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NEUROWINE
How extrinsic cues influence wine quality perception
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Preface

The Ph.D. thesis, titled “NEUROWINE”, derives its name from a combination of two concepts: “wine”, the famous alcoholic beverage, and the prefix “neuro”, which conveys the complexities of the nervous system. In this context, the nervous system is not examined only anatomically, but above all takes on an abstract guise, representing the intricate cognitive processes through which human experiences are perceived and evaluated.

“NEUROWINE” is not simply a catchy title, but encapsulates the essence of the thesis, embracing a multidisciplinary approach that integrates wine economics, rural development, marketing, psychology, and neuroscience. The main aim of this study is to undertake a journey into the minds of wine industry consumers, revealing their perspectives and behaviours. The analysis focuses on the extrinsic cues that shape consumers’ perception of wine quality and their preferences. The thesis examines several relevant aspects of the wine industry, both from service and product perspectives.

Using a macro approach related to the scale of the wine region, the thesis explores the strengths and weaknesses of wine tours and cellar door visits to optimize the experiences offered and satisfy the needs of visitors. A positive wine tourism experience not only serves as a sponsor for the product but also creates a meaningful connection with the consumer, thus fostering trust and brand loyalty. At the same time, the thesis takes a micro approach, delving into the visual presentation of the product, and investigating the role of label design and brand name in consumer decision-making.

This research attempts to provide practical frameworks to assist both researchers and professionals in the analysis of wine consumer behaviour. It addresses existing gaps related to consumer experiences and product valorisation in the field of wine marketing by introducing innovative methodologies. Simultaneously, it seeks to provide companies, marketers and

designers with the knowledge necessary to improve the performance of their wine products and services and consequently meet the needs of their customers.

“NEUROWINE” guides you through the intricate relationship between human perception and the world of wine, from reviewing literature to practical experimentation. The hope is that the observations and results can contribute to future research in this fascinating and multidisciplinary field.

Extended abstract

The modern wine market is characterized by its intricate complexity and intense competition. Companies must employ targeted marketing strategies to convey their value proposition effectively and distinguish themselves in a crowded marketplace. The success of these companies depends on their ability to satisfy the needs and desires of their customers, an outcome that can only be achieved through a deep understanding of the decision-making process and the myriad of factors that shape consumer choices.

In this customer-centric framework, quality emerges as a critical factor for achieving business success. Traditionally, the quality of wine is closely associated with the intrinsic organoleptic characteristics of the product. However, opportunities for consumers to taste the product before purchase are increasingly rare, and evaluating quality based solely on intrinsic cues proves challenging for non-expert buyers. Consequently, in the absence of prior product knowledge and tasting experiences, consumers turn to external factors, or extrinsic cues, to make their decisions.

For instance, the presentation of the product, encompassing elements like information and label design, stands out as crucial extrinsic cues that serve as the initial point of contact between consumers and the product. These elements communicate the values and image of the winery, exerting a significant influence on consumer expectations and impressions.

In addition, wine services such as wine tours and cellar visits play a fundamental role in strengthening the presentation aspect of wine products. These services offer a unique opportunity for consumers to interact directly with the winery environment. By immersing visitors in the sensory experience of vineyards, cellars and tasting rooms, wine tours enhance the narrative of the quality associated with the product. They serve as a tangible

extension of the winery's presentation, providing face-to-face encounters that strengthen and enrich consumers' perception of the quality of the wine.

Surprisingly, despite their importance, these extrinsic cues have remained largely unexplored. The few examples in the literature on this topic have mainly used conventional research methods, including focus groups, interviews, surveys or questionnaires. It's important to note, however, that these traditional marketing research techniques have their limitations. They rely primarily on consumers' rational responses, but decision-making and evaluation processes are often influenced by subconscious and emotional factors that individuals may not readily recognize or effectively articulate in words.

To overcome these limitations, the thesis seeks to identify external factors that shape consumers' experiences and their perceptions of wine quality. It aims to enhance wine tourism products, encompassing from the macro-scale of wine region to the micro-scale of product presentation. By analyzing consumer opinions and preferences, it aims to uncover the critical factors influencing their contentment or discontentment with wine products and services. This study employs a combination of conventional marketing methods and innovative techniques designed to monitor the biophysical responses guiding consumer evaluations. To achieve this objective, the thesis utilizes both quantitative and qualitative approaches, including Sentiment Analysis (SA) and Text Mining (TM), as well as Consumer Neuroscience (CN) techniques, specifically eye-tracking (ET) and electroencephalography (EEG). The overarching aim of this research is to offer guidance and recommendations beneficial to researchers, businesses, marketing professionals, and designers involved in the creation and promotion of wine tourism products.

The research methodology employed a structured approach, as follows:

- **Literature Review:** a literature review was conducted to establish the concept of quality, the quality of wine and the methodologies for assessing this quality. Furthermore, by highlighting the gaps in the literature on wine marketing, potential problems in this field and the solutions proposed by the thesis were identified (Chapter 1).
- **Service quality:** two researches identified which factors characterize the quality and failure of wine tours and visits to wineries by analyzing user reviews shared online on the TripAdvisor platform. Sentiment Analysis (SA), Text Mining (TM) and Natural Language Processing methods were used to extract the information and emotional aspects that characterized experience assessment. The outcomes not only transcend the limitations often associated with traditional questionnaires but also furnish invaluable insights for designing successful wine tours and cellar visits. These insights are poised to assist operators, companies, and policymakers in enhancing the tourism offerings and winescape (Chapter 2, Research Articles 1 and 2).
- **Product quality:** Two experiments explored which visual cues of product presentation influence consumer perception during the assessment process. These experiments primarily focused on the design of product labelling and the familiarity of the brand. Neuroscientific techniques, especially eye-tracking (ET) and electroencephalography (EEG), were employed to capture unconscious and biophysical reactions, shedding light on mechanisms of visual attention and their correlation with preferences expressed during evaluation. The findings attempt to meet theoretical and practical needs by investigating consumer behaviour and preferences through innovative and multi-method approaches, in particular by combining EEG and Sentiment Analysis (Chapter 3, Research Articles 3 and 4).

In conclusion, the research findings provide a significant contribution to the field of wine marketing research, both in theory and in practice. First, the study attempts to address gaps in the literature by examining how extrinsic cues influence perceptions of wine quality, presenting innovative methods for fellow researchers. Additionally, it offers practical guidance to wineries, marketers and designers in the development of wine products and services, ultimately improving the overall winescape (Chapter 4).

Keywords: Wine, Quality perception, Extrinsic cues, Service quality, Service failure, Label design, Brand name, Consumer behaviour, Customer satisfaction, Sentiment Analysis, Text Mining, Consumer Neuroscience, Eye-tracking, Electroencephalography.

List of research articles

The thesis is based on the following research articles:

1. Barbierato, E., Bernetti, I.* and Capecchi, I. (2022), Analyzing TripAdvisor reviews of wine tours: an approach based on text mining and sentiment analysis, *International Journal of Wine Business Research*, Vol. 34 No. 2, pp. 212-236. <https://doi.org/10.1108/IJWBR-04-2021-0025>.
2. Barbierato, E.*, Bernetti, I., & Capecchi, I. (2022). What went right and what went wrong in my cellar door visit? A worldwide analysis of TripAdvisor's reviews of Wineries & Vineyards. *Wine Economics and Policy*, 11(1), 47-72. <https://doi.org/10.36253/wep-10871>.
3. Barbierato, E.*, Berti, D., Ranfagni, S., Hernández-Álvarez, L. and Bernetti, I. (2023). Wine label design proposals: an eye-tracking study to analyze consumers' visual attention and preferences, *International Journal of Wine Business Research*, Vol. 35 No. 3, pp. 365-389. <https://doi.org/10.1108/IJWBR-06-2022-0021>.
4. Barbierato, E.*, Alvino, L., Kizgin, H., Van der Lubbe, R., and Bernetti, I. Brand Name and Label Design Effect: A Neuroscientific Exploration of Attentional Preferences through EEG and Sentiment Analysis. *Working paper*.

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List of Abbreviations

AIDA	Attention, Interest, Desire, Action
CA	Content Analysis
CN	Consumer Neuroscience
EEG	Electroencephalography
ET	Eye-tracking
fMRI	Functional Magnetic Resonance Imaging
GLM	Generalized Linear Model
LM	Linear Model
MDS	Multidimensional Scaling Method
NLP	Natural Language Processing
PCN	Posterior Contralateral Negativity
PGC	Producer Generated Content
RF	Random Forest
RO	Research objective
RQ	Research question
SA	Sentiment Analysis
SEC	Search-Experience-Credence
SOR	Stimulus-Organism-Response
SVM	Support Vector Machine
TF-DF	Term Frequency–Document Frequency graph
TM	Text Mining
UGC	User-Generated Content

CHAPTER 1: INTRODUCTION

1. Theoretical background

In this section, there is the theoretical background underlying the thesis. Relevant literature on the concept of quality, its application in the wine industry and methods for assessing consumer behaviour was examined.

1.1. Quality as a concept

In today's highly competitive marketplace, companies must use targeted marketing strategies to effectively communicate their value proposition and differentiate themselves from competitors. The role of marketing has evolved significantly from the 1960s to today, becoming essential within the business context (Kotler et al., 2021). The main objective of marketing is to understand the needs and decision-making process of consumers to help companies achieve the best positioning on the market and increase their profits (Szmigin & Piacentini, 2018).

Business success comes from the company's ability to meet and exceed customer expectations (Khan et al., 2022). Within this customer-centric framework, it emerges that quality is a determining factor for this success (Guerola-Navarro et al., 2022). Customers' perceptions of product and service quality are critical in shaping their relationships with companies (Singh et al., 2023). Quality is therefore the foundation on which strong and long-lasting customer-company relationships are built based on which companies achieve profitability, growth and development, (Cvjetković et al., 2021).

Quality is a complex concept with a variety of meanings and definitions (Garvin, 1984; Steenkamp, 1989; Zeithaml, 1988). To simplify this issue, scholars distinguish between *objective* quality and *perceived* quality. Objective quality concerns the tangible attributes of a product, measurable to precise quality parameters. In contrast, perceived quality represents the consumer's personal evaluation of the quality of a product or service that depends on individual circumstances (Zeithaml, 1988).

In the field of marketing, the prevailing viewpoint leans towards perceived quality. This perspective places the responsibility for determining quality on the consumer,

thus essentially suggesting that quality is subjective (Mitra & Golder, 2006, Styliadis et al., 2020). This has led to a focus on perceived quality rather than actual quality (Ophuis & Van Trijp, 1995, Rust et al., 1999). Therefore, the question of whether or not quality exists or how it works becomes secondary to the consumer's perspective (Charters & Pettigrew, 2007).

During the quality evaluation process, consumers rely on so-called “quality cues” (Solin & Curry, 2023). These signals are indicators or attributes that are used to evaluate the quality of products and services (Bagshaw & Tarurhor, 2018). These cues are conventionally divided into *intrinsic* and *extrinsic* (Olson and Jacoby, 1972; Charters and Pettigrew, 2006; Jover et al., 2004). Intrinsic cues concern the internal attributes of the product or service that cannot be changed without altering their characteristics. Extrinsic cues, on the other hand, are not inherent to the core qualities of the product or service itself but rather are associated with how the product or service is presented or marketed. For example, in the hospitality industry, such as in hotel, the intrinsic cues are the physical attributes of the hotel room (its size, layout, and furniture) or the cleanliness and overall maintenance of the hotel; while the extrinsic cues are the hotel's brand name and reputation, the kindness of the hotel staff and the feedback from previous guests (Goeltom et al., 2019; Wen et al., 2021).

In summary, defining and categorizing an abstract concept such as perceived quality is complex and presents ongoing challenges for researchers and marketers. For this reason, in-depth investigations are needed to adapt to evolving consumer expectations and to devise effective strategies that align with different perspectives on what constitutes quality in various contexts (Solin & Curry, 2023).

1.2. Quality in the wine industry

Given the importance of quality to business performance, it is not surprising that a considerable body of research has been devoted to exploring this crucial construct in wine marketing research (Orth & Krška, 2001; Charters & Pettigrew, 2007, Lockshin & Corsi, 2012; Schäufele & Hamm, 2017; Bucher et al., 2018, 2019; Deroover et al., 2021).

Even among researchers and marketers within the wine industry, there is a consensus that explaining the concept of quality is a hard task because the nature of wine quality has almost an aesthetic character and a close relationship with personal taste (Charters & Pettigrew, 2006, 2007). It is in this context that researchers and marketers have focused on understanding what factors manufacturers can use to create a favourable perception of product quality that leads to increased opportunity and/or willingness to pay higher prices (Orth & Krška, 2001).

This intent is amply demonstrated by the multitude of articles found in the literature. A search for publications concerning the perception of wine quality on the Scopus platform yielded a total of 556 articles published between 1988 and 2023. Given this considerable volume of research, I analyzed the co-occurrences of these articles through the VOSviewer software. Co-occurrence analysis is a powerful tool that is used to identify and measure the frequency with which two or more terms or concepts appear together within a textual dataset. It helps reveal associations and relationships between these terms, which can provide valuable insights into the underlying thematic patterns, connections, and associations in the literature (Alsharif et al., 2020; Khudzari et al., 2018, Wang, 2018).

Figure 1¹ shows the findings obtained through the application of co-occurrence analysis². Each term is represented as a node, and the connections between nodes illustrate the co-occurrence relationships. The size and proximity of the nodes in

¹ A zoomed image in Appendix A.

² The co-occurrence analysis encompassed 14352 terms that appeared at least 150 times within the dataset. From this set, 353 terms exceeded the significance threshold established. A relevance score was computed for these 353 terms to identify the most pertinent ones, with the top 60% being selected. Consequently, a total of 212 highly relevant items were obtained and subsequently categorized into two distinct clusters.

summarized by Cluster 2, widens the opening to explore the external factors and circumstances that surround the experience of consuming and purchasing wine. Examine the surrounding environment, product presentation and the wider influences of pricing, branding and labelling.

As described in the previous paragraph, this contrast represents the underlying idea of consumer psychology. Wine consumers assess the quality of products and services based on both intrinsic and extrinsic factors (Olson & Jacoby, 1973). Typically, intrinsic cues involve sensory elements such as aroma, colour, and taste. In contrast, extrinsic cues are associated with external factors, extending from the visual elements of product presentation to the overall experience of wine tourism.

The extrinsic cues operate at both macro and micro levels (Thomas et al., 2010). On a macro scale, they encompass the aspects of the wine region, including its geographical and architectural features, as well as the various stakeholders involved in enhancing its appeal. Within this context, wine tours and cellar visits play pivotal roles as they serve as intermediaries connecting consumers with the product (Terziyska & Damyanova, 2020). These services play a fundamental role by immersing visitors in the sensorial experience of the vineyards, cellars and tasting rooms, increasing the narrative of the quality associated with the product. They serve as a tangible extension of the winery's presentation, providing face-to-face encounters that strengthen and enrich consumers' perception of the quality of the wine (Terziyska, 2018).

At the micro level, these cues are intricately linked to the wine product itself. They encompass visual aspects of the product presentation, such as price, label design, brand name, and even the country of origin. These factors significantly influence consumer perceptions of wine quality and their subsequent decision-making (Galati et al., 2018). In essence, the extrinsic cues at both levels are essential to enhance the product, encourage interactions among consumers, product, company, and wine regions, and increase purchase and revisit intentions.

Wine literature has traditionally favoured intrinsic cues over extrinsic cues (Miyazaki et al., 2015). This distinction is evident in Figure 1, where Cluster 1 displays a multitude of concepts and interconnections compared to Cluster 2. This

preference towards intrinsic attributes has led to a simplified evaluation process that fails to fully recognize the complex nature of perception wine, in which extrinsic cues exert a significant influence. The question becomes even more relevant in today's context, characterized by the difficulty of evaluating intrinsic cues, especially for those without specialist knowledge in oenology. Furthermore, modern wine consumers are faced with increasingly limited opportunities to taste the product before making purchasing decisions, further underscoring the importance of extrinsic cues in shaping their perceptions and choices.

In light of these critical gaps in the existing body of literature, this thesis aims to fill the gap by focusing on the impact of extrinsic cues on the perception of wine quality, consumer preferences and customer satisfaction. The thesis addresses different and relevant aspects of the wine industry, both from service (wine tours and cellar visits) and product perspectives (brand name and label design). It aims to help researchers, companies and professionals better understand consumer behaviour and develop marketing strategies aimed at improving wine performance.

The following section aims to identify the main applications and methodologies used in the analysis of product and service quality assessment processes, highlighting the gaps in the literature. Furthermore, the solutions proposed by the thesis to fill these gaps will be presented.

1.3. Assessing wine consumer behaviour

As discussed in Section 1.2., extrinsic cues significantly influence consumer decisions and preferences. Questionnaires, surveys, interviews, and focus groups are the traditional methods of analyzing the impact of quality cues on consumer satisfaction and decision-making processes (Sáenz-Navajas et al., 2013). These approaches operate under the assumption that consumers act as rational and well-informed decision-makers guided by explicit information (Elliot & Barth, 2012; Celhay & Trinqucoste, 2015). However, these techniques are not always able to provide objective results on consumer behaviour (Ariely & Berns, 2010; Babiloni et al., 2014; Alvino et al., 2018, 2019).

Roe and Bruwer (2017) argue that consumer choices are impossible to evaluate simply by asking their opinions. This is because most people are unwilling or unable to explain their preference as 95% of the decision-making and evaluation processes occur at an unconscious level (Zamani et al., 2017). Therefore, consumer behaviour is not the result of logical evaluations and predictions, but rather the result of a complex process in which individual emotions and preferences play a key role (Dooley, 2011).

To address this limitation, novel approaches have emerged for analysing wine consumer behaviour. These methods, such as Sentiment Analysis and Consumer Neuroscience, complement traditional techniques and aim to uncover the hidden processes occurring within consumers' minds (Cruz et al., 2016). Sentiment analysis examines spontaneous reviews shared by consumers, extracting feelings and opinions. This method provides a qualitative dimension, offering insights into the emotional responses and subjective perceptions associated with wine-related experiences (Cambria et al., 2017).

On the other hand, Consumer Neuroscience (or Neuromarketing) employs advanced technologies, including neuroimaging and biometric measurements (EEG, eye-tracking, fMRI, etc.), to delve deeper into consumers' neurological and physiological reactions during product evaluation and choice. By uncovering implicit and emotional responses, Consumer Neuroscience contributes to a deeper

understanding of the subconscious processes guiding consumer choices (Harris et al., 2018).

The wine marketing literature has recently adopted these techniques to examine consumer behaviour and preferences. However, current examples are rather limited and focus mainly on intrinsic factors (e.g., aroma and taste). The thesis tries to overcome this gap by exploring the extrinsic cues that influence consumers' evaluation of wine services and products. It integrates Sentiment Analysis and Consumer Neuroscience with traditional marketing methodologies (ranking, rating, stated preferences) to examine both the conscious and unconscious elements that drive consumer decision-making.

1.4. Research conceptual framework

The research thesis investigates how extrinsic wine cues influence consumer preferences, choices and satisfaction. In this context, extrinsic cues serve as the independent variable (IV) and consumer behaviour is the dependent variable (DV). The relationship between IV and DV is mediated by how individuals perceive the quality of a product or service. Perceived quality acts as a cognitive and evaluative filter that leads to greater satisfaction and purchase intention.

Furthermore, this relationship is strengthened by several psychosocial factors, which function as moderators. Emotions play a significant role in consumer behaviour. The positive or negative emotions aroused by extrinsic cues can intensify or decrease the perceived quality of a wine product/service and the consequent consumer preference. For example, an aesthetically pleasing label design generates positive emotions, stimulating product choice. Likewise, a positive experience at the winery not only contributes to a positive overall rating but also creates the intention to repeat the experience and purchase the product.

Visual aesthetics, therefore, play a pivotal role as moderators. Products that successfully capture consumers' attention are more likely to be chosen. Furthermore, the beauty of the surrounding landscape or the architectural design of the winery significantly influences consumer preferences and brand image.

