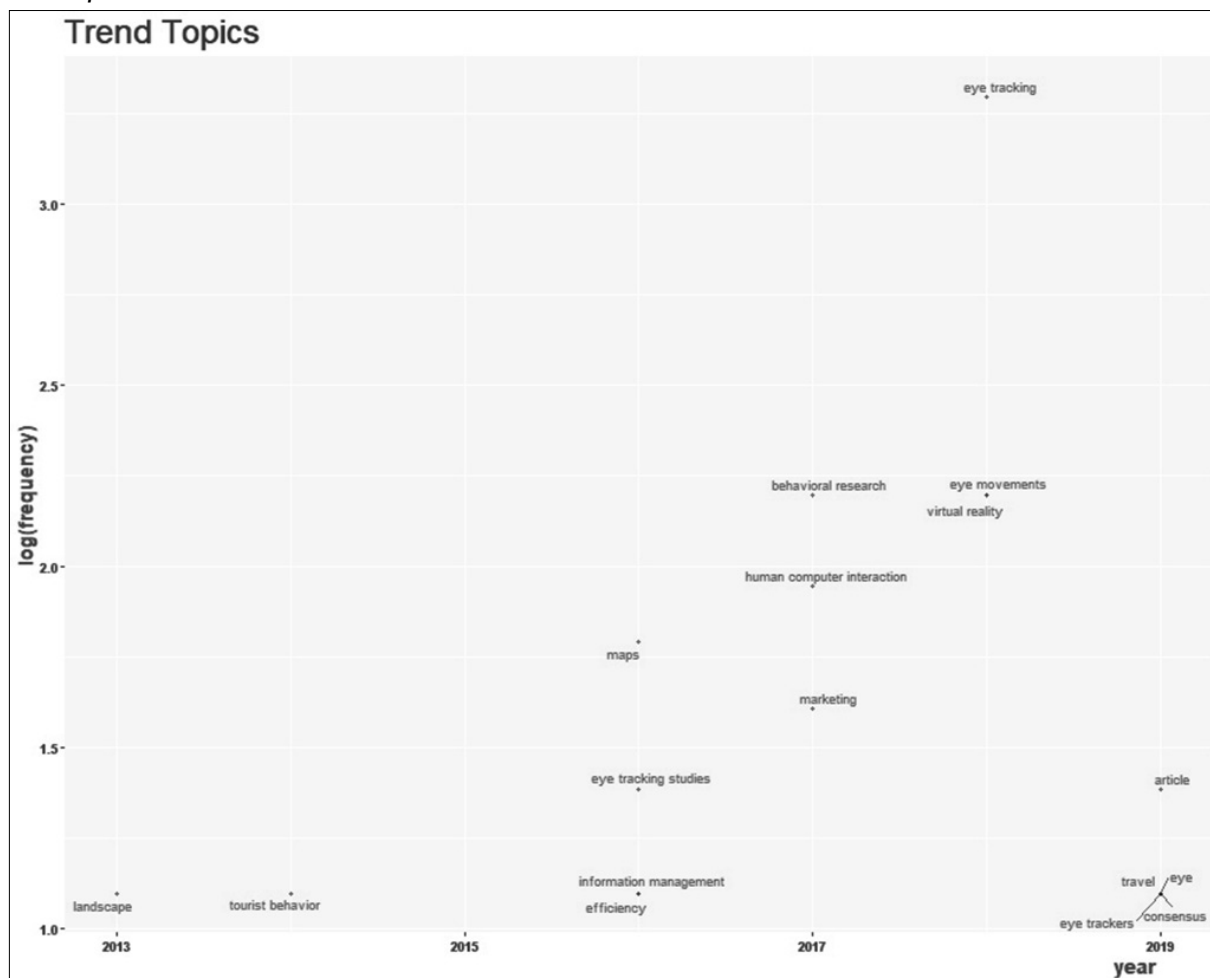
Table 2
Top cited documents

Paper	Topic	Findings	TC
Li et al. (2015)	• Current and potential methods for measuring emotion in tourism experiences	• Studies of emotion in tourism literature generally use self-reporting questionnaire strategies that capture the high-order emotions of tourists and are subject to a number of types of biases.	55
Hernández-Méndez, & Muñoz-Leiva (2015)	• The efficiency of online ads on various sites under the eTourism	• Participants take longer periods and higher levels of fixation to recognize text than images, and the static banner was the first element fixated by them.	34
Li et al. (2016)	• Visual attention toward tourism photographs with text	• Texts within photographs attract the visual attention of tourists. Photographs with text in a known language and/or with a single message draw more visual attention. The text language is important for participants' perceived advertising effectiveness.	26
Wang & Sparks (2016)	• Tourism photo stimuli, image characteristics, and ethnicity	• High-arousal images draw a high number of fixations and a longer duration of fixation. Images of nature attract a longer duration of fixation. There are differences in the attention and scanning patterns of Australians and Chinese.	26
Raptis et al. (2018)	• Effects of mixed reality on players' behavior and immersion in a cultural tourism game	• The effects of the human cognitive style on game-specific interactive behavior and visual behavior have been amplified by mixed-reality interaction.	25
Scott et al. (2016)	• Using eye-tracking to examine tourism advertising effectiveness	• Methods of eye-tracking are more effective than methods of self-reporting for tourist ads research.	21
Kiefer et al. (2014)	• Exploring touristic trips with a mobile eye-tracking device	• A good predictor for the total exploration duration was found to be the number of areas of interest revisited in a city by tourists during a short period of time.	19
