The Relevance of Eye-Tracking to Understand Users' Practices and Content Interpretation in Tourism-Related Online Navigation

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Abstract This chapter presents and discusses the implications of current approaches to understand practices of users accessing tourism-related online content, especially when it comes to their understanding and interpretation of main contents and sentiments being expressed in the resources they navigate. The Eye-Tracking technique has been implemented to reach such goal, integrating results from previous research conducted by the authors (Marchiori and Cantoni, Information and communication technologies in tourism 2015, Springer, Cham; Cantoni et al., Design, user experience, and usability: understanding users and contexts, Springer, Cham, 2017). The eye-tracking technique is used to explore the match between users' actual navigation on webpages and their interpretation of the topics covered by such online resources. Results suggest that a multisource approach/data triangulation helps to reduce possible biases that may occur if only one approach is adopted both in online content analysis as well as in online consumer behavior investigation.

Keywords Eye-tracking · Web navigation · Online content analysis · User experience

1 Introduction

The ability to evaluate what prospective customers are looking at in an online publication outlet represents a new way to enhance the promotion of a destination and can provide actionable implications to designers and managers who want to better design online messages. In fact, as it has been extensively argued by studies on listening/reading and interpretation (Gadamer 1960; Cantoni and Tardini 2014),

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expression and interpretation of meaning might be misaligned: the sender intends to express a meaning, while the addresses might interpret the message in a different way(s). When it comes to social media platforms, the interpretation task is made even more complex: on the one side many different users publish very different (even contradicting) messages, with different communication goals and strategies; on the other side, all such messages are published together and have to comply with specific templates defined by platforms' creators.

The eye-tracking technique is nowadays used for studying eye movements applied to several fields. In the context of online navigation practices and content interpretation, scholars already confirmed that "seeing is not necessarily liking" (Cantoni et al. 2017; Husić-Mehmedović et al. 2017; Fraiss et al. 2017). Indeed, the eye-tracking measures should be complemented with other methods such as surveys, direct observations, log-file analyses in order to avoid biases in data interpretation (Qu et al. 2017).

This chapter proposes an approach to online content analysis that includes the Eye-Tracking technique (ET) using the tourism domain as an application field. The procedure for performing an analysis of users' practices and content interpretation using the eye-tracking technique is described using a specific case study: an experiment with 48 users (21 males, 27 females) who have been exposed to several tourism-related online contents. The eye-tracking tools Tobii Studio 3.4 and the Tobii tracker X2–60 have been used to capture users' gazes and fixations, together with a pre-post questionnaire for collecting their self-reported perceptions on specific tourism-related online contents. Results provide insights on how to apply an eye-tracking technique in order to understand what kind of relation exists between content recognition and eye movements on tourism-related social media contents.

Overall, the capacity of ET has been recognized as a useful tool to understand what grabs users' attention the most, while navigating social media pages (e.g., elements of a web page, such as topic and sentiment expressed). In particular, ET might be useful for: (1) investigating online navigation patterns; (2) understanding how to better communicate/design online messages; and (3) understanding users' online decision-making process.

Destination managers might benefit from this study as the proposed framework, which comprises self-reported and eye-tracking techniques, could be used for testing the effectiveness of an online marketing campaign, or a website interface, or a new mobile application.

2 Related Works

2.1 Eye-Tracking Technique and Tourism

With the term "eye-tracking" it is intended a technique that measures the movements of the eyes with respect to the head (Nielsen and Pernice 2010). Nowadays, thanks to

technological advances, the ET technique uses eye-tracker hardware and software that can be applied in various fields.

In particular, psychology and marketing benefit from the use of ET as it allows a deeper understanding of users' behavior (Gidlöf et al. 2013). ET is also used to evaluate user experience for (digital) products and services (Qu et al. 2017). Eye-tracking is also applied to investigate the online consumer behavior in the tourism and hospitality domain, in particular, to explore: the online decision-making process of potential clients (Noone and Robson 2014); users' behaviors using different smart devices (Fraiss et al. 2017); people's perception of tourism-related images according to ethnicity (Wang and Sparks 2014); until using mobile ET for investigating visitors' interactive learning experience in a real-life museum context (Rainoldi et al. 2018).