In addition, the familiarity and reputation of a brand or wine region act as a powerful moderator. A well-established and familiar brand has a stronger influence on consumer preferences than lesser-known brands. Lastly, word-of-mouth (WOM), or the influence of recommendations and reviews from others, can also moderate the impact of extrinsic cues. Positive WOM can strengthen the associated perceived quality and create a ripple effect in consumer preferences. On the contrary, negative WOM influences consumers and leads them to reconsider their choices.

Figure 2 illustrates the conceptual framework of the research, outlining the intricate relationships between IV, DV, moderators and mediators in the wine industry.

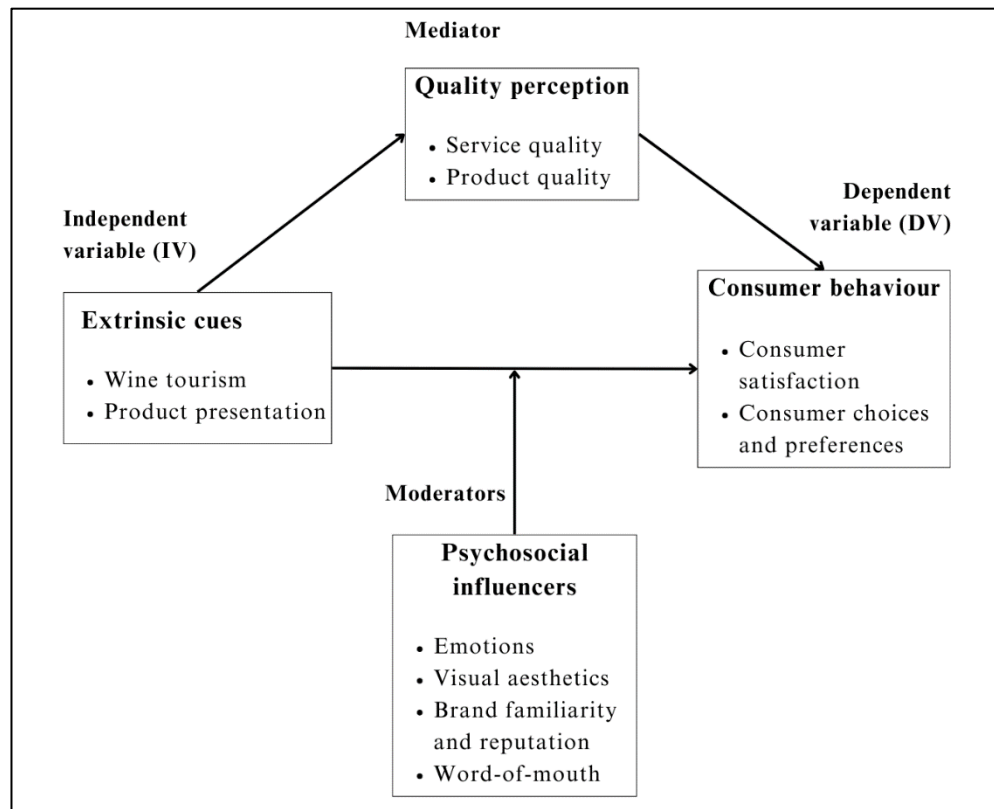


Figure 2. - Conceptual framework of the thesis

1.5. Research questions and objectives

The thesis attempts to fill the gaps mentioned above by conducting research and experiments aimed at understanding the extrinsic cues that influence consumers' perception of quality. This is achieved by employing both macro and micro approaches to gain a comprehensive understanding of the issue.

At a macro level, it focuses on the wine region and identifies the quality and failure of wine services, with a specific emphasis on wine tours and winery visits. At a micro level, it delves into product presentation and the recognition of visual cues that shape the perception of product quality and influence consumer preferences.

This research aspires to contribute to the existing corpus of knowledge in the domain of wine marketing by introducing innovative methodologies and replicable approaches for assessing consumer behaviour and measuring customer satisfaction.

One of the most innovative aspects of the research is the incorporation of unconscious, emotional and biophysiological factors as reliable indicators that overcome the cognitive biases associated with traditional marketing tools. A further aspect is the combination of multiple methods in the same evaluation framework to investigate consumer opinions and preferences in depth. For instance, the fusion of techniques such as Sentiment Analysis and Consumer Neuroscience is useful for gaining a comprehensive understanding of consumer sentiments and behaviours.

In light of the above, based on the major issues described in the previous paragraph, the following research questions (RQs) and their research objectives (ROs) are formulated:

RQ1: Which extrinsic cues influence consumers' assessment of service quality and their overall satisfaction with the experience?

- RO1.1.: Identifying the key elements for the success of wine tours, evaluating their strengths and weaknesses through the analysis of reviews shared by users (Research Article 1).
- RO1.2.: Evaluating service quality and service failure during winery visits by analysing user-generated reviews and content (Research Article 2).

RQ2: Which extrinsic cues shape the consumers' perceptions of wine quality and their decision-making processes?

- RO2.1.: Assessing wine label design through eye-tracking techniques (Research Article 3).
- RO2.2.: Investigating the impact of brand names and label design on champagne bottles using EEG methods (Research Article 4).

These research questions and objectives outline the specific areas of investigation and methodologies used.

1.6. Structure of the thesis

The research questions and objectives will be accomplished in the next chapters.

Chapter II delves into the topic of wine tourism, exploring the quality of these experiences and the methodologies for analyzing consumer behaviour and satisfaction. Adopting a wine region (macro) perspective, the aim is to evaluate the quality of wine services, offering insights to help researchers and professionals improve the tourism offering and elevate the overall experience of the wine region. The two research articles focus on identifying the strengths and weaknesses of both wine tours and wineries, using qualitative Sentiment Analysis techniques to delve deeper into consumer opinions.

Chapter III focuses on the presentation of the product and the concept of the visual attention it must have to attract consumers and increase the possibilities of choice. By adopting a product-related (micro) perspective, the objective is to evaluate the role of these quality cues, offering insights to help researchers and professionals refine proposals and identify the right marketing strategies depending on the reference situation. The two research articles investigate the role of label design and brand name during product evaluation, using consumer neuroscience techniques (EEG and eye-tracking) to study the visual attention mechanism involved in the decision-making process.

Chapter IV illustrates the main research outcomes by answering the research questions formulated in the Introduction (Chapter 1). It also highlights the practical and theoretical implications of the thesis, limitations of the research and future directions.

Figure 3 provides a graphic summary of the thesis structure, highlighting the key research concepts and main contributions.

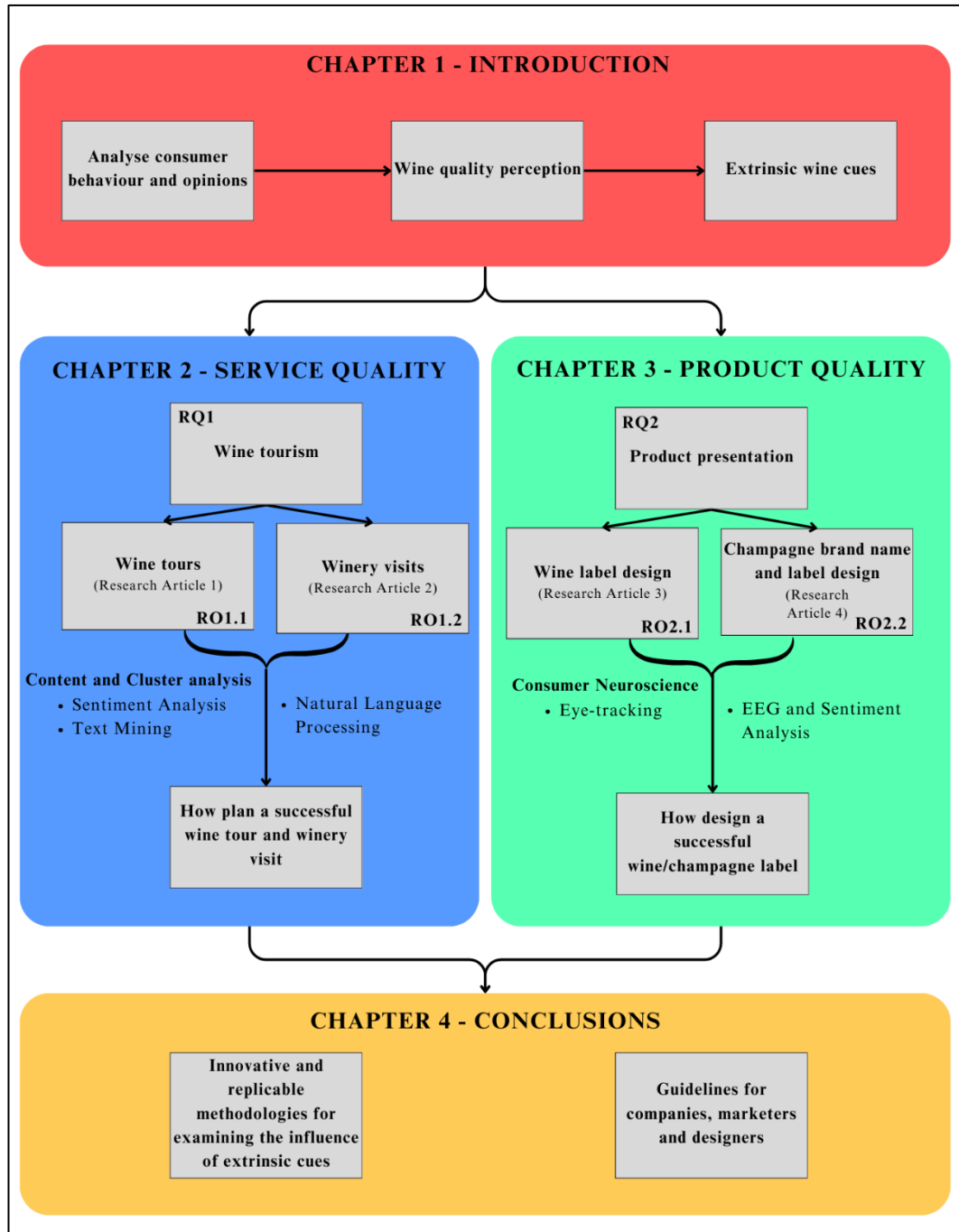


Figure 3. - Graphical abstract of the thesis structure encapsulating its aims, key findings, and theoretical and practical implications.

1.7. Content of the thesis

The following paragraphs briefly summarize the research articles.

Research Article 1 (Chapter 2, Paragraph 2.3.)

The first paper focuses on identifying the key factors influencing the success and failure of wine tours. Utilizing TripAdvisor reviews, the research employs text mining, sentiment analysis, and natural language processing techniques to extract customer opinions and feelings. The wine quality is certainly one of the central elements, but it is not the only aspect that characterizes these experiences. The extrinsic cues that shape consumers' wine perception are the tour guide's role, logistical arrangements, culinary offerings, additional activities, and the scenic beauty of the landscape and historic villages. Surprisingly, integrating top-quality wine products with local cuisine, scenic landscapes, and historical sites emerges as a pivotal strength. Conversely, criticisms mainly revolve around tour organization and planning, underscoring the importance of meticulous logistics. The tour guide's influence on consumer satisfaction is noteworthy.

This research represents a significant advancement in understanding the intersection between wine tourism and regional development. One of its key theoretical contributions lies in its ability to bridge the gap between these diverse domains. By exploring the fusion of wine with local culture, food, and natural beauty, the study offers novel insights into how these elements can be strategically integrated to enhance the quality of wine tours. Moreover, the methodology applied in this study is easily adaptable to various countries, making it a pioneering effort that combines multidimensional scaling, sentiment analysis, and natural language processing, contributing to the field's advancement.

Furthermore, this research is of practical use as it benefits both industry experts, by helping to improve the quality of wine tours, and policymakers, by encouraging the development of high-quality wine regions. Promoting the integration of wine with local culture, gastronomy and natural landscapes is in tune with the overall objective of regional development in wine production areas.

Research Article 2 (Chapter 2, Paragraph 2.4.)

The second paper analyses the service quality and failure during winery visits in five regions where wine tourism is most developed: Hunter Valley (AU), Mendoza (AR), Napa Valley (the USA), Stellenbosch (ZA) and Tuscany (IT). Leveraging sentiment analysis and natural language processing on TripAdvisor reviews, the research highlights the key factors linked to service quality and failures. These include the tasting room experience, organized tours, staff empathy, staff reliability, and the cellar and landscape setting. While these themes are consistent across all regions, each region handles them differently.

This research seeks to address a void in the field of wine tourism studies by introducing a novel approach that combines sentiment analysis and natural language processing. Additionally, it takes a global perspective, a unique aspect not explored previously in this context. Through the methodology, which involves the comparison of five distinct wine tourism regions worldwide, it was possible to mitigate the limitations emphasized by numerous researchers concerning the limited generalizability of results typically derived from questionnaires.

In practical terms, the findings have both professional and product design implications, benefiting wineries, tour operators, travel agents and wine tourists. This information is particularly valuable for nascent wine regions seeking to develop their tourism services. Showing the beauty of the wine landscapes, taking care of the layout of the cellars and tasting rooms, preserving the historic villages, enhancing the food and wine offer and facilitating direct interactions with wine producers have emerged as the main guidelines for improving the winescape and enhancing the product. Furthermore, the results highlight the need to train operators in oenology and psychology to effectively manage cellar visits. Finally, operators should leverage electronic word-of-mouth data to monitor tour perceptions, allowing for continuous service improvement and timely resolution of issues to improve overall efficiency.

Research Article 3 (Chapter 3, Paragraph 3.3.)

This study aims to identify the extrinsic cues that shape consumers' perceptions of quality during the evaluation process. In addition, the research intends to delve into the relationship between consumers' visual attention to wine label design and their preferences. By using quantitative eye-tracking metrics to evaluate design proposals, it was possible to identify extrinsic cues that significantly improve participants' preferences. Images and colours have a profound impact on how individuals perceive the quality of wine and subsequently make their choices.

The primary theoretical contribution of this study lies in the innovative application of eye-tracking metrics to uncover the underlying visual mechanisms, crucial in stimulus evaluation. Our findings underscore that a product should not only have immediate visual appeal but also possess the ability to sustain consumer attention during the overall decision-making process. Notably, the research reveals a recurring phenomenon where consumers tend to revisit stimuli that initially captured their attention, introducing the concept of attention returns as additional indicators tied to consumer preferences.

From a practical perspective, these insights have significant implications for both wine label designers and manufacturers. By utilizing these methods to refine label selection and streamline the label design process, the research facilitates the decision-making process for marketers during the conceptual phase. This approach provides objective, quantifiable, and predictive insights into consumer preferences, offering valuable guidance for researchers, manufacturers, designers, and marketing managers alike.

Research Article 4 (Chapter 3, Paragraph 3.4.)

The research aims to analyse the impact of brand name and label design on consumers' visual attention and preferences. It employs a variety of champagne brands, some familiar and others unfamiliar, having different design styles - ranging from the traditional and simple to the modern and complex. The study adopts a multi-method approach, combining Sentiment Analysis with electroencephalography (EEG) to delve deep into the factors that shape how product quality is perceived.

Familiarity with a brand proves pivotal when it comes to consumer preferences. Established and revered brands tend to be associated with higher perceived quality compared to their unfamiliar counterparts. On the other hand, for unfamiliar brands, the design emerges as a defining factor. In such cases, a modern and complex design tends to be more appealing. However, while a visually captivating design successfully grabs consumers' initial attention, it doesn't wield enough influence to sway their preferences.

The theoretical contribution of this study lies in its attempt to address gaps in the field of wine marketing. It seeks to uncover the most effective extrinsic cues that impact consumers' perceptions of quality and their preferences. By doing so, it provides fresh insights into consumer behaviour and the role of visual attention reflected in brain activity during the decision-making process.

On a practical implication, the study aims to offer recommendations for wineries, designers, and wine marketers to enhance product performance. It aspires to provide actionable guidelines for label design and delineate marketing strategies that can increase product value. In a rapidly changing and fiercely competitive landscape, this information offers a competitive edge, allowing companies to more effectively capture consumer attention, shape preferences and increase sales.

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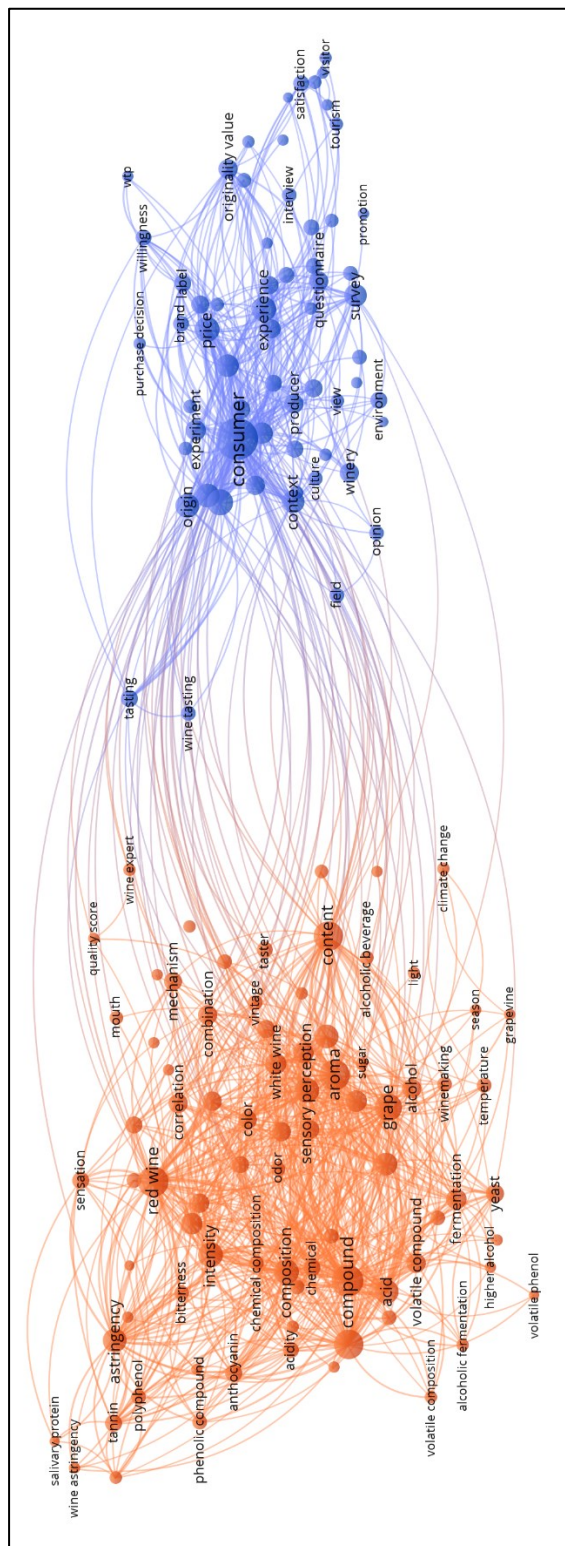
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Appendix A

Figure A.1. – A zoomed image of a co-occurrence map of terms and clusters of wine quality perception



CHAPTER 2: SERVICE QUALITY

2. Wine tourism quality

Wine tourism encompasses a diverse array of activities and services including tours of a single winery or a series of wineries in a region, dining at winery restaurants offering wine and food pairings, or wine tastings (Charters & Ali-Knight, 2002).

Quality in wine tourism refers to the excellence, satisfaction, and overall positive experience that visitors encounter when participating in wine-related activities and visiting wine-related destinations (Haller et al., 2021). According to Loureiro et al. (2017), the concept of quality and consumer satisfaction in wine tourism encompasses various aspects, which are divided into drivers and outcomes.

The drivers that determine the quality of the experience are multiple and fundamental for visitor satisfaction. First among these is the aesthetics of the environments of the winescape. This includes the landscapes surrounding the vineyards, the architectural appeal of the wineries, and the design of the tasting rooms (Brochado et al., 2021). The visual appeal of the wine landscape plays a crucial role in attracting visitors, creating a harmonious environment that complements the sensory experience of wine tasting (Liu et al., 2017). The second set of drivers focuses on educational and convivial aspects. A well-informed tour guide, expert in revealing the intricacies of winemaking and the history of the vineyard, enhances the educational dimension of the visit (Hashimoto & Telfer, 2013). At the same time, fostering a convivial atmosphere through friendly interactions contributes significantly to the overall enjoyment of the experience (Haller et al., 2021). The third driver includes hospitality in its broadest sense. The behaviour of the staff, the accuracy of the guided tours and a general welcoming climate significantly influence the positive perception of the company. Additionally, the provision of accommodation and transportation services also form a key part of the overall experience (Byrd et al., 2016).