Boz et al. (2017)	• Neuromarketing aspect of tourism pricing psychology	• Positive statements of previous customers in ads draw customers' attention. Discount rates draw more attention than reduced prices. The center of a visual promotion is a good place to show reduced prices and discount rates.	16
Scott (2019)	• Eye-tracking studies in tourism	• The use of eye-tracking techniques in tourism is important. Advertising perception, website design and effectiveness, and visual attention of customers are the main research areas in tourism studies.	13
Wang et al. (2016)	• Predicting learning outcomes and diagnosing cooking interests using eye-tracking	• Text draws much more visual attention than pictures on static recipes. Videos draw more visual attention than text on dynamic recipes. On the dynamic page, the visual attention paid to the text was negatively related to the knowledge of knife skills. The visual attention paid to the text on the static page, on the other hand, was positively related to prior cooking interest.	13

4.2.1. Keyword trends and co-word analysis

Keyword trends (trend topics) analysis shows how the literature has changed over the years on a coordinate plane by using keywords, abstracts, and titles. This analysis indicates which topics are used in which years in the published studies. There are certain benefits to choosing the right keywords and writing titles and summaries that accurately describe the topic in scientific publications. The preliminary definitions such as abstract, title, and keyword in the scientific publications are important to describe the related research field and framework. Thus, other researchers can easily access the publications in the related literature with the help of keywords, titles, and abstracts (Grant, 2010). Thanks to trend topics analysis, it is possible to observe the changes in the keywords, titles, and abstracts over the years, which have become the driving factor for the proliferation of research in any field (Figure 4). Trend topics analysis assigns logarithmic frequency values to terms on a coordinate plane to observe the changes.