Eye-tracking research has been carried out also in the field of social media and tourism. Taking as a reference point the previous studies applying an eye-tracking approach to social media (Wan Adilah et al. 2013), this branch of research has attempted to analyze what are the digital aspects that attract users the most while navigating on tourism-related social media pages (Marchiori and Cantoni 2015). Moreover, other studies used the eye-tracking technique to analyze advertising effectiveness on tourism-related blogs, social networks, and review portals (Méndez 2015).

2.2 Eye-Tracking Technique and Users' Practices

A previous study done by Cantoni et al. (2017) compared the results from three different research approaches, namely: eye-tracking, web analytics, and self-declared investigation in order to gain an understanding of users' preferences in terms of tourist attractions for a specific destination. In fact, the study revealed certain correspondences in terms of preferred themes, but some results may seem contradictory. For example, even if participants mostly looked at sections related to a theme (i.e., nature), the majority of self-declared attractions belong to another one (i.e., sports/outdoor), indicating that what users look at does not always reflect their preferences. This shows the importance of adopting a multisource approach: if only one approach is used, possible biases may occur in identifying online preferences.

Current approaches in (web) content analysis generally consider the viewpoint of the coder in his/her identification of the main topic expressed and/or using in-depth sophisticated analysis such as restructuring sentences and analyzing their specific linguistic composition. So far inter-coder reliability generally helped to identify if there was or not an agreement in the way coders interpreted the same content (e.g., text, video, or a mix of them as on social media). However, evidences from content analysis involving actual users are needed in order to better assess web page navigation and better identify the content categories.

3 Research Design

Having the abovementioned theoretical background, an approach is proposed that includes the eye-tracking technique, using the tourism domain as an application field. An experiment, which comprises the exposure of users to a selection of manipulated contents from social media about a tourism destination, was performed.

The eye-tracking tools Tobii Studio 3.4 and the Tobii Tracker X2–60 were used to capture users' gazes and fixations while users navigated the manipulated contents.

Pre-post questionnaires were performed for collecting users' self-reported agreement on the identification of the main topic/sentiment among the four most popular social media platforms: Facebook, Tripadvisor, Twitter, and Instagram.

Thus, it is assumed that eye-tracking technique can be a valid aid to answer the two following research questions:

1. *Which elements of the pages do attract users' attention the most, which in turn might lead to the identification/interpretation of the main topic/sentiment expressed within social media pages?* In order to answer this question eye-tracking data were checked against users' assessment of the main topic/sentiment among social media pages.
2. *How do users interpret the main topic/sentiment of mixed pages, that is, pages that contain positive and negative content?* In order to solve this second research question, users were randomly divided into two groups; one group was exposed to positive and mixed contents, while the other group was exposed to negative and mixed contents. This procedure allowed to identify if there is any sentiment prominence in the interpretation of such pages. Also, a question devoted to investigate the willingness to visit the destination in both cases (exposure to main positive or negative contents) was asked.

Case Study
The case study selected for the experiment was a tourism destination located in the South of Switzerland: Ticino. A group of teenagers participated in the experiment; they were from a border city located in the North of Italy. A total of 48 participants (21 males, 27 females) aged between 17 and 19 years recruited on a voluntary basis took part in the test, which was performed in April 2016. Participants were recruited from a high school of an Italian city located in a region neighboring the Swiss destination under study. A consent form signed by them (or their parents) was required in order to involve them in the test.

3.1 Selection of Stimuli

The test was based on a user navigation of a selection of manipulated social media pages regarding the destination Canton Ticino, the Italian-speaking region in Southern Switzerland on the border with Italy.

Design of the visual social media stimuli:

11 stimuli were used for the experiment. The stimuli were from original social media pages from different social media platforms divided as follows:

Social media platforms: Facebook (3 stimuli), Tripadvisor (3 stimuli), Twitter (3 stimuli), and Instagram (2 stimuli).

Topic: each stimulus (a screenshot of a social media feed page) was representing one main topic. The 11 topic categories from the DORM model have been used, namely: accommodation, attractions, events, gastronomy, culture and traditions, safety, destination image, entertainment, locals, weather, and transportation.

Most stimuli included also a subtopic, with the goal to clarify the object of the main topic. When present, the subtopics covered "price" or "tourist experience."