As a result, these drivers generate a spectrum of outcomes that profoundly shape the consumer experience. The positive experiences and emotional bonds created during them contribute to brand image (Gómez-Rico et al., 2023). They generate brand loyalty by promoting a lasting relationship characterized by trust in the

quality of the companies' products and services (Teng et al., 2022). The results also manifest themselves in the form of repeat visits and greater purchase intentions (Pelegrín-Borondo et al., 2020). In addition, a further aspect is word-of-mouth (WOM), where satisfied visitors, enamoured of the holistic experience, become enthusiastic storytellers, sharing their positive impressions with friends, family and online communities. This positive diffusion contributes to the growth of the company's reputation, attracts new visitors and turns non-consumers into consumers (Torres et al., 2021).

Therefore, understanding and strategically managing these drivers and outcomes is crucial for wineries and wine-related destinations seeking to advance in the competitive landscape of wine tourism. The exploration of wine tourism experiences and the evaluation of service quality have taken on a central role within the marketing literature. These efforts are not only critical to meeting and exceeding consumer expectations but are also indispensable measures to ensure business success. The following section comprehensively delves into the methodologies used to analyze service quality in the wine industry, highlighting the gaps in the literature.

2.1. Marketing analysis of wine tourism

In the literature, wine tourism experiences have predominantly been analyzed through the lens of the theory of consumption experiences (Pine & Gilmore, 1998), which introduces the 4E framework, encompassing aesthetics, education, entertainment, and escape (Quadri-Felitti and Fiore, 2013). Aesthetics involve sensorial enrichment (e.g., scenic beauty, enjoyment of wine and food), escape implies immersion in different times and places (e.g., traditional grape harvest participation), education refers to knowledge development (e.g., wine tastings, seminars, wine-food pairing events), and entertainment involves attending performances (e.g., live music, art exhibitions, themed events; Cohen & Ben-Nun, 2009; Madeira et al., 2019; Quadri-Felitti and Fiore, 2012; Thanh & Kirova, 2018).

However, what has been underexplored is the marketing aspect of the wine tourism experience (Pikkemaat et al., 2009). Experience marketing involves providing customers with memorable experiences to achieve competitive advantage and customer satisfaction (Cetin, 2020). Experience marketing conceives of consumption as a holistic experience (Massa & Bédé, 2018) and recognizes that consumers are emotional rather than rational decision-makers (Joy et al., 2021).

The marketing of the wine tourism experience revolves around the services offered by wine tours and visits to wineries. Studying the quality of these services becomes fundamental to understanding how to design an attractive offer that satisfies consumers and sponsors in the wine region. As a result, the SERVQUAL model has gained considerable importance in marketing, as it evaluates customers' perceptions and expectations regarding service dimensions (Ladhari, 2009; Haverila et al., 2021).

2.2. Service quality methods

The main methods to measure and evaluate the quality of service in the marketing of wine tourism are predominantly quantitative methods based on questionnaires (O'Neill et al., 2002; Taylor, 2006; Carlsen, 2011) mainly employing the SERVQUAL model and its variants (Ladhari, 2009), adapting it to the specificities of the wine industry (Haverila et al., 2021). These researchers examined the importance of the service quality of cellar door experiences in the overall satisfaction of wine tourists by asking them to respond to certain constructs that reflected 5 fundamental dimensions of the model: tangible elements (appearance of physical facilities, equipment, and personnel), reliability (ability to deliver the promised service reliably and accurately), responsiveness (willingness to help customers and provide service promptly), reassurance (competence and courtesy of employees and relative ability to inspire trust and confidence), empathy (caring and personalized assistance given to customers and users).

Only some studies apply a qualitative approach to evaluate service quality. For example, Bruwer and Lesschaeve (2012) and Bruwer and Gross (2017) adopted an unstructured research approach in their exploration of the wine region destination image, specifically focusing on the Canadian and Australian wine regions, respectively. In contrast to the prevailing quantitative methodologies, these studies embraced a more open-ended and flexible research approach, aiming to unravel the intricate and multifaceted dimensions that constitute the destination image of these wine regions. In doing so, they contributed to a richer and more contextually sensitive understanding of these regions' unique attributes and qualities, which might not be as readily discernible through quantitative means.

However, both quantitative and qualitative studies exhibit significant limitations. Firstly, they rely heavily on questionnaires, which restricts the generalizability of the findings. This limitation arises because the case studies typically involve a small sample of consumers who frequent one or more wineries within a specific wine tourism region. Secondly, these studies tend to focus exclusively on the concept of quality while overlooking the critical factors that contribute to service failure. It's important to recognize that subpar service or service failures can lead to customer

dissatisfaction, triggering a cascade of reactions, including complaints and negative word-of-mouth (Babić Rosario et al., 2020). As such, these indicators, namely complaints and negative word-of-mouth, play a fundamental role in assisting companies in enhancing the performance of their services. They serve as valuable signals for improvement, highlighting areas where companies can rectify shortcomings and better meet customer expectations.

In response to these limitations, a novel methodology has recently emerged to analyse the quality and failure of services based on customer opinions: Sentiment Analysis (SA). This innovative approach, also known as opinion mining, is a natural language processing (NLP) technique used to analyse and quantify the sentiment or emotional tone expressed in text data, such as reviews, comments, and social media posts. It focuses on understanding whether the sentiment is positive, negative, or neutral and to what degree. The interest in Sentiment Analysis has increased significantly over the last few years due to the large amount of stored text in Web 2.0 applications and the importance of online customer opinions (Wankhade et al., 2022).

In the digital age, users can freely contribute their thoughts and experiences through User Generated Content (UGC) on various platforms, which has fundamentally transformed the way consumers engage with brands and services (Cassar et al., 2020). Consumers trust UGC more than Producer Generated Content (PGC) - content published by professional creators, organizations, or brands- whether it reports positive or negative information (Cheong & Morrison, 2008). These activities represent an essential form of electronic word-of-mouth that influences the decision-making of other customers.

Given the abundance of online text data, companies and marketers are increasingly harnessing this “Big Data” to identify critical elements that characterize product and service quality. This method has found significant applications in assessing the quality of various sectors, including restaurants (Bhardwaj et al., 2018; Agüero-Torales et al., 2019; Wang et al., 2019; Zuheros et al., 2021), hotels (Dina, 2020; Bagherzadeh et al, 2021; Orea-Giner et al., 2022), as well as heritage sites and

natural parks (Lee et al., 2020; Akin, 2021; Islam, 2023). This highlights the method's effectiveness in evaluating service quality across diverse domains.

Despite the importance of this issue, in wine marketing research, it was overlooked. The researchers used Sentiment Analysis to evaluate wine websites (Treen et al., 2018; Zhang, 2021) and wine product reviews, focusing exclusively on intrinsic cues, such as taste and aroma (Wariishi et al., 2015; Tao & Fang, 2020; Penagos-Londoño et al., 2022). The part concerning extrinsic cues relating to the services, such as wine tours and winery experiences, has been neglected.

Consequently, the thesis proposes two research articles to fill the gaps in the literature on wine tourism. Both articles aspire to assess the strengths and weaknesses inherent in wine tourism services. Research Article 1 undertakes an in-depth exploration of Tuscan wine tours, while Research Article 2 scrutinizes visits to wineries in the most advanced wine regions worldwide. In both instances, the application of advanced Sentiment Analysis techniques extracts information from reviews freely shared by visitors on online platforms, particularly TripAdvisor. This analysis aims to discern the extrinsic cues that shape consumer satisfaction and characterize a quality wine tourism service.

2.3. Research Article 1

Analyzing TripAdvisor reviews of wine tours: an approach based on text mining and sentiment analysis

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Abstract

Purpose. Wine-packaged tours as a specific aspect of wine tourism have so far been neglected in research, for this reason, the purpose of this study is to study the key elements for the success of the wine tour in Tuscany (Italy), evaluating the points of strength and weakness.

Design/methodology/approach. The study combines approaches of text mining, sentiment analysis and natural language processing, drawing on data from the TripAdvisor platform, obtaining through an automatic procedure 9,616 reviews from 600 tours in the years 2010–2020.

Findings. The authors identified six elements of successful wine tours expressed by research subjects: tour guide; logistical aspects; the quality of the wine; the quality of the food; complementary tourist and recreational activities; and the landscape and historic villages. The key strength associated with success was the integration of the leading wine product with food, landscape and historic villages, while the main criticisms were concerned with the organization and planning of the tour. Furthermore, the tour guide also plays a fundamental role in consumer satisfaction.

Research limitations/implications. The limitations of the method were linked to the origin of the data used. The main one is that TripAdvisor does not allow you to have social and personal information about the tourist who wrote the review;

therefore, the methods are substantially complementary to the traditional survey through questionnaires.

Practical implications. The proposed model can be used both by professionals to improve the quality of their products and by policymakers to promote the territorial development of quality wine-growing areas.

Social implications. The proposed model can be useful for policymakers to promote the territorial development of quality wine-growing areas.

Originality/value. The methodology we tested is easily transferable to many countries and to the authors' knowledge, for the first time attempts to combine multidimensional scaling, sentiment analysis and natural language processing approaches.

Keywords. Text mining, Natural Language Processing, Sentiment Analysis, TripAdvisor, Wine tours, Multidimensional scaling.

Introduction

There is now shared evidence that wine tourism is among the most dynamic in tourism (World Tourism Organization, 2012) and numerous studies highlight the increased importance. Worldwide, an estimated 93% of travellers have engaged in experiential tourism during their recent vacations and 49% indicated that food and wine were the main reasons for at least one journey in the past two years (World Food Travel Association, 2016).

One of the forms in which wine tourism is practised is through organized group wine tours. Even though this form of tourism is becoming increasingly important, the characteristics of the winescape of organized tours at the macro and micro levels have not yet been sufficiently studied. On a macro level, organized tours can combine all elements of the winescape in one package: wine, food, landscape historic villages and winery visits. In contrast, the expectations of wine tourists are high (Garibaldi et al., 2017) and the packages are complex; therefore, it is necessary to objectively understand how these elements are valued in a specific wine region. At the micro-level, moreover, studies have focused almost exclusively on the

quality of winescapes without considering the problems of service failure. An important factor influencing a client's perception of the quality of a service is the number and extent of problems they encounter and how these problems are handled by the provider. Organized wine trips can be particularly susceptible to the problem of service failure because of the complexity of the service offered and the fact that it is a strongly people-based service.

The broad topic of our work is to study the elements of the quality and failure of wine tours by applying an innovative method based on the combination of text mining and sentiment analysis of social media data. This study aims to increase the limited knowledge about organized wine tours by analyzing the specific characteristics of wine tours in Tuscany. Specifically, this research aims to answer the following research questions.

RQ1: What are the dimensions of packaged wine tour experiences that emerge from reviews left by users on travel sites? We applied a multidimensional scaling method and cluster analysis to TripAdvisor reviews to identify the emerging themes in tourists' experiences. We believe that the results of the research can provide useful information for operators to improve the quality of wine tourism products and for policymakers to promote tourism development in quality wine regions. RQ2: What are the elements of perceived quality? Understanding the value that wine tourists place on the characteristics of the winescape is important to the design of new tours. RQ3: What are the determinants of service failure? We used sentiment analysis to separate perceived positive and negative themes. By better understanding, the causes of customer complaints, the number of problematic events can potentially be reduced and better remedies can be provided.

Literature review

Wine tourism through organized tours is a complex product that is made up of tangible assets such as the wineries visited, the wine tasting and the eventual purchase and intangible assets such as the landscape perceived during the trip, the visits to historical villages and the information given by the guide and the winemakers. The study of wine tours using social media data analysis, therefore, includes three theoretical fields of research: winescapes, package tours and the

theory of content analysis/lexical analysis applied to social media. In this literature review, we will first give brief references to these three fields of research and then examine the most recent methodological developments in the wine tour-specific literature.

Winescape literature

Our work adopts the theoretical definition proposed by Johnson and Bruwer (2007), which defines the winescape as the interaction of the natural landscape and environment, heritage, architecture and interior of a winery, vineyard, wines and the complementary services of tourist information and organization. This definition has been applied by the literature on two spatial scales. Some studies take a micro approach that is specific to the individual winery visited and apply service quality methodologies (Griffin and Loersch, 2006; Petrick, 2002) to this definition. Other studies take the macro approach in which the winescape is conceptualized by the context of a wine landscape or wine route (Bruwer and Lesschaeve, 2012; Getz and Brown, 2006; Bruwer and Gross, 2017). Both approaches have advantages and limitations (Quintal et al., 2015).

The macro approach is certainly holistic in that it more easily captures the relationship that exists between the tangible and intangible dimensions of the winescape. However, it is difficult for the macro approach to generalize and measure specific attributes of the winescape, in part because of the great variability these characters have around the world, resulting in few empirical studies of the winescape. The micro approach has complementary merits and limitations: it is easy to define the characteristics of winescapes at the level of a single winery, as the winery visit process is similar in all wine regions of the world. However, the complementarity between wine production and rural territory is lost and it is not possible to evaluate the effect of the externalities of the landscape on the quality of the wine tourism experience.

Packaged tours

The literature on packaged trip management is vast. Focusing the literature review on topics complementary to winescapes, studies that apply theories of group

dynamics are of interest. Quiroga (1990) analyzed the characteristics of package tours and found that the variables that influence the degree of final satisfaction depend on group dynamics such as the interaction, setting, group size and group cohesion.

Other studies have focused on the relationship between tour leader likability and knowledgeability and tourism value cocreation behaviours and have examined the mediating effect of tour leader attachment on this relationship (Huang et al., 2010; Zhu and Xu, 2021).

The importance of communication skills and guiding knowledge also emerges from the studies that applied the member-leader fit theory to tour guides (Chang et al., 2020). The tour member–leader fit refers to the compatibility between tourists and their guide: tour leaders are usually mentors to their tour members, monitors of the itinerary and managers of the entire tour. The results indicated that travel agencies should consider the concept of fit when organizing tour guides for various types of groups to maximize the additional and complementary fit between the tour leader and members.

Content analysis

Content analysis is a research tool used to determine the presence of certain words, themes or concepts in some qualitative textual data. Using content analysis, researchers can quantify and analyze the presence, meanings and relationships related to words, themes or concepts (Neuendorf, 2002). Traditional content analysis involves subjective human interpretation, as a research team must either formulate a classification scheme and apply it manually or train coders generally based on deep learning.

To overcome this limitation, linguistics researchers developed lexical analysis (Lai and To, 2015), which helped reduce subjective interpretation due to the subjective definitions of categories. The simplest methodologies rely on indices derived from co-occurrences between terms and document-term frequency matrices. More complex methods group keywords based on themes and present graphically identified themes or clusters.

A particular form of content analysis is sentiment analysis. In sentiment analysis, texts are classified into only three categories referring to their emotional polarity based on a scaled score: positive, neutral or negative.

Content, lexical and sentiment analyzes have been applied to social media data from the tourism industry in general. TripAdvisor is the most widely used review platform for marketing. TripAdvisor has many advantages: it is the platform with the highest number of reviews (more than 884 million reviews and an average of 460 million visitors each month). Additionally, TripAdvisor checks the system to avoid false reviews (Filieri et al., 2015; Schuckert et al., 2015; O'Connor, 2010). Sentiment analysis has been applied to the analysis of service quality and service failure through TripAdvisor reviews mainly of restaurants (Bhardwaj et al., 2018; Agüero-Torales et al., 2019; Wang et al., 2019; Zuheros et al., 2021) but also heritage sites and natural parks (Lee et al., 2020).

Wine packaged tours

There is limited statistical data on packaged wine tours. In a study entitled “Wine Road of Northern Greece,” Alebaki and Iakovidou (2010) found that 28.8% of the wine tourists who were surveyed came by tour bus. According to a study on wine tourism by Tourism Research Australia (2014), the wine tour segment represents 11.9% of all tourism. These data seem to align with what was found by Charters and Ali-Knight (2002), who identified the wine tourist segment interested in organized tours as the “wine novices.”

According to Wargenau and Che (2006), organized bus tours can offer wineries new ways to reach customers. Interest in organized motorcoach tours varied based on the size and scale of winery operations. The authors found that larger wineries work with tour operators, as these wineries take buses upon reservation by applying costs for the bus and tastings. Tour operators direct small groups of people with more wine knowledge and, therefore, are more inclined to buy at small wineries.

Finally, Garibaldi et al. (2017) examined the profile of 540 wine tourists interested in wine-related businesses and 109 wine tour operators in the USA. The authors found that wine tour data are an important tool for the international promotion of

wine tourism. Therefore, tour operators must address several issues if they aim to attract and satisfy wine (and food) tourists who tend to shy away from other forms of organized travel (Croce and Perri, 2017). They concluded that future research is needed to better understand the convergence between customer needs and tourist proposals and highlight the critical issues that allow tour operators to enter the market successfully.

Wine tourism and content analysis

Some very recent works have analyzed TripAdvisor reviews about wineries and wine tours. The most commonly used approach is content analysis with different levels of complexity.

In their research, Terziyska and Damyanova (2020) adopted a qualitative netnographic approach to verify the perception of winescape dimensions at a macro scale for a single tour in Piedmont (Italy) with 118 reviews. Despite the small sample size, the results help to address the limitation of excessive descriptive dimensions of the winescape by identifying the dimensions most perceived in the region considered. Another interesting finding of this study is that the tour guide is one of the most important dimensions of the perception and quality of the experience.

Content analysis was applied to the analysis of reviews related to wine tourism in specific wine regions through classification methods based on deep learning algorithms. The two studies applying this methodology (Thanh and Kirova, 2018; Kastenholz et al., 2020) adopted a macro definition of the winescape and are both based on the QSR NVivo software applied to classify categories of experiences defined a priori by the researchers who also contributed to the training of the coder. The two studies described the winescape through experiential dimensions based on the Entertainment, Educational, Esthetics, and Escapist model for the Cognac region (Thanh and Kirova, 2018) and on a literature review for the Barreida region (Kastenholz et al., 2020). The main limitation of the adopted methodology is that class definitions and coder training are defined subjectively by researchers and, thus, may be limited by the epistemological position of the researcher, which may impact the reliability of the results (Wilk et al., 2019).

Recent work applies lexical analysis (Brochado et al., 2020a, 2020b) by processing reviews explicitly referring to tours, wineries and wine hotels and, thus, has an approach oriented not only to the macro scale but also to the micro-scale. All three works applied cluster analysis based on the co-occurrence of terms processed in a graphical concept map by the Leximancer software. The main advantage of this procedure over deep learning classification using the NVivo software is that the dimensions of the winescape are not defined a priori but arise from the exploratory analysis of the textual data. Brochado et al. (2020a) collected 4,114 reviews of 52 wine hotels in 11 countries. The winescape themes identified through a lexicographic analysis were wine, lodging, food, scenery, staff and recommendation. Brochado et al. (2020a) collected 470 reviews related to winery visits in the Douro wine region from wine tourists posted on TripAdvisor and identified 12 topics: wine, view, staff, room, hotel, food, restaurant, pool, service, Douro, deliciousness (food and wine) and comfort. The only work specifically related to organized wine tours is that of Brochado et al. (2020b). The authors identified the dimensions of sustainably organized tours from the tourists' perspective by analyzing 878 reviews of 20 tours in Portugal written on TripAdvisor. The authors calculated a concept map containing the following topics: tour, guide, experience, excursion, service, food, recommendation, fun, return, walk, difference and wildlife.

Gaps in the literature

The literature regarding winescape dimensions at the macro and micro levels specifically related to organized wine tours still has some gaps. The research focused on recent years is based on netnographic methods (Terziyska and Damyanova, 2020) and lexical analysis (Brochado et al., 2020b). The findings identify the winescape dimensions specific to organized group tourism, but the areas of study are still too limited and one case study was based on a low number of reviews analyzed. Additionally, to the best of our knowledge, research that focuses specifically on quantitative perceptions of winescape quality and quantitative analysis of wine tour service failure is absent.