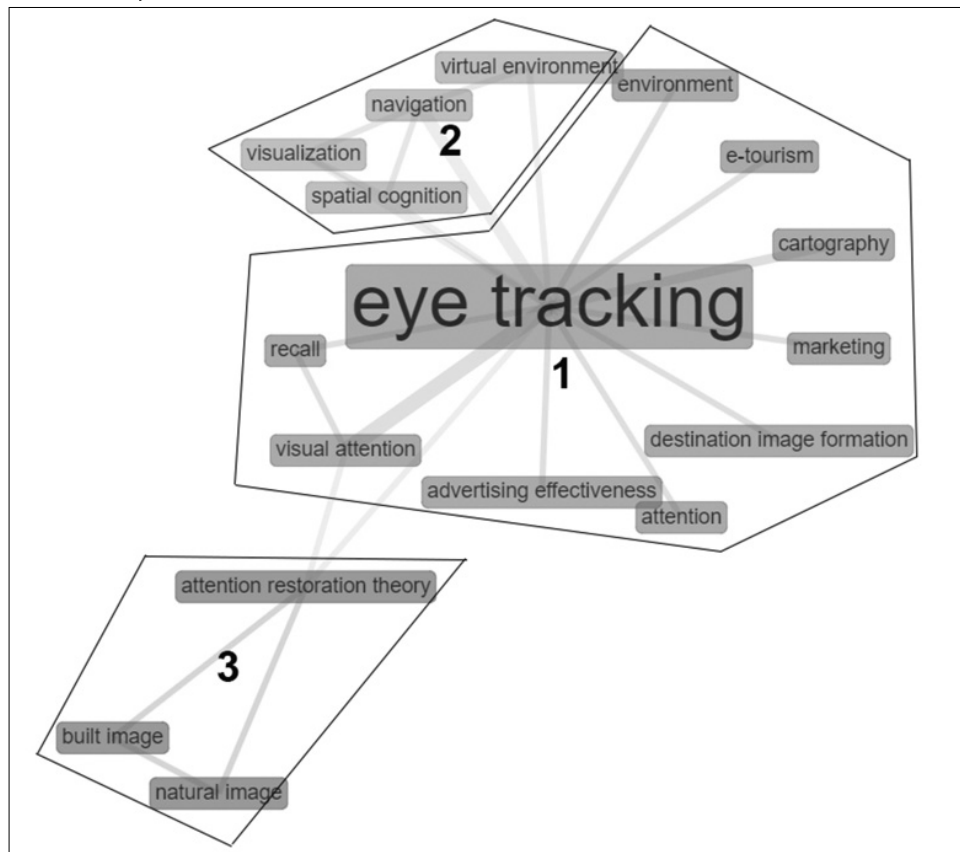
Figure 4
Trend topics of the field



With the help of Figure 4, created to show the 3 keywords mentioned at least 3 times every year between 2013-2019 (obtained from abstract, keyword and title), the trends of eye-tracking studies in tourism were investigated. It was seen that while the studies frequently included keywords from the marketing and behaviour fields in more recent years, the terms "eye tracking" and "eye movement" preserved their popularity.

Co-word (co-occurrence) analysis presents keywords used together in research. In the analysis, keywords in the publications were visualized with the "Fruchterman-Reingold" algorithm. Fruchterman-Reingold is a power-based order algorithm. The fundamental starting point is to move the nodes to adjust the balance of power between them and minimize the system energy. In the normalization of the values in the network, the "association" method and "Walktrap" as a clustering algorithm were preferred. Lastly, the network map was visualized with a minimum of 2 connections and 17 nodes that meet the criteria (Figure 5).

Figure 5
Co-word analysis



Three clusters in Figure 5 were represented with Cluster 1, Cluster 2, Cluster 3 respectively. It was seen that Cluster 1 with the highest number of elements represented a general structure of eye-tracking topics in tourism with the help of marketing and geography disciplines, while Cluster 2 and Cluster 3 emphasized studies that focused on behavior, psychology, and cognition.