Sentiment: each stimulus was representing one main sentiment polarity (mainly positive or mainly negative) or a mixed scenario, that is the page contains positive as well as negative contents). Thus, stimuli were divided in three groups: four stimuli had mostly positive sentiment, four had mostly negative sentiment, while three stimuli were mixed, having a balanced presence of positive as well as negative sentiment.

Table 1 presents a summary of the composition of the visual stimuli. In the rows, the social media platforms are indicated, while in the columns, the related sentiment is indicated. Each cell contains the related main topic.

3.2 Setting of the Experiment

The setting of the test was structured as follows: each participant was invited to sit in front of a PC, equipped with the Tobii X2–60 hardware mounted below the PC screen. Once the eye calibration process was completed, the test started.

A pre-questionnaire was administered asking demographic information (age and sex), if they had already visited the destination under study (Ticino) or not, and their willingness to visit it.

Users were randomly dived in two groups:

- Group A (22 students) was exposed to 4 mainly positive stimuli +3 mixed stimuli.
- Group B (26 students) was exposed to 4 mainly negative stimuli +3 mixed stimuli.

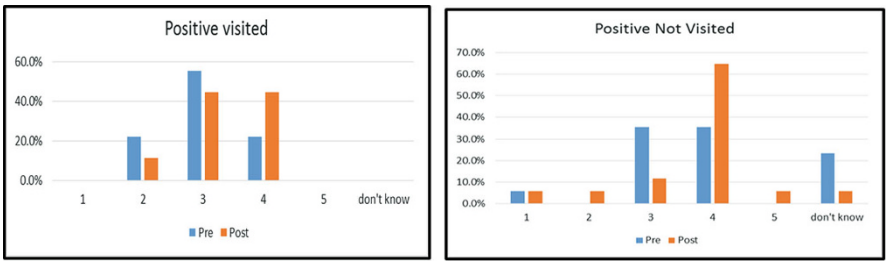
Each user was exposed to seven stimuli. Each stimulus contained 1 of the 11 defined topics.

After the exposure to each stimulus, participants were asked to identify:

- Main topic: accommodation, attractions, events, gastronomy, culture and traditions, safety, destination image, entertainment, locals, weather, transports (destination dimensions derived from Marchiori and Cantoni 2016)
- Secondary topic: prices, tourist experience, or none

Table 1 Summary table of the 11 stimuli used in the experiment

	+	-	+ -
FACEBOOK	Safety	Events	Weather
TRIPADVISOR	Site attractions	Residents	Transportation
TWITTER	Culture and traditions	Entertainment	Gastronomy
INSTAGRAM	Overall Image	Accommodation	- None -



Figs. 1 and 2 Exposure to mainly positive stimuli. Pre and Post willingness to visit Ticino among who had already visited the destination, and who had not visited it yet

- Sentiment expressed: a 5-point Likert scale was used, from completely negative to completely positive

A post-questionnaire was finally administered, asking users what did grab their attention the most, and their willingness to visit the destination.

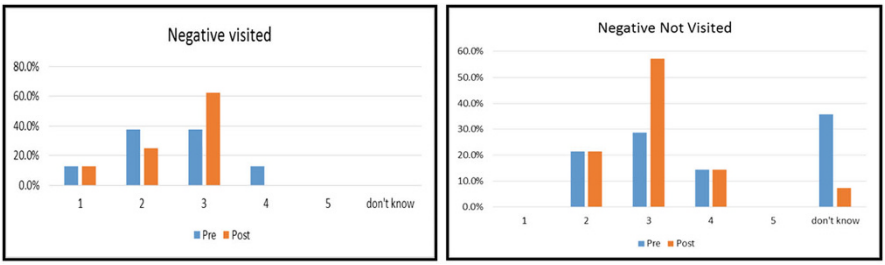
4 Results

Results of the pre-test questionnaire revealed that 95% (46 out of 48) of the respondents had heard about the destination under study. However, 65% (31) of the respondents had not visited Ticino yet. Among the 35% (17) who had already visited Ticino, the large majority indicated a medium-high level of appreciation of the destination. Among them, almost all (14) stayed there overnight at least once. Overall, the main reason to visit Ticino had been "Events" (35%).