Materials

Study area

Tuscany is a region in central Italy with an area of about 23,000 square kilometres. The production of wine in Tuscany concerns the entire territory; six Appellation of Controlled and Guaranteed Origin areas and 35 Appellation of Controlled Origin areas are defined, in each of which various wines are classified among the best worldwide produced. Furthermore, it hosts the highest number of roads of wine and is the first Italian region to practice agritourism, both in absolute terms and the different types of services offered – catering, accommodation, tasting and proposals for experiences.

According to Colombini (2015), Tuscany is the most popular region for both Italian and foreign tourists because it offers four fundamental things: surprising landscapes, high culture, exceptional food and great wines. Furthermore, it manages to maintain its supremacy, owing not only to an excellent tourism network of services but also to the offer of many activities (such as antique fairs, art festivals, concerts and other cultural events) while the names of famous people are often linked with the region and luxury shopping. Therefore, we chose Tuscany as our study area.

Methods

The methodology used to answer the research questions was divided into five phases. In the first phase, we acquired the data from the TripAdvisor platform. Next, the texts were preprocessed to make them suitable for subsequent analyzes. We then applied the multidimensional scaling method to the corpus of reviews to identify winescape dimensions specific to wine tours.

Subsequently, through sentiment analysis, the positive or negative polarity of the review was assessed. On the TripAdvisor website, users write opinions and rank their overall experience in the TripAdvisor Bubble Rating, a score ranging from 1 to 5 bubbles where 1 represents a terrible opinion and 5 represents an excellent opinion. The reviews were classified into four categories combining sentiment polarity and TripAdvisor ratings:

1. reviews with positive sentiment and positive evaluation (bubbles > 3);
2. reviews with negative sentiment and negative evaluation (bubbles ≤ 3);
3. reviews with negative sentiment and positive evaluation (bubble > 3); and
4. reviews with positive sentiment and negative evaluation (bubbles ≤ 3).

Natural language processing procedures were applied to each of the three groups. A flowchart of the procedure is shown in Figure 1.

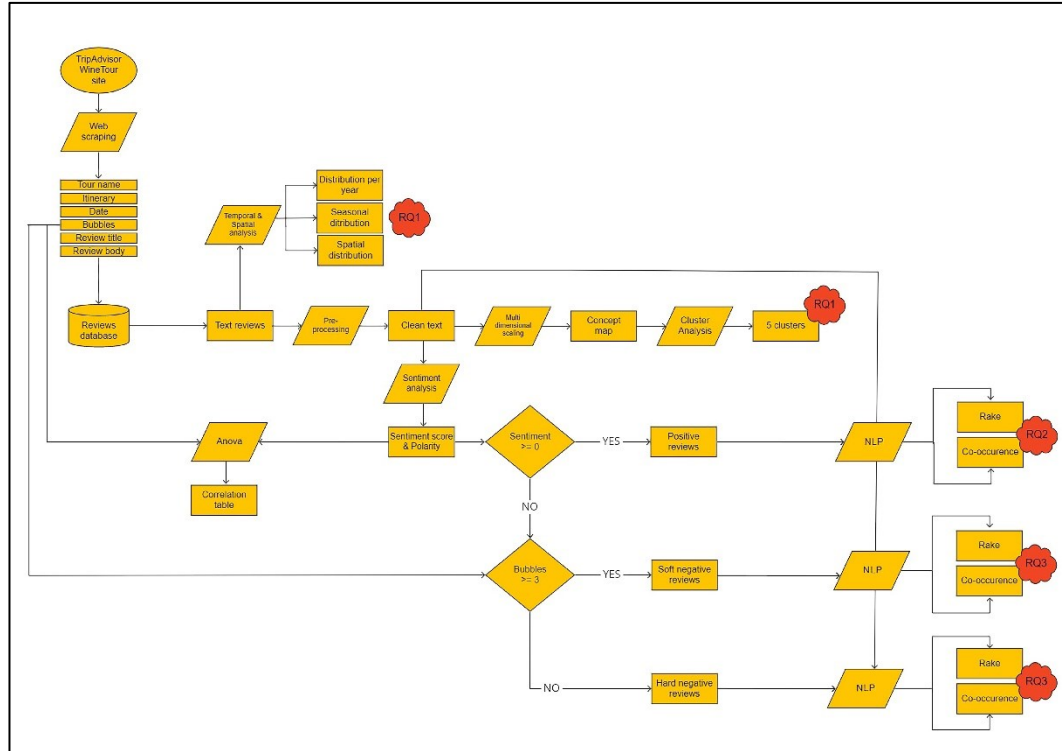


Figure 1. - Flow chart of the methodology. The method addresses the research questions to find the elements of service quality and failure of the wine tours.

Data collection

We scraped the TripAdvisor reviews related to the theme “Wine tasting in Tuscany” in the section “Food, Wine and Nightlife” (URL https://www.tripadvisor.com/Attraction_Products-g187893-zfc11891-zfg11868-Tuscany.html).

The following information was collected:

- Tour,
- name,
- URL,
- itinerary,
- review,
 - date,
 - bubbles,
 - title,
 - review title,
 - review body.

The data were scraped through an R language script based on the “rvest” library. The structure of the script was as follows. First, the list of tour URLs was obtained in the “Wine tasting in Tuscany” section, the HTML code of each URL was downloaded and processed by retrieving the general data and all the reviews of the tour and, finally, the reviews were recorded in a database. All the collected reviews were written in English.

Preprocessing

Before conducting the analysis procedures, we preprocessed the text. The steps we performed on the database were as follows:

- tokenization of the text that involves the division into words of the text itself;
- the removal of stopwords defined as words that do not carry significant information for the analysis;
- stemming and rooting, which consist of reducing words to the root;
- the removal of extra numbers and spaces;
- the removal of punctuation; and
- part-of-speech tagging also called grammatical tagging – the process of marking a word in a text as corresponding to a particular part of speech: verbs, adjectives, adverbs, etc.

Multidimensional scaling method and cluster analysis

In the present work, we used the multidimensional scaling (MDS) method, which can graphically represent on a Cartesian plane the complex multivariate world of consumer judgments in a perceptual map. This aims to identify similarities in the set of concepts that correspond to the dimensions of the winescape. The advantage over the more frequent topic analysis is that MDS is based on a distance model and, therefore, it is easy to graphically interpret neighbouring words to identify the dimensions of the winescape. The first step of the analysis is the construction of the document-terms matrix. A document-term matrix is a mathematical matrix that describes the frequency of terms occurring in a collection of documents. In a document-term matrix, the rows correspond to the documents in the “corpus” (the collection of reviews), whereas the columns correspond to the terms. In these applications, documents are represented by reviews. The document-term matrix has the following formulation:

	t_1	t_2	...	t_j	...	t_m
d_1						
d_2						
...						
d_i						
...						
d_n						

$$P_{i,j} = \{1,0\}$$

were $d_i = \{d_1, \dots, d_n\}$ are the documents (reviews), $t_i = \{t_1, \dots, t_n\}$ are the terms and P_i are binary variables. The document-terms matrix is subsequently transformed into a co-occurrence matrix that represents the number of times a pair of terms appear in the same review.

	t_1	t_2	...	t_k	...	t_m
t_1						
t_2						
...						
t_h				$\{f_{h,k}\} \mid h \neq k$		
...						
t_m						

Where $f_{h,k}$ is the co-occurrence frequency of the terms t_h and t_k . To evaluate the strength of the associations (distances) between the terms the cosine similarity (CS) index was used, defined as:

$$CS^{h,k} = \frac{f_{h,k}}{\sum_{j=1}^m (t_h^j)^2 \cdot \sum_{j=1}^m (t_k^j)^2}$$

In this application, the cosine method was chosen as it is more efficient for very large datasets (Sacchelli et al., 2016). We thus obtain a matrix of distances (similarity) between the terms:

	t_1	t_2	...	t_k	...	t_m
t_1						
t_2						
...						
t_h				$CS^{h,k} \mid h \neq k$		
...						
t_m						

The next step consists of transforming the $CS^{h,k}$ in sets of coordinates in an abstract

two-dimensional space through a Multidimensional Scaling method. A non-metric scaling method, the Sammon method, was employed in the work as it tends to produce more readable results (Higuchi, 2016). Given the number of dimensions chosen (two in the application), the non-metric method identifies the pairs of coordinates (one pair for each term) which minimizes a parameter that evaluates the efficiency of the fitting.

This function, called *stress function*, is typical of the method adopted. In Sammon's method, the stress function has the following form:

$$S = \sum \frac{CS^{h,k} - d^{h,k}}{CS^{h,k}}$$

with $d^{h,k}$ distance between t_h and t_k in Sammon space.

The last step is the identification of the clusters that define the main themes of the reviews. We first limited the analysis to nouns and adjectives with a frequency greater than 500 and we used Ward's method with a Cosin distance calculated in Sammon space. The elaborations were carried out with the KH Coder 3 software.

The last step is the identification of clusters that define the main themes of the reviews. We restricted the analysis to nouns and adjectives with a frequency higher than a threshold identified by analyzing the graph term frequency-document frequency (TF-Df). The frequency threshold is chosen to select nouns and adjectives that are present both in many documents and with high frequency and, therefore, significant for defining the concept of winescapes. To generate the clusters, we used Ward's method with a cosine distance calculated in Sammon space. The number of clusters was chosen via the agglomeration graph. The elaborations were carried out using KH Coder 3 software.

Sentiment analysis is a subdiscipline of computational linguistics that focuses on the opinions expressed in a textual document. The essential questions are how the feelings are expressed in the textual documents and whether the expressions indicate positive or negative opinions regarding the experience. Sentiment analysis uses a predefined lexicon to calculate the scores associated with words. When sentiment analysis is performed on a text, each relevant word obtains a score based

on its proximity to a positive or negative word in the library. Therefore, it is necessary to have a lexicon that assigns each word a positive or negative polarity and a score. In this study, sentiment analysis was conducted using the “syuzhet” library of R software using the AFINN lexicon (Nielsen, 2011).

The sentiment scoring procedure is as follows:

1. Each review of is broken down into its sentences $d_i = \{s_{i,1}, s_{i,2}, \dots, s_{i,n}\}$ on the basis of punctuation and then each sentence is broken down into words (w) $s_{i,j} = \{w_{i,j,1}, w_{i,j,2}, \dots, w_{i,j,l}\}$ by means of a semantic annotation procedure (Kiyavitskaya et al., 2006).
2. Punctuation is removed except for pause punctuation marks (commas, colons, semicolons) which are considered as “comma words” (cw) within the sentence.
3. The words in each sentence, $\{w_{i,j,k}\}$, are searched and compared with the lexicon of polarized words and each of them is assigned its negative or positive score. Not all words have a sentiment score, so we will get a subset of polarized words $\{pw_{i,j,k}\} \subseteq \{w_{i,j,k}\}$.
4. Users often write reviews with complex linguistic structures that through the so-called contextual valence shifters (Kennedy & Inkpen, 2006) can change the polarity of the feeling (e.g. “*not very happy*”, “*far from pleasant*”, “*definitely not beautiful*”, etc.). To take this into account, for each polarized word a polarized context cluster is identified considering 4 words before and 2 words after. The cluster can be represented as:

$$c_{i,j,l} = \{pw_{i,j,l,k-4}, \dots, pw_{i,j,l,k}, \dots, pw_{i,j,l,k+2}\}$$

Through the lexicon the valence shifters of the polarized context cluster are classified into the following categories:

$$neutral: w_{i,j,l,k}^0$$

$$negator: w_{i,j,l,k}^n$$

$$amplifier: w_{i,j,l,k}^a$$

de – amplifier: $w_{i,j,l,k}^d$

commaword: $w_{i,j,l,k}^{cw}$

Amplifiers are generally adverbs or adjectives that intensify the meaning of the sentence. Using our previous example, the sentiment of the altered negator phrase, “*I seriously don’t like the pie.*”, Is amplified with the addition of the amplifier “*seriously*”. While the de-amplifiers decrease the intensity of a polarized word as in the phrase “*I barely like the cake*”; the word “*barely*” de-amplifies the word like.

5. Each polarized word is weighted by the number of valence shifters that directly surround the positive or negative word using the specific weights in the lexicon. Comma words cw (punctuation denoting a rest that includes commas, colons, and semicolons) are indexed and considered when calculating the upper and lower bounds in the polarized context cluster. This is because these signs indicate a change in thinking and the preceding words are not necessarily connected with the words after these punctuation marks.

The following rules apply:

- a. Amplifiers become de-amplifiers if the context cluster contains an odd number of negators.
 - b. The negation flips the sign of the polarized word; linguistically two negatives equal a positive, 3 negatives equal a negative and so on.
6. Last, these weighted context clusters and divided by the square root of the word count ($wn_{i,j}$) yielding an **unbounded polarity score** $\delta_{i,j}$ for each sentence.

$$\delta_{i,j} = \frac{\sum\{c_{i,j,l}\}}{\sqrt{wn_{i,j}}}.$$

Natural language processing

Natural language processing procedures were used to identify the strengths and weaknesses of the tours based on reviews classified according to sentiment and the evaluation of bubbles made by users. Two procedures were used: rapid automatic keyword extraction (RAKE) and co-occurrence graphs.

Following Rose et al. (2010), keywords are defined as a sequence of one or more words that provide a compact representation of the concepts in a document. Ideally, keywords are the condensed forms of the relevant contents of a document. According to the authors, this method is particularly effective for documents that do not follow specific grammatical conventions. RAKE begins the process of extracting keywords by identifying a set of candidate words in the text. The first step is to split the text into a word list and remove stopwords from that list. The algorithm then splits the text into phrase delimiters and stopwords to create candidate expressions. Once the text has been split, the algorithm creates a matrix of word co-occurrences. One of the unique characteristics of the RAKE method is the identification of not only single keywords but also terminologies consisting of two or more words. To do this, RAKE inserts into the matrix of co-occurrence sequences of words that are repeated in sequence and the same order more than twice (e.g. “flow chart,” “linear regression,” etc.). The words are scored after the matrix is built. The score can be determined by the sum of the number of co-occurrences the word has with any other content word in the text, the number of times the word appears in the text or the number of co-occurrences divided by the frequency.

The co-occurrence graph is derived from the co-occurrence matrix. By identifying the most frequent adjacent words, the co-occurrence matrix can be converted into a co-occurrence graph to identify the frequency with which words are associated in reviews.

Results

Primary information

At the weblink cited in the methodology, 1,234 wine tours were listed, but we were only able to download 9,616 reviews from 600 tours. This is because many tours were scheduled on dates after the survey (TripAdvisor is also used for booking); therefore, there were no reviews. In addition, many scheduled tours were cancelled due to the pandemic. In the download process, approximately 10% of the reviews were lost due to a server timeout error and duplicate reviews and reviews without text were discarded.

The frequency of reviews in Figure 2 seems to show that the demand for wine tours has been growing strongly recently. The number of reviews grew weakly until 2017, with growth rates lower than the total number of reviews posted on TripAdvisor. Starting in 2018, the number of reviews shared underwent a surge with a growth rate of up to 250%. The sharp decline in 2020 is most likely due to the pandemic emergency to which wine tour products are particularly sensitive.

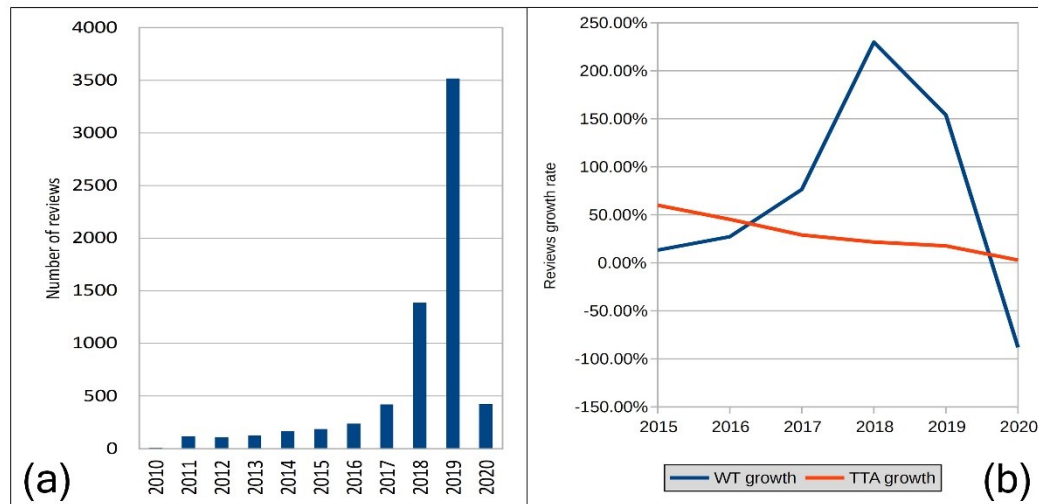


Figure 2. - (a) Frequency of reviews per year, (b) Growth rate of reviews: WT: Wine tours, TTA: TripAdvisor total reviews.

The distribution of reviews per month (Figure 3) shows a peak in October and November, which are the months following the harvest in Tuscany, an intermediate level of attendance in the spring and summer months and a low number in the winter month.

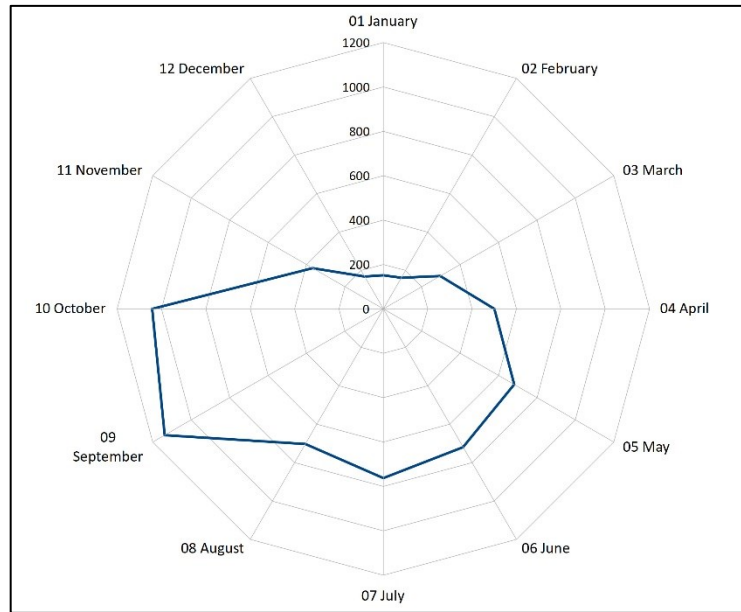


Figure 3. - Monthly distribution of reviews. The total count of reviews per month.

Finally, the spatial distribution of the tours (Figure 4) focuses on the hills of central Tuscany and is centred on the art cities of Florence, Pisa and Siena. Currently, recent appellations of the southern coast of Tuscany are not regularly frequented by wine tours.

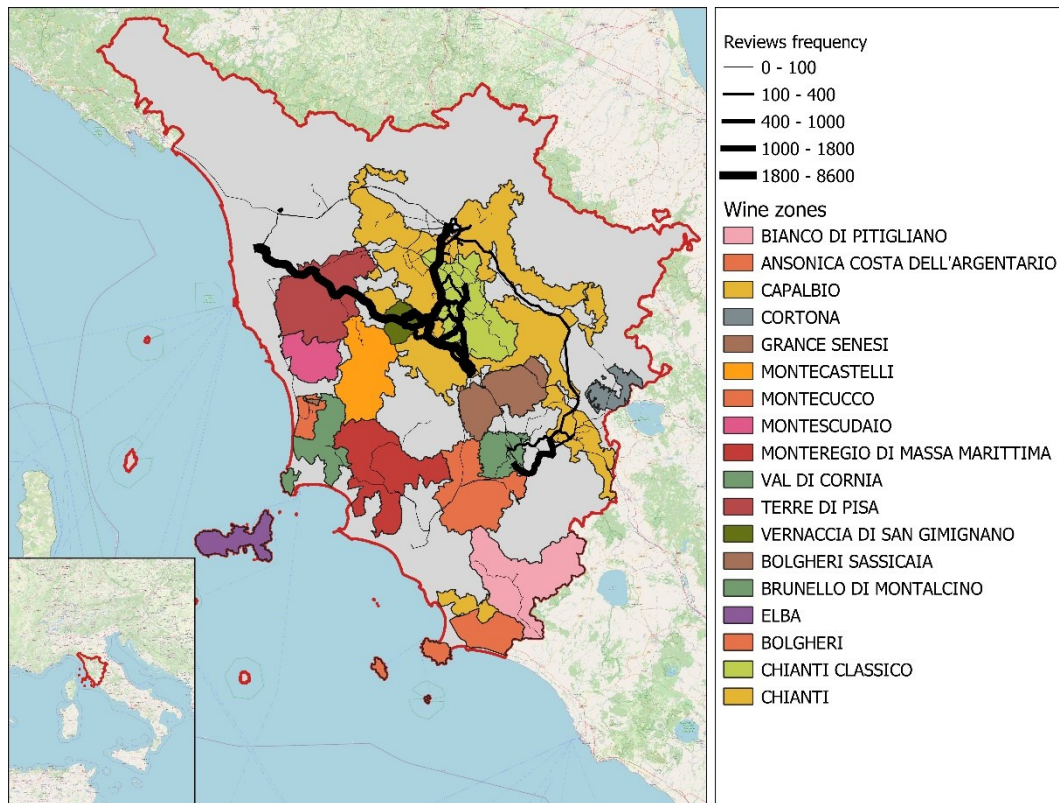


Figure 4. - Spatial distribution of tours. The reviews frequency (total reviews count divided by the number of days per year) for each specific wine Tuscany region.