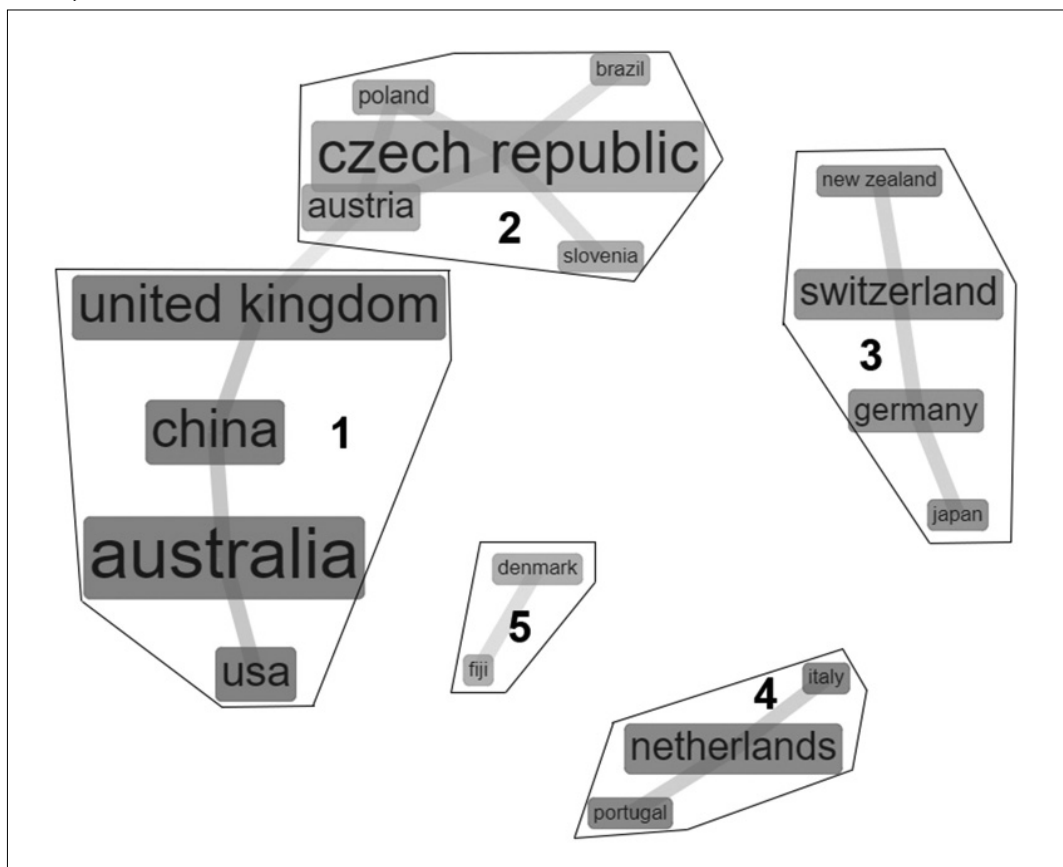
4.2.2. Collaboration networks

Collaboration networks present partnerships of individuals or organizations such as countries, authors, or journals with a social network. When the collaborations were investigated for countries, *country x country* adjacency matrix determined for co-publication frequency was used. The formation of the network analysis based on co-publishing is given below according to the modularity score Q (Blondel et al., 2008; Newman, 2003).

$$Q = \frac{1}{2h} \sum_{ii'} \left[a_{ii'} - \frac{\delta_i \delta_{i'}}{2h} \right] s_i s_{i'}$$

In the formula, δ_i represents the degree of node i , h represents the total number of edges and s_i represents the membership node i to a community (Aria et al., 2020). When the collaborations were investigated for universities, *university x university* adjacency matrix determined for co-publication frequency was used.