4.1 Self-Declared Willingness to Visit Ticino

Figures 1 and 2 present the results of group A, which is the group exposed to mainly positive stimuli about the destination. Within them, two additional groups were checked against each other: the ones who had already visited the destination, and the ones who had not visited it yet. Pre and post answers were checked using a 5-point Likert scale where 1 = not willing to visit, and 5 = very much willing to visit. Results revealed that those who visited already the destination after the exposure to positive stimuli tend to reinforce and increase their willingness to visit. The ones who had not visited the destination yet, after the exposure to positive stimuli tend to increase their willingness to visit and reduce their uncertainty ("don't know").

Figures 3 and 4 present the results of group B, which is the group exposed to mainly negative stimuli about the destination. Results revealed that those who visited already the destination after the exposure to negative stimuli tend to reinforce



Figs. 3 and 4 Exposure to mainly negative stimuli Pre and Post willingness to visit Ticino among who had already visited the destination, and who had not visited it yet

an average position (Likert value 3) to visit Ticino. The ones who had not visited the destination yet, after the exposure to mainly negative stimuli tend to reduce their uncertainty and reinforced the average position.

4.2 Correlation Between Eye-Tracking (ET) Outcome and Self-Declaration of Main Topic, Subtopic, and Main Sentiment Expressed for Each Stimulus

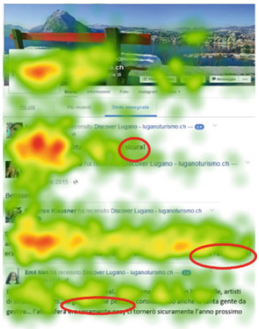
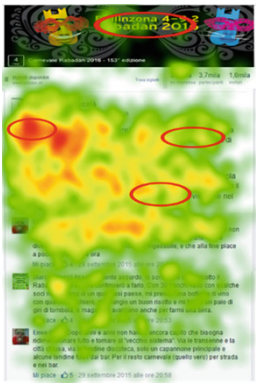
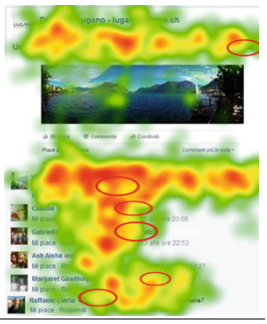
Tables 2, 3, 4, and 5 present an in-depth focus on the correlation between ET outcome and interpretation of the main topic, subtopic, and the main sentiment expressed divided by social media platforms.

Table 2 presents the results for the platform Facebook. Checking the ET heat areas that grabbed the users' attention the most against the users' interpretation of the main topic, subtopic, and the main sentiment expressed, it can be assumed that the only non-recognized main topic of the stimuli was for the topic "safety." Indeed, as underlined with circles in the picture (Stimulus 1 of Table 2), the indication of the topic safety was only in textual form and displayed in the middle and bottom of the page. This might suggest that users tend not to look at the bottom of the page for identifying the main topic expressed.

Table 3 presents the results for the platform Tripadvisor. Results revealed an overall agreement in the identification of the main topic, subtopic, and the sentiment expressed. As underlined by the circles in the heat maps, users tend to pay attention to the title and first comment. It has to be said that the pages presented from Tripadvisor were mainly textual-based and therefore forced the respondents to read the contents in order to evaluate the page. Thus, that might be the reason why the first comment on each page was viewed entirely by the users.

Table 4 presents the results for the platform Twitter. Results revealed an overall agreement in the identification of the main topic, subtopic, and the sentiment expressed. As underlined by the circles in the heat maps, users tend to pay particular attention to the hashtags presented in the text. Indeed hashtags appeared to act as a

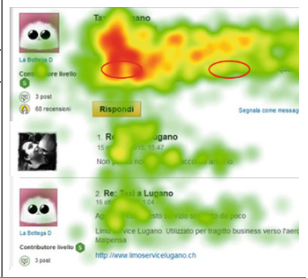
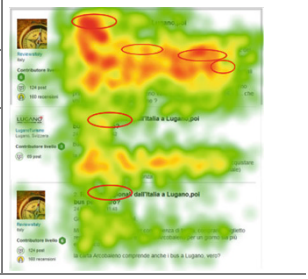
Table 2 Facebook pages