Multidimensional scaling method and cluster analysis

Multidimensional scaling (MDS) and cluster analysis (Figure 5) highlight the characteristic elements of wine tours and how they are perceived by different types of users. The method allowed us to identify five clusters in the space of the two Sammon dimensions with a significant stress value (0.152). Dimension 1 primarily encompasses words expressing subjective feelings and opinions (e.g., “great”, “beautiful”, “delicious”), thus can be described as “emotional”. Conversely, Dimension 2, associated with objective thinking and rationality (e.g., “informative”, “knowledgeable”, “good”), can be interpreted as “logical”. The frequency threshold of 500 terms was identified by analyzing the TF-Df graph [Figure 6(a)] to exclude terms that appear in relatively few reviews and are, therefore, not representative of describing the characteristics of the winescape of wine tours in Tuscany. Based on the agglomeration graph, we chose to generate 5 clusters [Figure 6(b)].

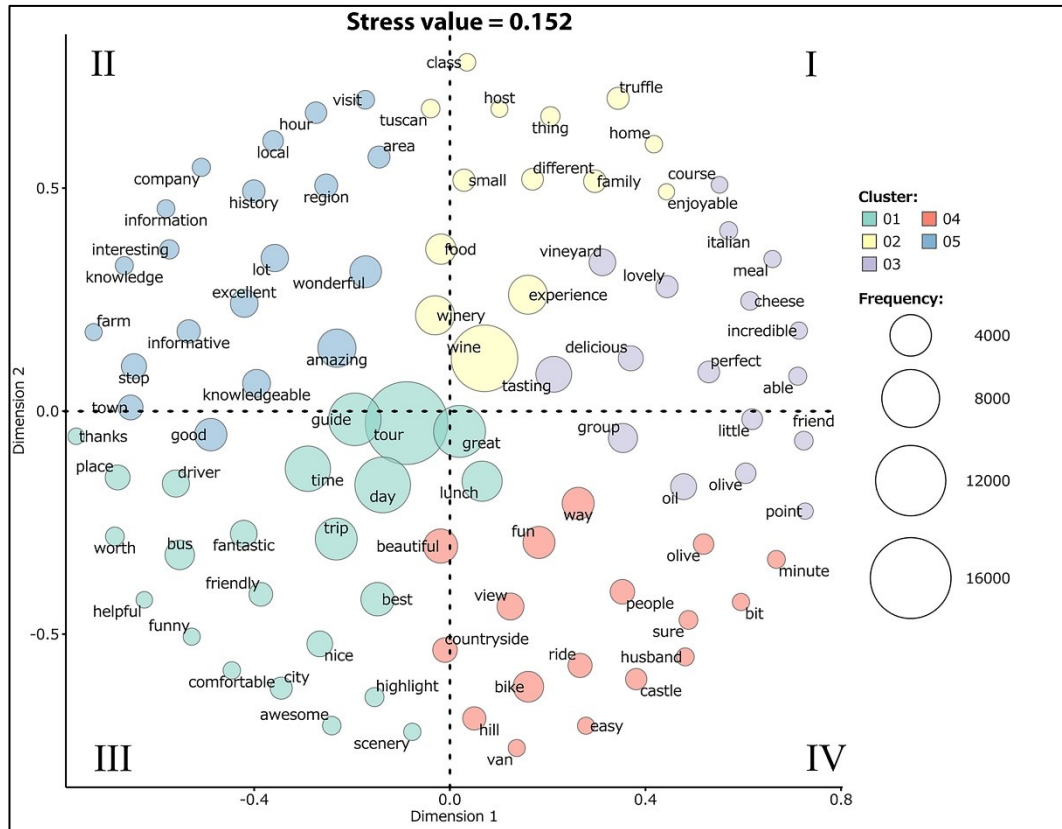


Figure 5. - Multidimensional scaling method and cluster analysis results.

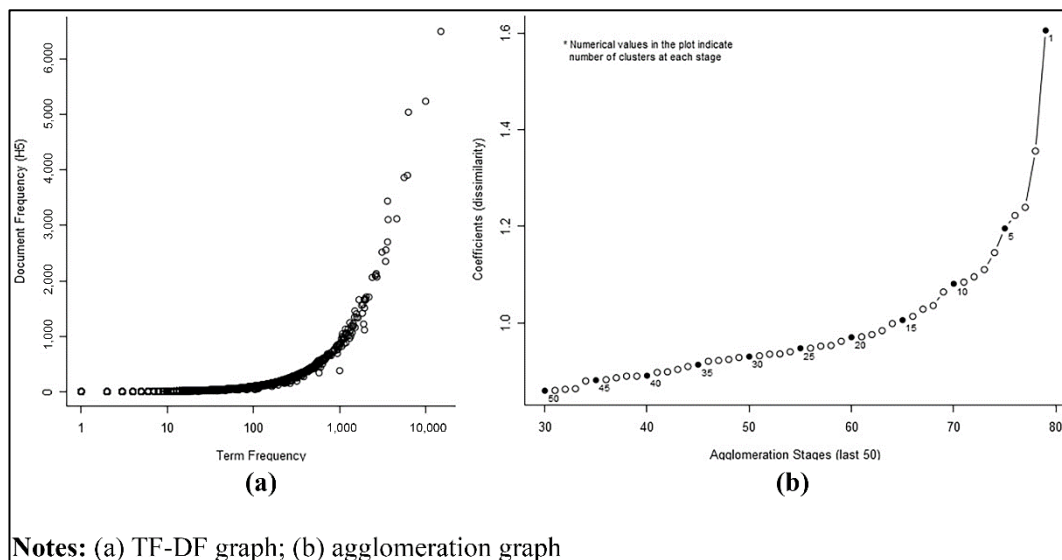


Figure 6. - MDS model parameters. (a) TF-DF graph to analyze the term frequency, (b) agglomeration graph to select the number of clusters.

Cluster 1 in the third quadrant mainly focuses on service issues. The most significant nouns in this cluster are “tour,” “guide,” “lunch,” “trip,” “bus” and “driver,” all associated with adjectives that express a positive perception in terms

of both specifically referring to the service (“comfortable” and “friendly”) and more generic terms (“great,” “best,” “fantastic,” etc.).

Cluster 2 and nearby Cluster 3, both in the first quadrant, are characterized by wine and food associations. The nouns “winery,” “experience” and “food” for Cluster 2 and “tasting” and “winery” for Cluster 3 are connected to the central term “wine.” The two clusters differed in more peripheral elements in both clusters. Cluster 2 presents nouns that refer to an experience of greater quality and exclusivity (“truffle,” “class,” “small” and “family”), whereas Cluster 3 seems to refer to traditional and typical gastronomic elements (“oil,” “olives,” “cheese,” etc.). Cluster 4, which is in the second quadrant and smaller in terms of both the number and the frequency of words, associates the wine tour with the landscape and architecture (“castle” and “countryside”) and active fruition experiences (“bike” and “ride”). The adjectives, all indicating a positive sentiment, seem to be specifically attributable to the recreational experience (“fun,” “easy” and “sure”) and the quality of the landscape (“beautiful”). Finally, Cluster 5 in the fourth quadrant includes perceptions based on the cultural content of the tour (“information,” “knowledge,” “history,” etc.) associated with terms related to the travel experience (“visit,” “region,” “stop,” “local,” etc.). The adjectives are both specific to the theme of knowledge (“interesting,” “knowledgeable” and “informative”) and generic in appreciation of the product/service offered (“wonderful,” “amazing” and “excellent”).

Sentiment analysis

The results of the sentiment analysis calculated using the AFINN lexicon are shown in Table 1. In general, the reviews of the wine tours show a tendentially positive sentiment, with an average score of 15.21 (median 14); the dispersion is relatively high and symmetrical, with the first and third quartiles equal to 9 and 20, respectively.

Table 1. - Sentiment analysis results. The minimum, first quartile, median, mean, third quartile and maximum values of the sentiment scores for each bubble.

Bubbles	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
1	-31	-5,75	-0,5	-1,519	3,75	13
2	-10	1	5	5,956	9,5	37
3	-9	3	8	8,079	12	41
4	-7	7	12	12,47	16	46
5	-17	10	15	15,9	20	79
Total	-31	9	14	15,21	20	79

Table 1 also shows that the average and median sentiment values progressively increase from reviews, with a rating of one to four bubbles. Only in the case of evaluations equal to one bubble are most reviews with negative sentiment (median -0.5 and average -1.5). Figure 7 shows the boxplots by class of bubbles and the results of the student's t-test for increasing pairs of ratings used to verify the actual consistency of classification in bubbles. The test result shows that the classification in bubbles given by the tourists is consistent with the sentiment score of the review text. All comparisons between adjacent ratings are highly significant, apart from the comparison between two and three bubbles, which is significant with a probability level of 95%.

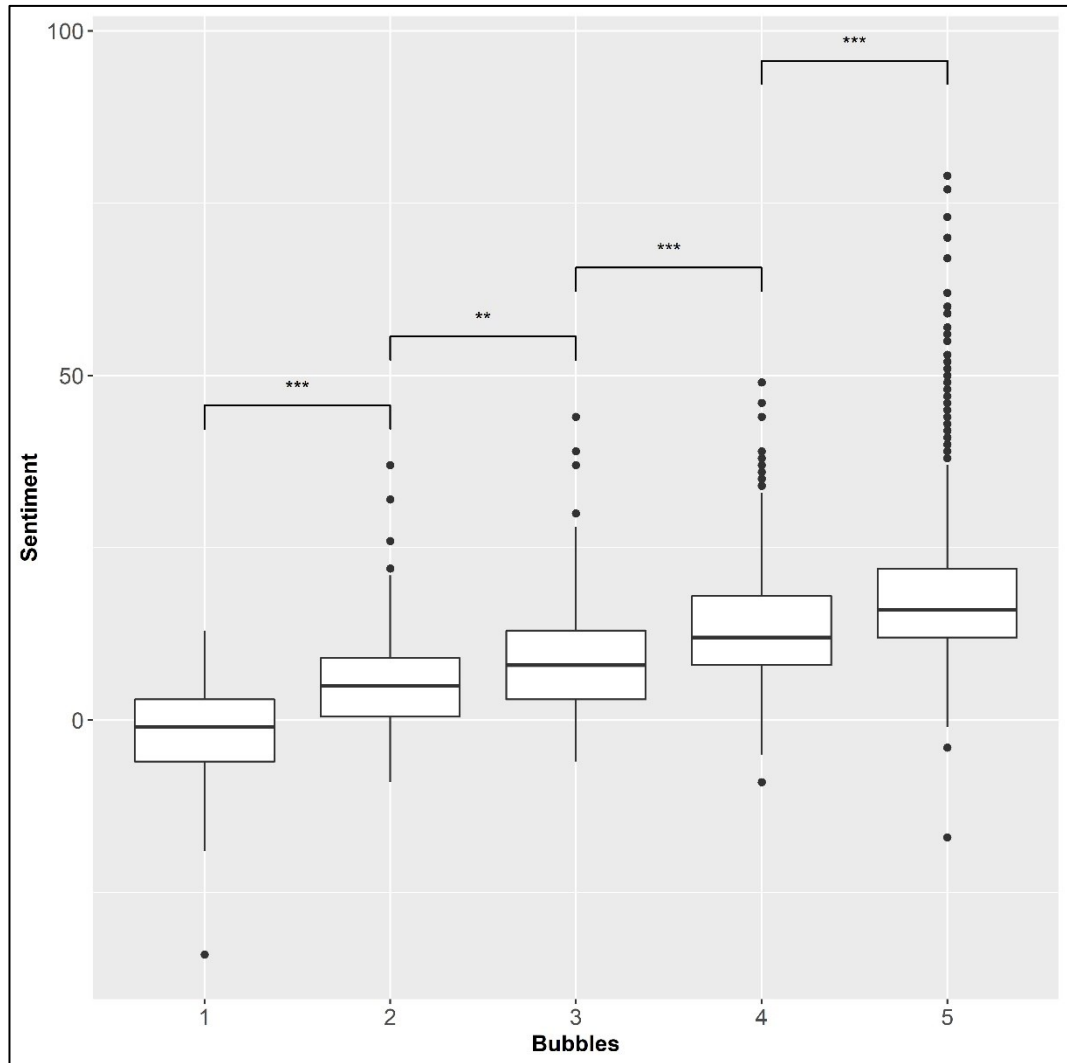


Figure 7. - Sentiment analysis and bubbles. The correlation between the sentiment scores and the bubble rating

Natural language processing

The key elements of definitely positive reviews (bubbles > 3 and sentiment score > 0) are shown in Figure 8. The results of the RAKE analysis and the analysis of co-occurrences seem to provide complementary information. The RAKE analysis underlines the relationship between wine and landscape. Bigrams “olive oil,” “olive grove” and “countryside” appear in the first three places of the analysis. However, a little further down the graph, there are also “Tuscany countryside” and “small-town.” The presence of elements that lead to the production of wine is also interesting: “wine make” and “organic farm.”

The analysis of co-occurrences highlights the importance of logistical and information aspects; the most frequent co-occurrence is “tour-great-guide” linked to the “guide-knowledgeable” co-occurrence. The second element that emerges from the analysis is the wine-food link, with the co-occurrences “wine-food,” “wine-oil,” “wine-tasting” and “wine-lunch”. Figure 8 shows the RAKE analysis and co-occurrence graph of reviews with negative sentiment and low bubbles (≤ 3). The critical elements highlighted by the two procedures are related to logistical and organizational aspects. The RAKE analysis highlights the importance of choosing the location of the meeting point (“meeting point” and “train station”) and the relationship with the tour guide (“tour guide” and “tour company”). The qualitative characteristics of the wine that are positioned at the bottom of the graph (“wine” and “tasting”) appear to be less critical. The graph of co-occurrences also emphasizes the importance of the efficient organization of the wine tourism experience with the “tour-people-guide” and “tour-bus” associations.

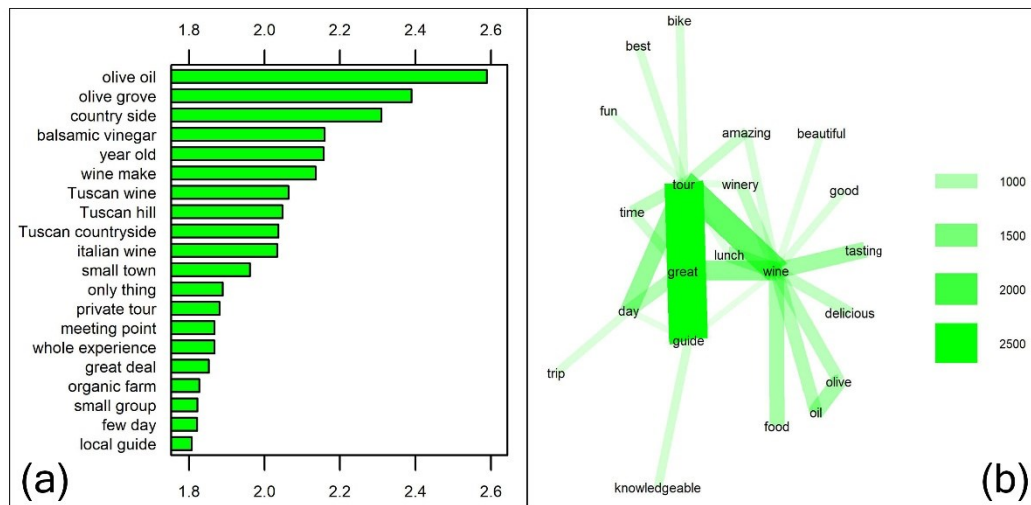


Figure 8. - (a) RAKE analysis and (b) Cooccurrence graph of reviews with a positive sentiment and high bubbles (>3).

Figure 9 reports the results of the natural language processing of substantially positive reviews but with critical elements. The results of this analysis appear to be less consistent than in previous cases because the number of reviews is considerably small (only 37 reviews). Nevertheless, an interesting result is the presence of the “credit card,” which turns out to be an element of disappointment typical of this class of reviews.

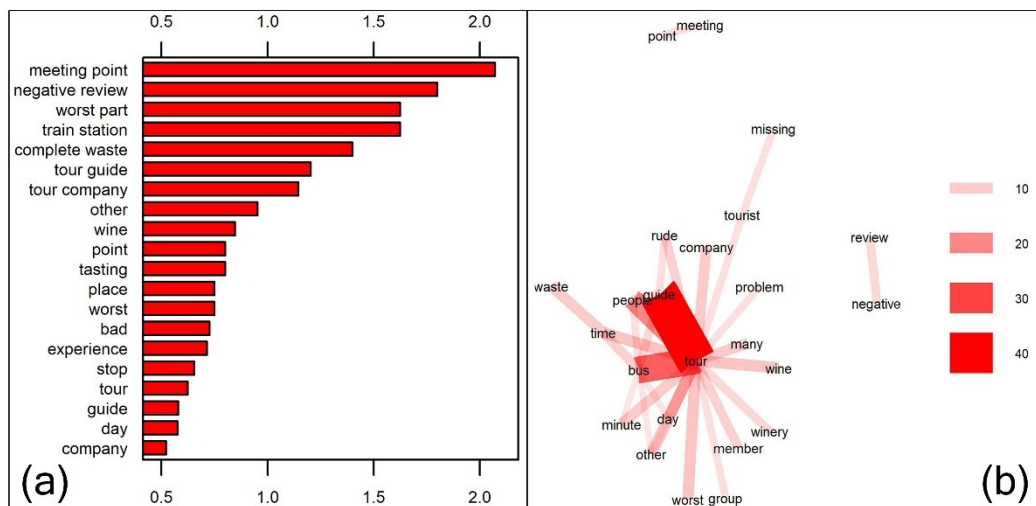


Figure 9. - (a) RAKE analysis and (b) Cooccurrence graph of reviews with negative sentiment and low bubbles (≤ 3).

The remaining terms seem to refer to the organizational aspects of wine tours such as the category of definitely negative reviews (Figure 10).

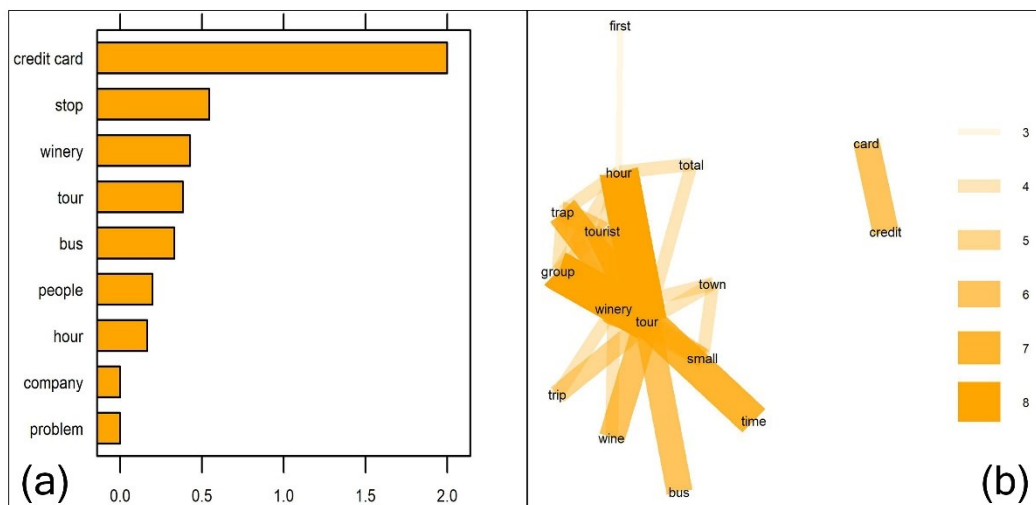


Figure 10. - (a) RAKE analysis and (b) Cooccurrence graph of reviews with negative sentiment and high bubbles.