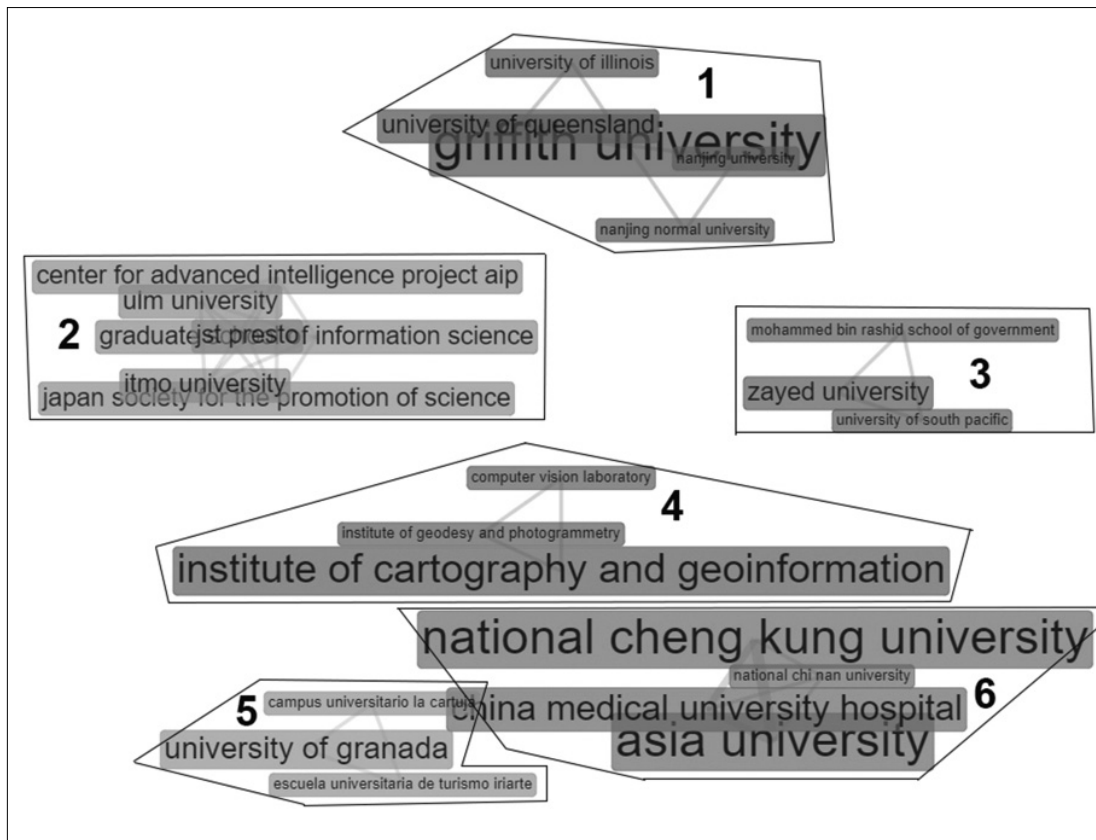
Figure 6
Country collaboration network



In Figure 6, it was seen that many countries were collaborating in eye-tracking studies in tourism. The size of the nodes in the network presents the publication frequency of the countries, while the number represents the cluster they belong to. It can be seen in Figure 6 that clusters with the same number tend to publish together more. When the cooperation network was examined, it was seen that Australia was an effective country in the Cluster 1. It was also determined that the countries in the Cluster 1 cooperate more. The Czech Republic, which was also effective in the collaboration network, dominated the Cluster 2. Switzerland in the Cluster 3, the Netherlands in the Cluster 4, and Denmark in the Cluster 5 were also effective countries in the network. With a total of 18 countries, the network was formed by clustering nodes with at least two connections.

Figure 7 shows that "Griffith University" in the Cluster 1, "Zayed University" in the Cluster 3, "Institute of Cartography and Geoinformation" in the Cluster 4, "National Cheng Kung University" and "Asia University" in the Cluster 6, and "University of Granada" in the Cluster 5 come to the fore in the context of the collaboration of universities or research centers. Due to the social structure of the network, a map of nodes with two or more relationships was not plotted. Instead, 24 countries with at least one connecting node that fit the criteria were represented on the social network.

Figure 7
University collaboration network



5. Discussion and conclusions

Developments in information and communication systems contribute to the advances in various aspects of life, including eye-tracking methods (Karatekin, 2007). The results of this study revealed that the consideration of eye-tracking studies in the field of tourism arose after the development of information and communication technologies. It was seen that eye-tracking studies in tourism had increased exponentially, although these studies have a short history. When the growth speed of eye-tracking studies in tourism is analyzed, it can be seen that the social sciences adopted certain technological developments, especially in tourism, as recently as the 2010s. Delayed efforts by social science and tourism researchers on topics that require technical hardware and software knowledge, such as eye-tracking, is an understandable phenomenon because of the human-centric nature of tourism studies (Buhalis & Law, 2008). Within this context, when the progress of eye-tracking studies in tourism research is investigated, the preference for social sciences keywords in recent years is an indication that the tourism literature has begun to change.

Marketing studies hold a particularly important position in the tourism literature. In their analysis of eye-tracking research in tourism, Scott et al. (2019) stated that topics such as "advertisement perception, website design, and usability, consumer attention to marketing information" were frequently mentioned. Interdisciplinary studies between social science and technology adoption have enabled the expansion of eye-tracking studies in tourism research. In addition, sector awareness of eye-tracking and the changing technological needs of businesses and DMOs are among the factors that direct academic studies. Within this study, the quantity of journals in the marketing and behavior disciplines is striking, although the majority of the journals are

related to the field of tourism. This situation runs parallel to the development of trend topics in the field, and it presents evidence that behavior-focused studies are increasingly important in tourism research. A perspective article (Scott, 2020) emphasized the importance of collaboration between academic institutions and tourism researchers with similar areas of investigation to break down the traditional structures in tourism research and shift to a prediction-based process. Tourism studies should evolve into a practice of theory-based thought and behavior prediction rather than descriptive studies or question-answer relationships (Laesser et al., 2019).