	Level of coding	Intended manipulation	Coded by users	Eye-tracking heat map
Facebook stimulus 1	*Main topic*	Safety	Recognized by 3 out of 22	
	Subtopic	Tourism experience	Recognized by the majority	
	Sentiment	>Positive	Recognized by the majority	
Facebook stimulus 2	*Main topic*	Events	Recognized by the majority	
	Subtopic	Tourism experience	Recognized by the majority	
	Sentiment	>Negative	Recognized by the majority	
Facebook stimulus 3	*Main topic*	Weather	Recognized by the majority	
	Subtopic	Tourism experience	Recognized by the majority	
	Sentiment	Mixed	Recognized by the majority	

particular formatting in the text (e.g., as bold formatting) and/or as a summary of its meaning, which captures the attention the most. Pictures also were paid attention; however, there is not a specific area in the pictures that appeared to grab most of the attention.

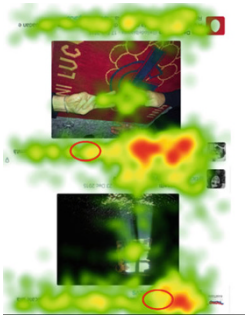
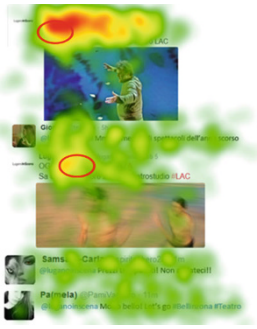
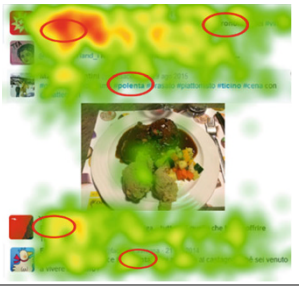
Table 5 presents the results for the platform Instagram. Results revealed an overall agreement in the identification of the main topic, subtopic, and the sentiment

Table 3 Tripadvisor pages

	Level of coding	Intended manipulation	Coded by users	Eye-tracking heat map
Tripadvisor stimulus 1	*Main topic*	Site attractions	Recognized by the majority	
	Subtopic	Price	Recognized by the majority	
	Sentiment	>Positive	Recognized by the majority	
Tripadvisor stimulus 2	*Main topic*	Residents	Recognized by the majority	
	Subtopic	None	Mixed	
	Sentiment	>Negative	Recognized by the majority	
Tripadvisor stimulus 3	*Main topic*	Transportation	Recognized by the majority	
	Subtopic	Price	Recognized by the majority	
	Sentiment	Mixed	Recognized by the majority	

expressed. However, for the first stimulus "Image," respondents indicated instead "Entertainment." This suggests how the keyword proposed "Image" was too generic and maybe not clearly understandable for the content analysis task they received. As underlined by the circles in the heat maps, users tend to pay particular attention to the comments present in the text. Indeed, in the stimuli proposed the expressions of sentiment were displayed mainly in the comments. Pictures also received attention; however, there is not a specific area in the pictures that grabbed most of the attention.

Table 4 Twitter pages

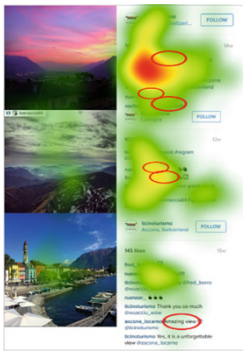
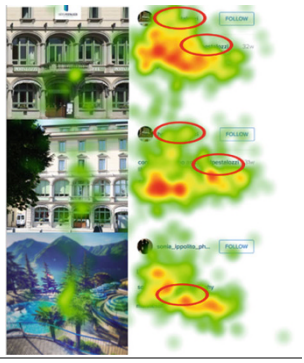
	Level of coding	Intended manipulation	Coded by users	Eye-tracking heat map
Twitter stimulus 1	*Main topic*	Culture and traditions	Recognized by the majority	
	Subtopic	Tourism experience	Recognized by the majority	
	Sentiment	>Positive	Recognized by the majority	
Twitter stimulus 2	*Main topic*	Entertainment	Recognized by the majority	
	Subtopic	Price	Mixed	
	Sentiment	> Negative	Recognized by the majority	
Twitter stimulus 3	*Main topic*	Gastronomy	Recognized by the majority	
	Subtopic	Tourism experience	Recognized by the majority	
	Sentiment	Mixed	Recognized by the majority	

5 Conclusions

This study wants to contribute to the current reflection of the methods used for online content analysis, particularly of social media pages, by including the eye-tracking technique. ET technique in this study is assumed to help to understand where a user/interpreter looked at while interpreting the main topic and sentiment of a page.