Finally, the results of the processing of reviews that were substantially negative (less than 3 bubbles) but that showed positive aspects (sentiment score > 0) did not yield particularly useful results, as they were very similar to the case of reviews that were certainly positive but with decidedly lower sentiment scores (Figure 11, Table 1).

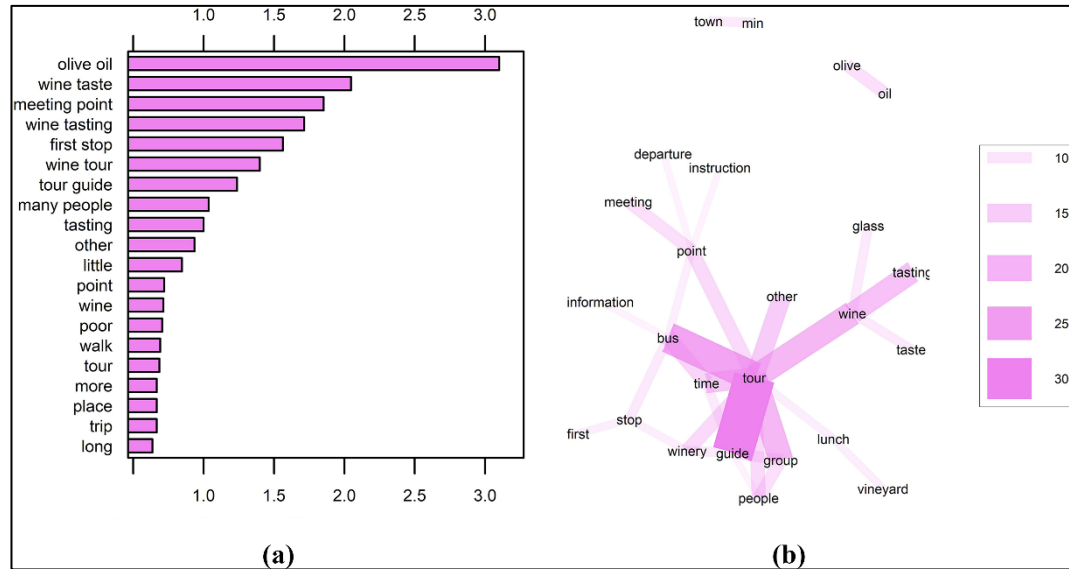


Figure 11. - (a) RAKE analysis and (b) Cooccurrence graph of reviews with positive sentiment and low bubbles.

Discussion

Research questions

Regarding the first research question (RQ1), research has shown that in Tuscany, wine tour products have experienced strong growth in demand in recent years and the seasonal distribution follows the work phases of grape harvesting and wine production. Spatially, the tours are limited to the wine regions located on the Florence-Pisa-Siena routes. Therefore, policymakers should encourage the expansion of wine tours to wine regions located on the Tuscan coast by promoting the link between seaside tourism and food and wine tourism. Furthermore, the results of the analysis make it possible to identify and evaluate the following six characteristic dimensions of wine tour products (Terziyska and Damyanova, 2020):

1. Professionalism of the tour guide and quality of explanations.
2. Logistical and organizational aspects.
3. Quality of the wine.
4. Quality of the food.
5. Complementary tourist and recreational activities.
6. Landscape and historic villages.

The tour guide is the most complex element of a wine tour service. The tour guide is present both in reviews with negative sentiment and low bubbles and those with positive sentiment and high bubbles. Furthermore, the tour guide has a central position in the multidimensional scaling graph (Figure 5) close to the words “wine” and “tour.” The tour guide is one of the most important elements in wine tours, plays an intermediary role between tourists and the destination and is the first contact with the wine region that tourists are going to visit (Rabotic, 2010). The literature has identified storytelling and cultural intermediaries as important concepts for interacting with tourists at winery doors (Maguire et al., 2020). In fact, the tour guide is mentioned in almost all reviews, often with the guide’s proper name and a detailed description of their characteristics, both in a positive and negative sense. The adjectives that occur most often are “knowledgeable” and “informative”; therefore, good knowledge of the place and the ability to know how to present and convey it are the main characteristics that a good tour guide must possess.

In the context of positive reviewers (RQ2), the perceived qualities are related to the knowledge of wine and its environment (Figure 7). The most closely associated words are “knowledgeable” and “wine.” The results obtained from the analysis of natural language processing are confirmed by the five sentences with the highest sentiment scores shown in Table 2. Enthusiasm and passion for the tour guiding job are easily noticed by tourists and reflected in the review with the best sentiment scores: “[...] guides who truly enjoyed themselves while making sure their guests were happy, safe and having a fabulous day!” (sentiment score of 75 points) and “... our guide Lavi and the other guests who were mostly young professionals were lovely people to be around for a whole day. We’d absolutely go again” (sentiment score of 73 points).

Table 2. - The sentences with the highest sentiment score in the reviews with bubbles > 3 and sentiment score > 0.

Sentence	Sentiment score
<i>We had the most amazing time, great wine, fabulous food, stunning views and a super fun way to travel on the off roads of Tuscany. (GabbianneAva August 2019)</i>	79
<i>You will have a heavenly experience filled with fun, breathtaking scenery, and guides who truly enjoyed themselves while making sure their guests were happy, safe and having a fabulous day! (Diana B, June 2021)</i>	75
<i>My boyfriend and I had an awesome time on this tour- perfectly organised from start to finish, great wines (although we learned that we weren't great fan of Chianti wines, that didn't detract from the overall experience) - highlights include the best meal I had in my week in Florence (truffle raviolis) served in a panoramic, non touristy setting, fun and interesting stories by our guide Lavi, and other guests who were mostly young professionals, lovely people to be around for a whole day. We'd absolutely go again :) (crispliid, September 2018)</i>	73
<i>Not only did we get a wonderful tour of the Tuscan countryside, but we also had a blast with the amazing tour guides (and got a great workout in too!) The guides were absolutely wonderful and gave a splendid tour of the vineyard and winery where you got the opportunity to taste delicious red wine and fresh olive oil all while enjoying the beauty of Tuscany and the castle that the winery is located in! (Rachel L, October 2014)</i>	70
<i>Hosts incredibly friendly and welcoming, a really fantastic tour packed with information followed by beautiful wines in a genuinely heavenly setting accompanied by the absolute best in local cheeses, meats, breads olive oils, and the highlight spiced cherries so bountiful that this was our lunch for the day and honestly the highlight of our weekend, the cherries astounded me, the spicing was perfect to complement the wines, the various cheeses and local meats all accompanied by the breads and olive oils, I will remember this tour always and dearly hope to return next year. (SpanielTash, August 2019)</i>	64

In negative reviews (RQ3), however, aspects related to the relationship and mediation between tourists prevail. In Figure 9, “guide” is connected to “people” and “rude” and the logistic management of the bus and behaviour (“rude”). In addition, in this case, the sentences with the lowest sentiment (Table 3) scores confirm the results of natural language processing, highlighting the lack of empathy with customers – “Worst of all, our tour guide had a negative attitude, scorned at

people who had to clarify questions and kept losing people because she didn't give clear meeting place instructions" (sentiment score of -17) – or the lack of professionalism – "Awful tour guide (Amanda) lost 3 members of the group" (sentiment score of -17) and "The tour guide was poorly trained and the information that was given was so basic anyone coming to Florence would already know the facts given" (a sentiment score of -16).

Table 3. - The sentences with the lowest sentiment score in the reviews with bubbles ≤ 3 and sentiment score < 0 .

<i>Sentence</i>	<i>Sentiment score</i>
<i>As my friend and I left the bus and walked alone approaching the Florence train station, two intoxicated tour members came up to us and called us vile names and the male physically threatened us for purportedly not being nice to the tour guide Lavinia.</i> (Lisa7234, February 2018)	-31
<i>Worst of all, our tour guide had a negative attitude, scorned at people who had clarifying questions, and kept losing people because she didn't give clear meeting place instructions.</i> (michellestraveling, September 2016)	-17
<i>Even the lunch was horrible and the wine was awful.</i> (jenny4480, February 2018)	-17
<i>Awful tour guide (Amanda) lost 3 members of the group. She had TERRIBLE organisation and all timings were late. Due to her lack of organisation when asked if we would miss the sunset (the tour is called sunset in sienna and is meant to include a panoramic vantage point to watch the sunset) she replied "I don't know what time it sets".</i> (Norah, October 2018)	-17
<i>The tour guide was poorly trained, the information that was given was so basic anyone coming to Florence would already know the facts given.</i> (happy_trail10, May 2019)	-16

Logistical and planning aspects are typical of negative reviews (RQ3). The greatest criticism seems to be related to the planning of the trip, especially regarding the "meeting point" and the "wasted time" (Figure 8). The lack of the ability to pay by credit card (Figure 9) constitutes a minor annoyance that does not seem to affect the total quality perceived by wine tourists. The sentences with the lowest sentiment

score in the reviews with high bubbles and negative sentiment score (Table 4) also report the following: “My husband attempted to pay with a credit card on the website and the paperwork we had stated this is an option” (sentiment score –5) and “Driver refused a credit card and said they do not take credit cards. They take you to an ATM to withdrawal cash” (sentiment score of –4). When comparing sentiment scores, however, it is evident that the credit card problem is perceived as less critical than the lack of competence of the guide.

Table 4. - The sentences with the lowest sentiment score in the reviews with bubbles > 3 and sentiment score < 0.

Sentence	Sentiment score
<i>The pasta that followed was even more disgusting and the vegetarian pasta was worse than prison food. (Somewhere, June 2018)</i>	-8
<i>The only thing I did not like was being left at the bus station after dark. It was not the easiest thing to get from the bus station to the train station, which was the central place where we met in the morning. (Lorraine J, February 2020)</i>	-6
<i>The minus star is for the fact that the tour was advertised as being no more than 25 people and there were 55 people on my bus. (dreamincolour39, August 24, 2019)</i>	-5
<i>My husband attempted to pay with a credit card as the website and the paperwork we had states is an option ... Driver refused credit card, said they do not take credit cards, they take you to an ATM for cash withdrawal. (boosgrandma, July 2019)</i>	-5
<i>The booking on line was easy, only draw back was that we had to pay cash due to the guide being a freelancer and couldn't use credit card - the website and booking part did say credit cards could be used. (Whenz, July 2016)</i>	-4

The quality of the wine, quality of the food, complementary tourist activities and landscapes and historic villages are the dimensions that allow the reviews to be segmented into specific clusters (RQ1) and are part of the strengths of Tuscan wine tours (RQ2). Reviews with positive sentiment emphasize the complementarity between wine, typical landscape, gastronomy and cycling, thus defining the wine tour as a typical example of the concept of winescape (Bruwer and Gross, 2017;

Thomas et al., 2018). The two sentences with the highest sentiment score are the following (Table 2): “We had the most amazing time. Great wine, fabulous food, stunning views and a super fun way to travel on the off-roads of Tuscany” (sentiment score 79) and “You will have a heavenly experience filled with fun, breathtaking scenery [...]” (sentiment score 75).

The “main wine product” is central to the wine tour experience (Getz and Brown, 2006). It significantly affects the perception and satisfaction of tourists and is heavily mentioned in their comments. This study has identified co-occurrences of the main wine product (“wine tastings,” “Tuscan wine” and “wine delicious”), co-occurrences that link wine to oil, the other typical product of the countryside Tuscany and keywords relating to wine production (“wine make” and “winery”). Furthermore, Table 2 shows the following:

“...beautiful wines in a genuinely heavenly setting accompanied by the absolute best in local cheeses, meats, pieces of bread, olive oils and the highlight spiced cherries so bountiful that this was our lunch for the day and honestly the highlight of our weekend. The cherries astounded me and the spicing was perfect to complement the wines, the various cheeses and local meats all accompanied by the pieces of bread and olive oils” (sentiment score 64).

The last interesting result derives from the geolocalization of the tours (Figure 4), which has allowed us to verify that not all Tuscan wine regions are interested in the wine tour product and that, therefore, Tuscany still has margins for increasing and differentiating the offerings by also focusing on the wine-sea association.

Managerial implications

The results of the present study offer useful managerial information for tour operators. First, for tourism operators in the tourism market, the results confirm that customers of wine tours seem to have high expectations and do not forgive mistakes made by organizations and management.

Second, for entrepreneurs who are planning to become tour operators in new wine tourism regions, the results highlight the most important dimensions of the wine tourism experience. When promoting newly organized wine tours, entrepreneurs

should emphasize the beauty of the wine landscape and historical villages, the quality of the food and wine offerings and the possibility to obtain information from the winemakers of the visited wineries through competent guides who are able to overcome language barriers.

A third important indication for new tour operators is the complexity of the wine tourism experience, which requires the coordination of art tourism in small villages and food and wine tourism in a single package.

Moreover, the results show the need to train guides who not only are prepared from an ecological point of view but also have psychological training to effectively manage the leadership of the tour and the dynamics of groups of people having different needs. The tour must be planned down to the smallest detail, starting with the choice of departure and arrival locations. Even the choice of wineries must be made carefully, selecting entrepreneurs not only for the quality of the product but also for their communication skills.

Finally, tour operators should use electronic word-of-mouth data to monitor the perceptions of their tours and, thus, continually improve their service design and promptly resolve issues that generate service failures.

Conclusions

Theoretical implications

The application of context analysis theory through natural language processing and sentiment analysis methods allowed the identification of winescape themes that influence the perception of the quality of wine tours or that may lead to service failures during the trip and winery visits. In general, the results highlight that organized wine tours is a complex product. In fact, the research confirmed the importance of the territorial (macro) characteristics of the winescape, including the quality of the wine, the landscape, the urban and architectural heritage and the food-wine relationship and the micro characteristics, including the logistics and planning of the experience, quality of the intermediation between wine production and consumers, intermediation and knowledge transfer.

This research fills a gap in wine tourism studies by adopting a new methodological approach and procedure that provides exhaustive answers to research questions. The use of sentiment analysis on freely written reviews has the advantage of being able to extract the real preferences and judgments of consumers to avoid strategic responses. Applying the natural language processing procedures after the classification of reviews based on sentiment scores allowed us to isolate the strengths from criticalities, which are often present simultaneously in the same review. The latest ones concerned a small subset of the reviews and, therefore, would have been difficult to identify if the entire body of the text was united.

Practical implications

The application of sentiment analysis techniques to TripAdvisor reviews made it possible to identify not only the elements of service quality but also the reasons for service failures. A key role is played by the guide, who not only has the important function of cultural intermediation between the winemaker and the consumer but also must exercise leadership in the management of the interpersonal relationships among tourists. Our research has shown that wine tourists positively perceive the technical preparation of the guide and negatively perceive the lack of leadership and empathy in the management of relationships. Logistics and travel organizations are a second element of the typical winescape of wine tours and are perceived almost exclusively according to their failures. Territorial characteristics of the landscape and historical villages are perceived as valuable elements; furthermore, the quality of wine and wine-food matching is fundamental in the overall quality of the experience, but they can also be the cause of very negative perceptions.

The research also found that the rating method adopted by TripAdvisor (the bubbles) is not always efficient. The application of sentiment analysis showed that useful information about service failure is present even in reviews with positive TripAdvisor ratings (three or more bubbles). In addition, reviews with fewer than three bubbles also highlight the positive characteristics of the winescape. In our opinion, tour operators should rely on sentiment scores, rather than TripAdvisor bubbles to monitor the quality of their product.

We believe that the elements with positive sentiment represent the guidelines for the planning of new tours in regions where this product is not yet common. Furthermore, tour operators should carefully monitor negative sentiment issues to maintain the quality of existing tours.

Limitations and future research

The limitations of the method were linked to the origin of the data used. The main limitation is that TripAdvisor does not provide social and personal information about the tourist who wrote the review; therefore, our methods are substantially complementary to the traditional survey method using questionnaires. Another possible limitation is the use of online reviews, which only consider consumers who have used TripAdvisor and, therefore, could be a statistically biased sample.

A third limitation is that the data set of reviews of wine tours in a wine region has a hierarchical structure: in a region, we can have a set of different tours and a set of reviews of each tour. As the goal of the research is to identify the dimensions of a wine tour's winescape, in this work, we decided to group all the reviews in a single corpus with the results referring to the entire wine region of Tuscany. With this choice, however, we could not evaluate the differences among tours. In future research, we will investigate the possibility of using TripAdvisor data hierarchically to identify if there are sufficiently diversified typologies of wine tours and if they significantly differ in terms of sentiments.

Regarding the results obtained, a further limitation is related to the geographical region in which the study area is located (Italy). If the study had been conducted in other states or on other continents, the results could have been different because of the diverse nature of wine tourism products. Therefore, future research is needed to validate this method for different contexts.

The final useful development of the research is related to the identification of methodologies for monitoring the quality of single wine tours over time employing TripAdvisor reviews to provide tour operators tools for controlling the quality of the service.

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2.4. Research Article 2

What went right and what went wrong in my cellar door visit? A worldwide analysis of TripAdvisor's reviews of Wineries & Vineyards

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Abstract

The purpose of this work is to study the issues of service quality and service failure during visits to cellar doors in the five regions where wine tourism is most developed: Hunter Valley (AU), Mendoza (AR), Napa Valley (the USA), Stellenbosch (ZA), and Tuscany (IT). We propose a methodology based on a combination of sentiment analysis and natural language processing applied to 89,672 TripAdvisor reviews. The results indicate that the issues most linked to service quality and service failure are as follows (in the order of importance): the quality of the main wine product, the experience in the tasting room, the organized tours, the empathy of the staff, the reliability of the staff, and the setting of the cellar and landscape. These themes are common to all five wine tourism regions, but each region treats them differently. The results obtained confirm and expand the results of previous studies and may prove useful both to professionals (wineries, tour operators, and travel agents) and for the design of a product that meets the needs of wine tourists. The main limitation of the study concerns the application of the methodology to the five most developed wine regions in the world; therefore, the results obtained may not be immediately applicable to the wine regions that are starting to develop wine tourism.

Keywords. Wine tourism, cellar door, service quality, service failure, TripAdvisor, sentiment analysis, natural language processing.

Introduction

Wine tourism industry has been shown to play a key role in regional rural development, and thus, tourism is one of the important and developing parts of the wine industry, even on an international scale (Hall et al., 2009). The feature that most characterizes wine tourism involves visits to cellar doors (Alant & Bruwer, 2004). Visits to cellar doors create a direct relationship between producers and consumers of wine that lasts over time (Menghini, 2015). Such visitors often research products when they return home, which results in positive word-of-mouth marketing to friends, family, and colleagues (Charters & O'Neill, 2001; O'Neill et al., 2002). From an economic point of view, direct sales in a cellar bring greater added value because of the minimum distribution costs and the consequent high associated margins (Charters & O'Neill, 2001). Winery visits are an important part of wine tourism and contribute to the development of the wine sector (Gill et al., 2007).

A key element in the success of winery visits is customers' perceptions of the quality of service. Quality of service is essential to develop the relationship between customers and brands and allows the implementation of relationship marketing strategies (O'Neill et al., 2002).

Although a range of tools is available to measure and evaluate the quality of service, only a few of them have been applied to the field of wine tourism. Such tools are predominantly based on questionnaires (O'Neill et al., 2002; Carlsen, 2011; Taylor, 2006), mainly employing the well-known SERVQUAL model and its variants (Parasuraman et al., 1994), adapting it to the specificities of the wine sector (O'Neill et al., 2002; Haverila et al., 2021). However, the use of questionnaires has the limitation of poor generalizability of results. This is because case studies consider a handful of consumers attending one or a few wineries within a single wine tourism region.