In bibliometric studies, social network analysis is applied to show the intellectual and social structure of the investigated field (Johnson & Samakovlis, 2019; Mehraliyev et al., 2019). When the results of the co-word analysis obtained from the research findings are evaluated, it is seen that the clusters have different approaches in the social sciences and tourism literature. However, upon considering the low number of nodes in the clusters, the social structure, and the effect level, it can be understood that unique schools in the tourism literature have not yet been clarified. Also, it is known that studies focusing on information and communication technologies usage have certain challenges (Miorandi et al., 2012). It is important to bring together those researchers with theoretical knowledge and those with experience in the application of technology in the social sciences. Various institutions and different researchers are forming collaborations to overcome these challenges (Racherla & Hu, 2010; Ye et al., 2013). In this study, it was seen that institutions and countries with close geographical links have a tendency to publish together. However, different countries in the network also tend to cooperate with countries that publish relatively frequently in the social sciences, such as the USA, the UK, China, and Australia.

5.1. Theoretical implications

In the study, a bibliometric workflow was developed based on PRISMA in order to draw a more systematic framework in bibliometric analysis. It is thought that this will help researchers follow a systematic path when designing bibliometric studies and help reviewers evaluate bibliometric articles in a more systematic way. Our study reveals significant descriptive data on the importance of eye-tracking research in tourism. For example, the rapid growth trend of eye-tracking research in tourism is an issue that should be emphasized. The willingness of researchers to work together, the development of technology, and the cooperation of tourism with other disciplines have increased the quantity of research. Besides the number of studies, a newly developed index on the number of researchers, called AFI, was also used. Therefore, our study offers two new bibliometric perspectives to the academy, namely bibliometric workflow and AFI.

Bibliometric research is inherently very limited in creating a new theory. However, it does have the ability to discover which disciplines make the most significant contribution to the research field. In addition, it is possible to reveal the conceptual structure of the research field with word-based analysis. Our keyword-based analysis shows that it is not possible to do eye-tracking research in tourism without resorting to disciplines such as marketing, geography, behavioral science, and psychology.

The findings of the collaborations in the study give clues to researchers about which academic ecosystem they can be included in and which country or university academicians attach more importance to eye-tracking studies. In this context, it should be considered that researchers who want to study eye-tracking in the field of tourism should cooperate with researchers from countries such as Australia, the Czech Republic, the UK, and China or universities such as Griffith University, National Cheng Kung, and Asia University.

5.2. Practical implications

The growth rate shown in our study cannot be explained solely by academic interest and interdisciplinary cooperation. It should be clearly stated that, as in many other fields, advances in technology are one of the reasons for the rapid growth in eye-tracking studies. The tourism sector has the potential to internalize

technology rapidly. In this context, actors in the tourism sector want to evaluate academic outputs to use their marketing budgets more effectively. Our study contains findings regarding the use of eye-tracking technologies, especially on websites. These findings summarize effective strategies tourism stakeholders should follow for their websites. In particular, exploring intercultural differences with eye-tracking technologies offers important opportunities for tourism stakeholders. For example, differences have been discovered between eastern and western cultures in how attention is captured, and advertisements are comprehended (Wang & Sparks, 2016). In addition, there are important sectoral indicators such as text language, position, and type of advertisements on websites. Choosing a static or dynamic banner (Hernández-Méndez, & Muñoz-Leiva, 2015) and creating static or dynamic recipes (Wang et al., 2016) are among the outputs that will help businesses find innovative solutions.

5.3. Limitations and recommendations

This study has certain limitations and recommendations for future research. In this study, Scopus-indexed English publications, which are mainly articles, and proceedings, are discussed. Future studies can generate seminal works by analyzing different academic databases and different publication types. By using different bibliometric techniques (co-citation, theme analysis, etc.), future studies might contribute to research flow. This study presents a panoramic image of the literature. Therefore, the study results are expected to give descriptive, social, and intellectual information to academicians and graduate students who want to conduct new studies about eye-tracking in tourism. However, statistical methods might be ineffective when searching for effective research in the literature due to a failure to add possible search terms by the authors in the titles, keywords, and abstracts of the publications. For example, one of the preliminary eye-tracking studies by Pan et al. (2004) was not identified in the descriptive bibliometric analysis. The increase of interdisciplinary studies, including with fields such as marketing, psychology, and geography, elevate the importance of research techniques used to understand and predict behavior, such as eye-tracking. Sectoral and academic collaborations are important for the future of eye-tracking research in tourism. It is recommended that sectoral representatives developing eye-tracking technologies exchange ideas and that academic representatives conduct studies in artificial environments such as the laboratory, or the field, for related academic studies in tourism.

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