This study provides insights about the actual interpretation of social media pages as actual users (segment teenagers) were involved. In this study respondents were

Table 5 Instagram pages

	Level of coding	Intended manipulation	Coded by users	Eye-tracking heat map
Instagram stimulus 1	*Main topic*	Image	Majority indicated entertainment	
	Subtopic	Tourism experience	Recognized by the majority	
	Sentiment	>Positive	Recognized by the majority	
Instagram stimulus 2	*Main topic*	Accommodation	Recognized by the majority	
	Subtopic	Price	Mixed	
	Sentiment	>Negative	Recognized by the majority	

asked to navigate several social media pages, allowing to know, thanks to the use of the ET technique, their perceptions associated with a specific content.

Results show an overall common agreement on the main topic, independently from the main expressed sentiment. Respondents' eyes were passing over significant elements related to the contents of the webpages. Apparently, in order to establish the main topic of a page, users looked more to text rather than to images.

However, in a content analysis which uses heat maps from eye-tracking data several insights can be mentioned:

- Images seemed to play a less significant role in the identification of the main topic, subtopic, and the sentiment expressed. However, results might change if the total number of fixations over the pictures is considered. Indeed, the creation of the areas of interest for each picture could be implemented in the content analysis.
- Some platforms are mainly picture-visual based such as Instagram and in part Twitter and Facebook. Thus, a combination of an in-depth analysis of the parts of the text viewed and the fixations on the pictures could be considered in the content analysis. This might provide a better understanding of the keywords/

sentences which were mainly viewed and in turn, might be associated with the content of the picture/s displayed on the same page.

- In this study, 65% of respondents answered "pictures" as the format that grabbed their attention the most, while 35% answered "text". This insight indeed revealed how a user tends to remember mainly picture/visual based aspects even if the actual navigation data revealed that a user spent the majority of his/her navigation time in looking at texts. The relative predominance of text over images when it comes to fixation time might be explained due to the different access we have to the two different communication codes: the visual one is perceived and interpreted in a holistic way, while the textual one requires a spatially ordered and more time-demanding attention.

As emerged from the study, a social media page can also be deconstructed in several aspects that might grab the attention the most, such as:

1. Format (textual or visual)
2. Characteristic of the textual part (the sentiment expressed, presence of formatting like bold, italic; size like title or paragraph)
3. Position of the element that grabs the attention the most (e.g., on top of the page)
4. Presence of symbols in the text (e.g., hashtag, emoji)
5. Stereotypical images, which easily communicate a positive or negative value (e.g., an image portraying garbage in a street might communicate a lack of care and thus create a negative judgment)
6. Presence of specific rating symbols (e.g., like button, star rating)

An in-depth investigation of the role of each of the abovementioned aspects could be further conducted in a future research.

Several limitations associated with this study are discussed below. Future research is suggested to carefully consider them. (1) In this study, users were required to identify the main and secondary topic of each page together with the sentiment expressed. These tasks can be considered as biased as they create an unnatural web navigation within the page. That is, users were focused much on reading rather than freely navigating the page. Future research can, therefore, check results against a free navigation, allowing users to freely search for content they are interested in and then follow their actual web navigation habits. (2) Lack of investigation on the areas of interest, specifically for the pictures. Future research can, therefore, consider using the functionality offered in the ET software, which allows to determine in advance the areas of interest to track and thus better count the number of fixation and gaze movements within them. (3) A specific age segment was considered in this study using tailor-made stimuli for a specific destination. Future research can, therefore, enlarge the sample and ensure a more variability in the stimuli proposed.

While this research has contributed to a better understanding of reading and interpretation practices of teenagers, when it comes to their access to social media pages related to a tourism destination, it has also practical implications. In particular, it can help destination managers and others involved in a destination's online

marketing, to better design their messages, based on a deeper understanding of actual users' practices.

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