There is also a lack of studies on the factors that determine service failure in winery visits. Poor service or service failure results in dissatisfaction, which, in turn, manifests in a series of responses that may include complaints and negative word of mouth. In the work of Magnini and Ford (Magnini et al., 2004), service failures

were defined as “any service-related mishaps or problems (real or perceived) that transpired during a customer’s experience with a firm.” By better understanding the causes of customer complaints, the number of problematic events can potentially be reduced, and better remedies can be provided. Therefore, attempts to develop a clearer understanding of problem areas benefit both winery owners and customers. Researchers have recently started measuring the service quality and service failure of hotels through the analysis of reviews left by users on travel sites (Giglio et al., 2020; Sann & Lai, 2020). Travel sites allow users to freely express opinions on the perceived quality of service, and from these reviews, a measure of the quality of service can be obtained through a semantic analysis of the content. These data can be considered complementary to questionnaires, as they have a very different nature. On the one hand, such data is not structured around variables or concerns, as it happens with existing validated questionnaires so it cannot be used to provide a summative assessment of quality. On the other hand, it has the potential to discover aspects of quality that are overlooked or given less importance in existing questionnaires.

A further gap that emerged from the analysis of the literature is that the research on the quality of service of visits to wine cellars is geographically limited to very few wine regions, located mainly in Australia. International travel sites allow reviews to be accessed from around the world (O’Neill et al., 2002; Gill et al., 2007; Carlsen, 2011).

The research questions (RQs) that our work attempts to answer are:

RQ1: Is it possible to measure service quality and service failure through a semantic analysis of the reviews made by users on travel sites?

RQ2: What are the determinants of service quality that emerge from reviews made by users on travel sites?

RQ3: What are the determinants of service failure that emerge from reviews made by users on travel sites?

RQ4: What are the factors that determine the quality and failure of service that are common globally? What are the typical determinants of the quality of wine regions?

This article is structured as follows. First, the literature review provides an overview of past studies within the theoretical framework of winescape, service quality assessment, and the use of data from social media in the wine tourism industry. Then, the methodology section describes the research context, data collection process, and procedures used to perform content analysis of web reviews. The results section identifies the major themes of service quality and service failure. The discussion section focuses on the answers to the research questions and the comparison of the research findings with the results of other approaches, concerning SERVQUAL. The last section reports the managerial implications, limitations, and possibilities for future research.

Literature review

Wine tourism is a complex product that combines the purchase of a market good, wine, with the enjoyment of intangible assets, such as the landscape and the information provided by the guide and wine producers. The study of wine sales from wineries through the analysis of social media data encompasses four theoretical fields of research: wine tourism, winescapes, theories of quality of service, and content analysis/lexical analysis theory applied to social media. In this literature review, we provide brief references to these three research fields as applied to cellar door visits.

Wine tourism

The number of articles published on wine tourism has been steadily growing since the mid-1990s. Based on prior literature, a framework for wine tourism was explored by Carlsen (Carlsen, 2004), in which production- and consumption-based research can be placed. A classification of the wine tourism literature was then conducted by Mitchell and Hall (2006), who identified eight themes:

- 1) wine tourism development;
- 2) winery and cellar door;
- 3) wine tourist behaviour;
- 4) wine events and festivals;

- 5) marketing and promotion;
- 6) critical success factors;
- 7) wine tourism models; and
- 8) education and more.

Between 2005 and 2014, there was an increase in theory-building in wine tourism research, referring to theory to provide theory (Mitchell & Hall, 2006). Theory-based research has focused on the analysis of wine regions' image (Brown et al., 2007) and service quality (O'Neill et al., 2002).

Winescape concept

One of the most prolific topics in wine tourism is the analysis of wine regions' image through the identification of wine tourism attributes (Mitchell & Hall, 2006; Gómez et al., 2019). The dimensions of the servicescape (i.e., the atmosphere that enhances the customer experience and influences buyer behavior during the service encounter) were adapted and applied by Peters (2018) in a winescape concept by highlighting attributes that are attractive to wine tourists. First, Peters (2018) identified three fundamental elements that shape a winescape: "(1) the grapes and their needs, (2) the natural environments that best meet those needs, and (3) the viticulturists and wine makers who determine everything from the varieties of grapes, spacing of the vines, and trellising systems to the final product that enters the bottle."

Johnson and Bruwer's (2007) conceptual definition specifically encapsulated the interplay of natural landscape and setting: heritage, architecture, and artefacts within a winery, winery's vineyard, cellar door, and wines; complementary products and services; signage and layout; and people at a winery.

The winescape scale developed in more recent studies is based on a plurality of theories: servicescape theory, multi-attribute theory (Quintal et al., 2018), and destination choice (push-pull) theory (Quintal et al., 2021). Thomas et al. (2018), from a meta-analysis of 70 supply-related winery articles, defined seven key attributes of a winescape:

1. The natural environment and scenery such as the natural landscape, vineyards, and rural setting referred to in the current study as the winescape setting attribute.
2. Built environment such as wineries, cellar doors, and buildings, and the heritage that they convey were identified as the winescape atmospherics attribute.
3. Wine products such as reputable wines, wine variety, and value-for-money wines were referred to as the winescape wine product attribute.
4. Complementary services such as restaurants, accommodation as well as other local produce and craft were identified as the winescape complementary product attribute.
5. Signage and information such as signposting and informational materials were referred to as the winescape signage attribute.
6. Layout and infrastructure connecting the physical attractions such as wine routes and roads were identified as the winescape layout attribute.
7. Service staff who interact with wine tourists were referred to as the winescape service staff attribute.

Service quality in cellar door visits

Service quality (SQ) originates from comparing perceived expectations (E) of a service to perceived performance (P), resulting in the equation $SQ = P - E$ (Lewis & Booms, 1983); service failure can be defined as service performance falling short of customer expectations (Sparks & Fredline, 2007).

Most of the research conducted in Australia on service quality at cellar doors is based on an adaptation of the SERVQUAL methodology. The SERVQUAL methodology, proposed by Parasuraman, Zeithaml, and Berry (1994), constructs a measure of perceived quality and, therefore, of customer satisfaction through a comparison of customer expectations in approaching a type of product/service and the perceptions of the product/service after consumption. It is a highly standardized quantitative methodology designed specifically to measure clients' opinions on the quality of services. This makes it possible to compare the expectations and perceptions of users regarding a specific service. It consists of a series of 22

questions valid for each type of service that makes it possible to measure perceived quality and expectations separately for five dimensions considered essential for judging service quality. The dimensions are as follows:

1. Tangible elements (appearance of physical facilities, equipment, and personnel);
2. Reliability (ability to deliver the promised service reliably and accurately);
3. Responsiveness (willingness to help customers and provide service promptly);
4. Reassurance (competence and courtesy of employees and relative ability to inspire trust and confidence);
5. Empathy (caring and personalized assistance given to customers and users).

Some authors have adapted and applied SERVQUAL's methodology to analyze the quality of service during the visits at cellar doors by assessing dimensions using Likert scales.

O'Neil and Charters (2001), in a study in the Margaret River region (AU), implemented a two-stage methodology, the first stage being a qualitative descriptive analysis through eight interviews with cellar door operators, and the second stage was based on 150 interviews through a specific questionnaire developed through an adaptation of the SERVQUAL methodology. Similarly, O'Neil et al. (2002) applied the SERVQUAL methodology by adapting it to 10 wineries in the Margaret River region and in the Barossa Valley (AU). For both surveys, respondents were asked to rate their perceptions of the dimensions listed on a five-point Likert scale. The scale items were grouped according to whether they were "wine-related" or "staff-related," and represented many of the original SERVQUAL dimensions. The items that comprised each dimension were based on King et al.'s (1997) (King et al., 1997) service quality model for cellar doors, which emphasized the importance of product and service quality for cellar doors' success.

Griffin and Lopersch (2006) applied a modified version of the SERVQUAL model in the Canberra District (AU). The authors identified 23 quality attributes across six dimensions: external, internal, service, staff, wine, and convenience attributes. The external and internal attributes are related to the physical qualities of wineries, with

the former associated with the environment and surroundings of wineries, and the latter relating to the layout and character of tasting rooms.

Gill et al. (2007), in research in the Margaret River and Swan Valley, instead, adopted a multidimensional model derived from Sweeney and Soutar's (2001) PERVAL and Petrick's (2002) SERV-PERVAL measures. The authors derived five dimensions from the SERV-PERVAL measures: quality (Q), emotional value (EV), price (P), social value (SV), and reputation (R). The questionnaires were structured on a seven-value Likert scale.

The only study we found outside Australia was carried out in Greece by Nella and Christou (Nella & Christou, 2004), who applied a structural equation model that incorporates three temporal dimensions of the winery experience: before the visit, on-site, and after the visit.

The use of social media data in wine tourism research

According to Lockshin and Corsi (2012), social media marketing is an interesting field of research in wine tourism research. There is an increasing amount of social media research on wine. Initially, research focused on the microblogs of wine consumers (Thach, 2009) and then expanded to Twitter (Claster et al., 2010) and Facebook (Nicholls, 2012) platforms. In the last three years, social media has been used to study the behaviour of wine tourists. Brochado et al. (2020) used 4,114 online reviews of 52 wine hotels located in 27 wine regions across 11 countries to identify key themes related to wine hotel experiences. Brochado et al. (2020) identified the sustainability dimensions of organized tours from the point of view of tourists by analyzing 878 reviews of 20 tours in Portugal, written on TripAdvisor. Terziyska and Damyanova (2020) employed 118 reviews on TripAdvisor to define the attributes of winescapes, as seen from the perspective of travel arrangements for a wine tour company in Piedmont, Italy. Brochado et al. (2021) collected 470 wine tourism reviews posted on TripAdvisor in the Douro wine region and used them to identify sensory perceptions during winery visits. Vo Than and Kirova (2018) analyzed with a netnographic approach 825 original reviews posted on TripAdvisor by tourists who visited Cognac (France). The results showed that the experiences

were globally positive and that experiences related to the dimensions of education and entertainment were predominant.

Finally, in a recent study (Orduña-Malea et al., 2021), social media was used to identify and characterize the behaviour of the “Masters of Wine” community on Twitter, as well as to determine the impact of these renowned wine experts through this platform. All Twitter profiles belonging to the Masters of Wine’s award-winning users were identified and analyzed. Additionally, a set of 35,653 tweets posted by the Masters of Wine were retrieved and analyzed using descriptive statistics.

Materials

Study areas

Wine, landscape, heritage, and tourism are all key- words that characterize wine tourism both in the Old World of Wine (Europe) and in the New World (the USA, South America, South Africa, and Australia). Currently, vineyards around the world represent not only a fundamental agricultural resource that guarantees rural development but also a great economic resource that allows the enhancement and maintenance of the same cultural wine landscapes and the development of the entire region (Lignon-Darmaillac, 2014).

According to the rankings on the TripAdvisor plat- form, based on the number of reviews, the top five wine destinations in the world are: Tuscany (Italy) in the first place, followed by Napa Valley (the USA), Hunter Val- ley (Australia), Stellenbosch (South Africa), and Mendoza (Argentina). While Tuscany has a long tradition, the other wine regions of the New World were established and developed very quickly, but with great success.

In the Chianti region, the integrated tourist offering is coordinated by eight wine routes. The wine routes, regulated by Italian Law n. 268/1999, bring together wineries, restaurants, hotels, wine bars, and other public and private facilities, clearly using the typical wine of the area as a physical and cultural link between all the subjects involved. This joint management encourages tourists to organize their stay in a way that allows them to experience the territory on an oenological and

intellectual level. The museums of wine and vines, which are in almost all Italian regions, help in promoting and communicating wine culture, although they differ in thematic approach, as well as in their size and history (Compés Lopez & Szolnoki, 2021).

In Napa Valley, the wine sector presents itself as an economy in its own right with many services, wherein the business model focuses on the diversity and originality of the wineries' design, a new attractive resource to guarantee their reputation and draw the largest number of visitors, both oenophiles and lovers of contemporary art. The suppliers of wine tourism in Napa Valley also recognize the need to continue to evolve as people search for innovation and trends while maintaining the brand that the region was built upon. This is manifesting itself in the addition of new restaurants, hotels, and wineries. Leaders and suppliers of the Napa wine tourism experience are also looking at creating dedicated bike trails, zip lines, and other activities to add to the physical and figurative landscape of the Napa wine tourism destination experience (Jones et al., 2015).

In Hunter Valley, food and wine represent one of the top three motivational drives for international tourists to Australia among the aquatic and coastal experiences, nature, and wildlife. In Australia, wine trails are not as developed as in Europe. However, regional and local government agencies have developed tourism routes where wine experiences are part of a broader tourism theme combined with other experiences (Compés Lopez & Szolnoki, 2021).

The wine industry in Stellenbosch has an active wine tourism market, well-developed facilities, and infrastructure. However, although the first South African wine road was established as early as 1971, association networks are currently non-existent or underdeveloped (Bruwer, 2003).

The vision of Mendoza's wine tourism development was based on the strength of identity, culture, and landscape. In particular, its architecture has contributed greatly to the prestige and attractiveness of wine tourism. It projects, by recognizing historical dynamics, nature, and society, the quality of life with identity (Compés Lopez & Szolnoki, 2021).

Despite having different marketing strategies, these wine regions share the same aims: to enhance their heritage, grow their economy, satisfy the needs of existing customers, and attract new ones, in particular through wine routes, organization of events, and the combination of wine and food. Therefore, we have chosen the five main wine tourism destinations according to the TripAdvisor platform as study areas to understand their strengths and weaknesses and, in particular, to draw up useful guidelines at a global level.

Methods

TripAdvisor as an evaluation source

TripAdvisor is one of the most popular networks for sharing travel experiences. As of 2018, it had collected over 570 million reviews and opinions on over 1.2 million accommodations. TripAdvisor not only collects reviews on hotels and restaurants but is open to all tourist interest activities, including the specific category of winery visits.

One of the most appreciated features of TripAdvisor in marketing research is its reliability. The platform has an efficient, automated quality control and review reliability system that involves many parameters. The system compares incoming reviews for a given activity with the historical patterns already examined for that activity by identifying suspicious anomalies in the patterns (TripAdvisor, 2021, <https://www.tripadvisor.com/TripAdvisorInsights/w3690>). In addition, several studies have been conducted to analyze the credibility of this website (Ayeh et al., 2013).

When writing a review, guests also have the option to rate their overall experience on a scale of 1 to 5 “bubbles,” with 1 being a poor rating and 5 being an excellent rating. Valdivia et al. (2019), in recent research, showed that the TripAdvisor rating system presents a problem: users tend to rate the overall experience positively, but there may also be negative comments within a review. Likewise, in an average or negative evaluation, there may be positive evaluations of the relevant aspects of service quality. To analyze and evaluate reviews efficiently, it is necessary to separate positive and negative aspects. Taking this into account, we identified a

methodology for identifying and separating positive from negative sentences in reviews. Positive sentences contain the relevant qualitative elements of service quality, whereas negative sentences contain the relevant elements of service failure. Once we obtained two series of subreviews, one with only positive sentences and the other with negative sentences through a text mining analysis, we identified the relevant elements of service quality and service failure.

Review processing

The methodology of this study is articulated in the following steps. First, we identified the most relevant wine-tourism regions at the international level. Then, we verified the reliability of the TripAdvisor platform for the identification of key elements of consumer satisfaction using prior literature. Finally, we built an algorithm for the automatic collection of reviews and lexical and sentiment analyses.

Sentiment analysis

Sentiment analysis has been increasingly applied in recent years, especially to the contents of Web 2.0. Sentiment analysis measures the polarity and intensity of the mood of a person's opinion expressed in a text written in natural language.

Sentiment analysis methods can generally be divided into two categories: dictionary-based methods and methods based on supervised classification. The methods of the first category apply sentiment lexicons containing the semantic orientation of words to the sentences in the text. One of the biggest challenges of dictionary-based methods is that the sum of the semantic values of individual words does not necessarily correspond to the polarity of the entire sentence (Wilson et al., 2009). Therefore, it is necessary to extract further linguistic patterns from the text by conducting morphosyntactic analyses of the text (Clavel & Callejas, 2015). However, too many specific extraction models limit the application of this method to a specific domain. The most recently applied second category of method uses unsupervised or supervised machine learning algorithms, such as machine learning-based methods and deep learning-based methods. These methods allow the development of more generic models but require data classified according to

specific categories. Consequently, the quality of these models is strongly influenced by the reliability of the training and testing sets performed by human classifiers (Ribeiro et al., 2016).

The literature reveals that there is no superior sentiment analysis method because all tools work differently depending on the specific context in which they are applied or based on the corresponding data source on which they were trained. One of the best sentiment analysis methods for analyzing poorly structured and simple texts, such as reviews in TripAdvisor, is AFINN (Khanna et al., 2017). AFINN (Nielsen, 2011) is a dictionary-based method that was initially created in 2009 for tweets downloaded for online sentiment analysis about the United Nations Climate Conference (COP15). It has since been extended to other data domains. The version called AFINN-96 adopted in this work has 2,477 words and uses a score ranging from -5 (very negative) to +5 (very positive).

The sentiment scoring procedure is as follows:

1. Each review is broken down into its sentences $d_i = \{s_{i,1}, s_{i,2}, \dots, s_{i,n}\}$ based on punctuation; subsequently, each sentence is broken down into words $w_{i,j} = \{w_{i,j,1}, w_{i,j,2}, \dots, w_{i,j,l}\}$ using a semantic annotation procedure (Kiyavitskaya et al., 2006).
2. The words in each sentence, $\{w_{i,j,k}\}$, are searched and compared with the lexicon of polarized words, and each of them is assigned a negative or positive score. Not all words have a sentiment score; therefore, we obtain a subset of polarized words $\{p_{w_{i,j,k}}\} \subseteq \{w_{i,j,k}\}$.
3. Finally, we sum the weighted context yielding an unbounded polarity score $\delta_{i,j}$ for each sentence.

We chose not to normalize the polarity score on the number of words because satisfaction or dissatisfaction with service quality is proportional to the number of positively or negatively polarized words used to write a review (Khanna et al., 2017).

Co-occurrence network of high-frequency words to extract useful information from the subreviews

to understand the reasons for the quality and failure of the service, we used the co-occurrence graph method of the highest-frequency words. The first step of the analysis was the preprocessing of the sets of subreviews, called corpora. We carried out the following steps:

- i. Tokenization of the text that involves division into words of the text itself;
- ii. Removal of stopwords defined as words that do not carry significant information for analysis;
- iii. Stemming and rooting, which consist of reducing words to the root;
- iv. Removal of extra numbers and spaces;
- v. Removal of punctuations;
- vi. Part-of-speech tagging aimed to assign parts of speech to each word of a given text (such as nouns, verbs, adjectives, and others) based on its definition and context.

The co-occurrence network of the higher-frequency words was performed using the KH Coder software. We only used nouns and adjectives, as they are parts of speech with the highest information content (Hu et al., 2017; Kobayashi et al., 2019). In the analysis, we took 50 words with the highest frequency in the review corpora of each of the five wine regions. The KH Coder provides choices of Jaccard, cosine, or Euclid for measuring the distance between terms; in this research, the distance cosine was chosen. To facilitate the reading of the results, the procedure applied the methods developed by Fruchterman and Reingold (1991) and by Kamada and Kawai (1989) to design the word- word network.

Community analysis is one of the most recent developments in network theory. A network has a community structure when it is possible to partition it into subnets (also called communities, subgraphs, or clusters) characterized by a density of internal connections (i.e., between elements of the community itself) much greater than the density of connections between a community and the other community. Typically, in a network where there is a community structure, there are groups of highly connected nodes, nodes that are isolated, and others that act as a bridge

between the different communities. To identify the subgraphs, we used the modularity method for its computational efficiency (Clauset et al., 2004; Newman, 2006).

Reviews processing

A flowchart of our procedure is shown in Figure 1.

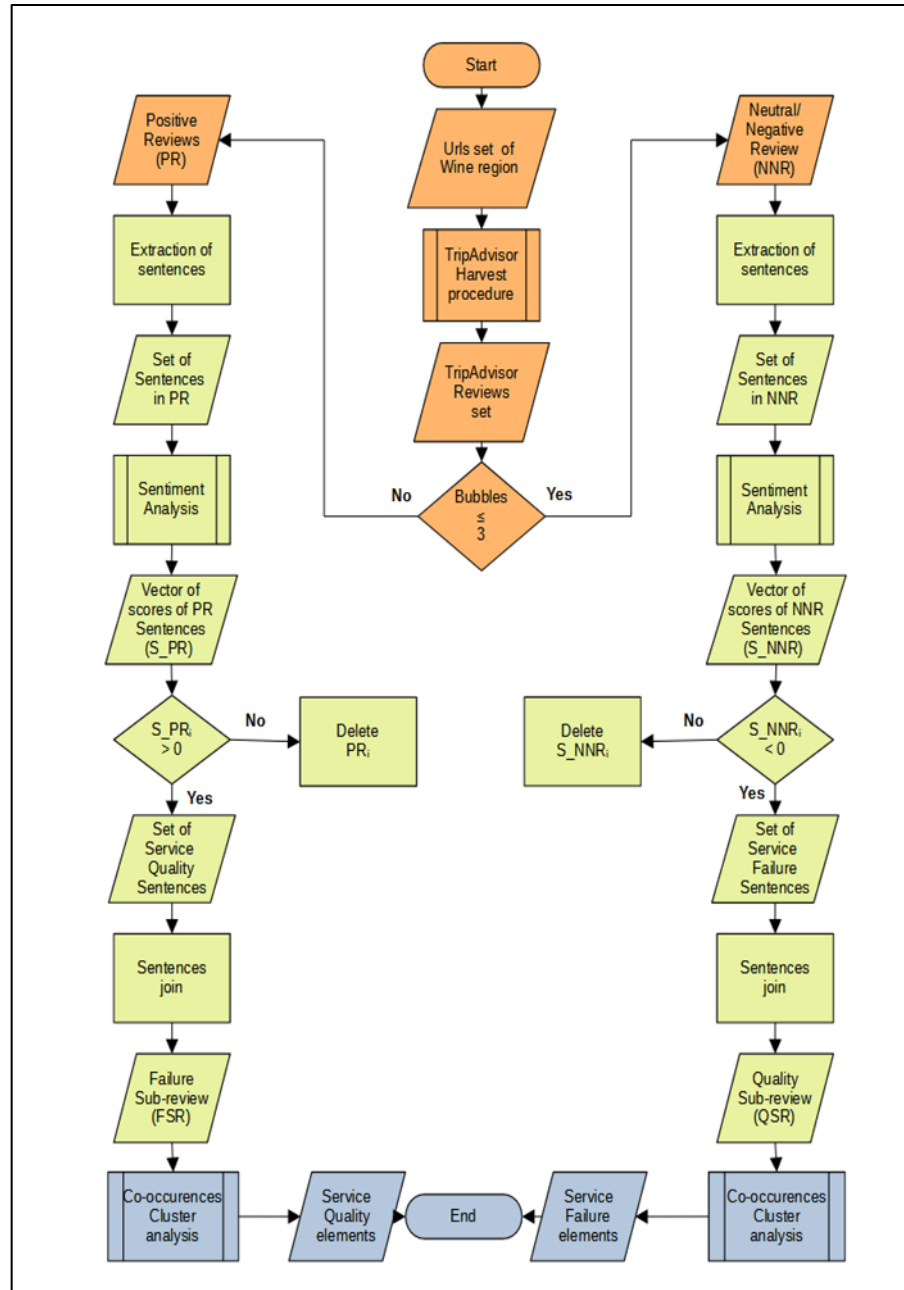


Figure 1. - Flow chart of the proposed methodology. The method addresses the research questions to find the elements of service quality and failure of several cellar doors in the world.

The procedure was divided into the following steps:

Step 1 (orange in Figure 1). In the first phase, we harvested the data relating to reviews based on the TripAdvisor URL of the five wine regions. For this purpose, we wrote a procedure in R language based on the “rvest” library (available as supplementary material). The data collected were the title of the review, review, and evaluation of the bubbles. The database obtained was divided into two subsets: positive reviews (PR) with a rating greater than three bubbles and neutral or negative reviews (NNR) with a rating less than or equal to three bubbles.

Step 2 (green in Figure 1). The reviews were divided into individual sentences. A sentence is the smallest lexical unit in natural language processing and is defined as a grammatical unit of one or more words that expresses an independent statement. A sentiment analysis procedure was applied to the sentences to assess the polarity (positive or negative) and the relative sentiment score of the perception of service quality or failure. Sentences with positive polarity express service quality, where- as those with negative polarity express service failure. In the subset of S_PR, only sentences with a sentiment score greater than zero were selected, while in S_NNR, only sentences with a sentiment score less than zero were selected. Finally, the sentences belonging to the same review were merged to obtain two sub-reviews, one with only the positive sentences and the other with only the negative sentences. Thus, we obtained two data- sets: service quality subreviews (SQRs) and service failure subreviews (SFRs) for the five wine regions. In this study, sentiment analysis was conducted using the “syuzhet” library of R software.

Step 3 (cyan in Figure 1). The co-occurrence graph method is one of the most widely used methods for analyzing large databases of unstructured text from social media (Liu et al., 2019; Niezgoda & Nowacki (2020)). The analysis of the co-occurrence net- work of words allows us to draw a network of relation- ships between words with a high degree of co-occurrence. This analysis allowed us to extract the most frequently recurring concepts for both service quality and service failure. A co-occurrence network of high-frequency words procedure was applied to the SQRs and SFRs to identify the factors and causes of service quality and

service failure during the visits to cellars. The elaborations were carried out using the KH Coder 3 software.

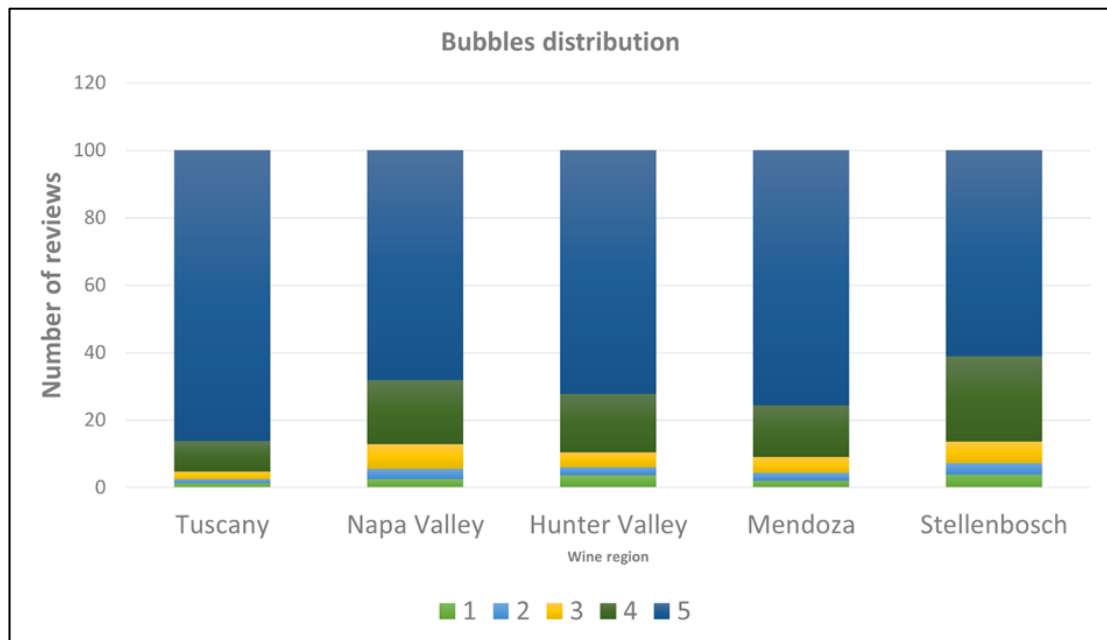


Figure 2. - Distribution of bubbles ranking. The aggregate count of reviews corresponds to the bubble ranking for each wine region.

Results

TripAdvisor ranking and sentiment analysis

We downloaded reviews and rankings of five wine regions collected in the period from January 2010 to April 2021 for a total of 89,672 reviews of 1,074 wineries. The wine region with the most reviews was Napa Valley with 46,753 reviews related to 387 wineries, followed by Hunter Valley with 13,204 reviews of 118 companies, Stellenbosch with 8,232 reviews of 81 companies, Tuscany with 7,402 reviews of 414 wineries, and Mendoza with 3,581 reviews related to 74 wineries. To understand how users rated their winery experience on TripAdvisor, we analyzed the percentage distribution of the bubbles' scores (Figure 2).

The figure shows that, in general terms, positive evaluations with five bubbles prevail. In particular, Tuscany had the highest percentage of reviews valued at five bubbles (86%), followed by Mendoza (76%), Hunter Valley (72%), Napa Valley (68%), and Stellenbosch (61%). The four bubbles score was highest in Stellenbosch

(25%), followed by Napa Valley (19%), Hunter Valley (17%), Mendoza (15%), and Tuscany (9%). The neutral score of the three bubbles was the same for Stellenbosch and Napa Valley (7%) and lower for Mendoza (5%), Hunter Valley (4%), and Tuscany (2%). Finally, two and one bubbles occurred at very low percentages in all five regions.

Table 1 reports the results of the sentiment analysis for the subreviews that express service quality (bubbles > 3 and sentiment > 0) and the subreviews related to service failure (bubbles ≤ 3 and sentiment < 0). For bubbles, the region with the highest perceived sentiment for service quality was Tuscany, followed by Mendoza, Napa Valley, Stellenbosch, and Hunter Valley. To validate the differences between the means, we performed a pairwise analysis with the van der Waerden test with the correction of the p-values according to the Bonferroni method. The advantage of the van der Waerden test is that it obtains a high efficiency of the standard ANOVA when the assumptions of normality are satisfied, but it also provides the robustness of the Kruskal-Wallis test when the assumptions of normality are not satisfied. The results reported in Table 1 show that the differences between the sentiment score of Tuscany compared to the other four wine regions and between the sentiment score of Mendoza compared to the other four regions are statistically significant. The differences between Stellenbosch, Napa Valley, and Hunter Valley are not significant.

Table 1. - shows the statistics, mean, and standard deviation of the sentiment analysis of service quality and service failure.

Service quality		Hunter Valley	Mendoza	Napa Valley	Stellenbosch	Tuscany
	n	11304	3063	38298	6763	16431
	mean	13.07	14.29	13.64	13.85	15.13
	sd	6.39	7.32	6.99	7.03	7.70
	Pairwise comparisons using van der Waerden normal scores test					
		Hunter Valley	Mendoza	Napa Valley	Stellenbosch	Tuscany
Service failure	Mendoza	7.3E-14 ***	-	-	-	-
	Napa Valley	6.9E-10 ***	2.3E-5 ***	-	-	-
	Stellenbosch	9.8E-10 ***	0.067 *	0.246	-	-
	Tuscany	< 2e-16 ***	8.4E-08 ***	< 2e-16 ***	< 2e-16 ***	-
Service failure		Hunter Valley	Mendoza	Napa Valley	Stellenbosch	Tuscany
	n	871	190	3269	693	519
	mean	-5.31	-5.08	-3.97	-4.84	-4.36
	sd	4.29	4.14	3.40	4.06	3.42
	Pairwise comparisons using van der Waerden normal scores test					
		Hunter Valley	Mendoza	Napa Valley	Stellenbosch	Tuscany
Service failure	Mendoza	1.000	-	-	-	-
	Napa Valley	< 2e-16 ***	8.3E-04 ***	-	-	-
	Stellenbosch	0.108	1.000	0.000	-	-
	Tuscany	9.9E-05 ***	0.619	0.042	0.469	-

For service failure, the region with the highest level of perceived sentiment was Napa Valley, followed by Tuscany, Stellenbosch, Mendoza, and Hunter Valley. The pairwise analysis shows that the perceived sentiment in the Napa Valley region was significantly higher than that in the Stellenbosch, Hunter Valley, and Mendoza regions, but not significantly higher than that of the Tuscany region. Tuscany, in turn, had a statistically significant difference compared only to Hunter Valley, while the difference with Mendoza and Stellenbosch was not significant. Finally, the perceived sentiment differences between Mendoza, Hunter Valley, and Stellenbosch were not statistically significant.

Co-occurrence network of service quality

The co-occurrence network and cluster analysis, based on databases with positive sentiment according to the AFINN dictionary (AFINN > 0) and positive bubble rankings (bubbles > 3), highlight the elements that characterize the service quality

of the wineries in various wine regions, and how they are perceived by the different types of users.

The analysis was carried out separately for each wine region (Figures A.1-A.5 in the Appendix), with both data- sets resulting from the union of all regions (Figure 3).

In general terms (Figure 3), the analysis identifies seven prevalent themes of service quality: “wine,” which characterizes subgraph 1 in Figure 3; “tour,” subgraph 4; “tasting,” subgraph 5; “winery,” subgraph 3; “service,” subgraph 2; “view,” subgraph 6; and “staff,” subgraph 7.

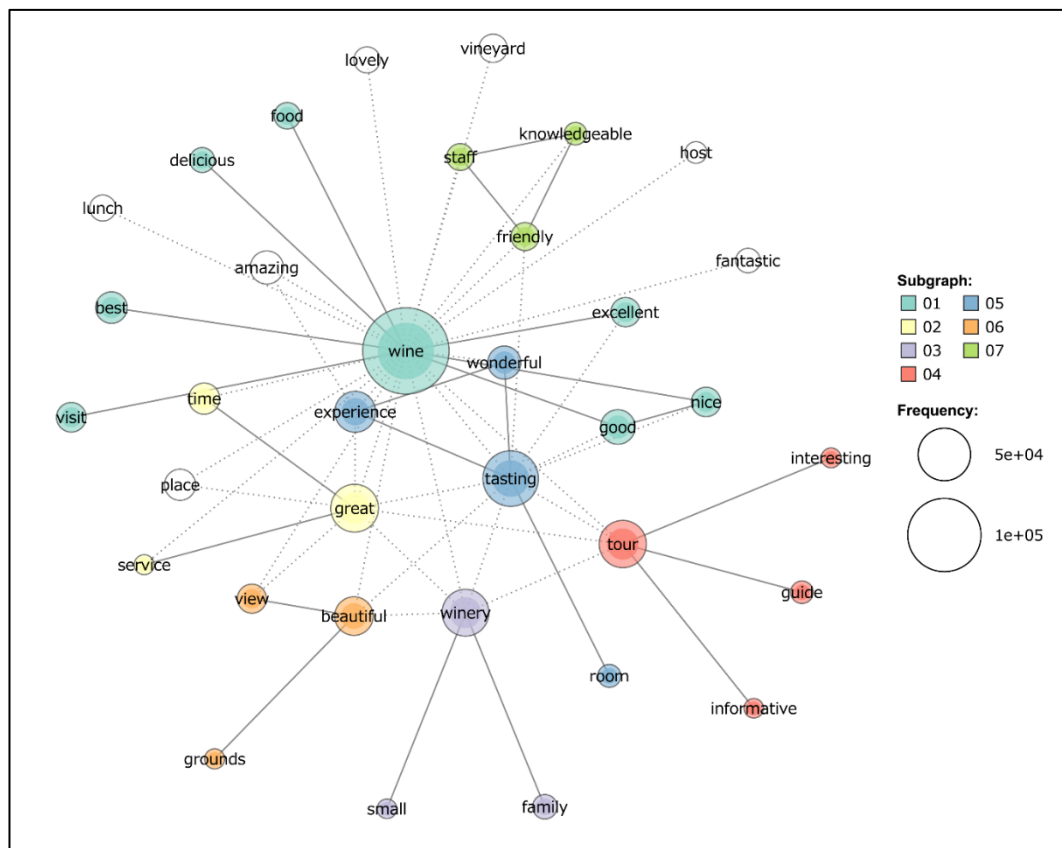


Figure 3. - Co-occurrence of service quality subreview for all five wine regions.

The wine theme

The core product, wine, is central to the perception of service quality both in the global analysis and sepa is associatied with the themes of “visit” and pairing with “food.” The different regions express the theme in slightly different ways. The

combination of “wine” and “food” on the occasion of the visit to a cellar can be found in Tuscany and Stellenbosch.

Hunter Valley associates “wine” with “winery” and the themes of landscape, “view,” “travel,” and “tour.” Meanwhile, in Napa Valley, “wine” is connected to the “tasting” – “room” – “experience.” Finally, Mendoza is characterized by the association of “good” – “wine” with the themes of the service: “amazing” – “service” and “nice” – “visit.”

The staff theme

The staff theme is another theme that is present in all five wine regions. In the global analysis (Figure 3) for Mendoza (Figure A.2, Napa Valley (Figure A.3), and Stellenbosch (Figure A.4), the term “staff” is associated with the two complementary qualities of service: “friendly” and “knowledgeable.” In the analysis referring to Tuscany, we find the subgraph “friendly” – “staff,” while for Hunter Valley, the theme is expressed with the terms “staff” “helpful,” “friendly” and “knowledgeable.”

The tasting theme

The tasting theme is present as a separate subgraph for Hunter Valley, Mendoza, Stellenbosch, and Tuscany, while for Napa Valley, it is in the wine theme subgraph. In the global graph, it is clearly expressed as “wonderful” – “experience” in the “tasting” – “room.” Similarly, for Hunter Valley, we have “great” – “fun” – “tasting” – “experience”; for Stellenbosch, “nice” – “good” – “experience” in the “tasting” – “room.”

However, in the Mendoza graph, the theme is articulated in a much more complex way. The “excellent” experience in the “tasting” – “room” is associated with the “tour,” with “guides” defined as “interesting” and “informative.” The location of the theme is then specified: “family” – “small” – “winery.

The tour theme

The “tour” theme is present as a subgraph in the graphs of Napa Valley and Tuscany. In the Hunter Valley graph, it is part of the “wine” theme, and in the

Mendoza graph, it is part of the “tasting” theme. It is not present in the Stellenbosch graph. In Tuscany, “tour” is associated with the theme of “lunch” and is defined as “informative” and “interesting.” In the Napa Valley graph, the tour theme “tour” is associated with the typical “cave” theme. The history of wine cave construction in the United States dates back to the 1860s in Sonoma and the 1870s in the Napa Valley region. In 1982, the Far Niente winery completed the first “new age” wine cave in Napa Valley. The Far Niente Winery caves now comprise approximately 3,700 m² (Conawy, 2002).

The service theme

The service theme is presented as a subgraph in the Hunter Valley and Napa Valley graphs. In the Mendoza graph, it is connected to the subgraph “wine.” It is not present in the graphs of Stellenbosch or Tuscany.

In the global graph, it is linked to the terms “great” and “time.” Hunter Valley associates the adjective “excellent” with “service” and in the Napa Valley graph with “great” – “time.”

The view theme

The “view” theme is present in the graphs of Stellenbosch, Napa, and Tuscany. In the global graph, as well as in the Napa Valley graph, it is associated with “beautiful” and “ground.” It is associated with “amazing” and “stunning” in the graph of Stellenbosch and with “amazing” and “beautiful” in that of Tuscany.

The regional themes of food and restaurant

The theme of food is not present in the global graph (either as a subgraph or as a high-frequency word). The theme features subgraphs in the graphs of Hunter Valley, Mendoza, Tuscany, and Stellenbosch. In Mendoza, the subgraph is highly articulated and includes the themes of the “course” and the “pairing” of wine with “food.” In Hunter Valley, “food” is simply associated with “lunch.” In the other two regions, the term food does not appear specifically but refers to gastronomic specialities, such as “olive” “oil” in Tuscany; “platter” of “cheese” and “wine” and “chocolate” “pairing” in Stellenbosch.

Co-occurrence network of quality failure

The co-occurrence network and cluster analysis, based on a database with negative sentiment according to the AFINN dictionary ($AFINN < 0$) and negative bubble ranking (bubbles ≤ 3), highlights the elements that characterize the failure of winery services in various wine regions and the problems experienced and encountered by consumers. Similar to the previous case, the analysis was carried out both globally (Figure 4) and separately for each wine region (Figure A.6. - Figure A.10. in appendix A), using only the most frequently used nouns and adjectives for a maximum number of 50 words.

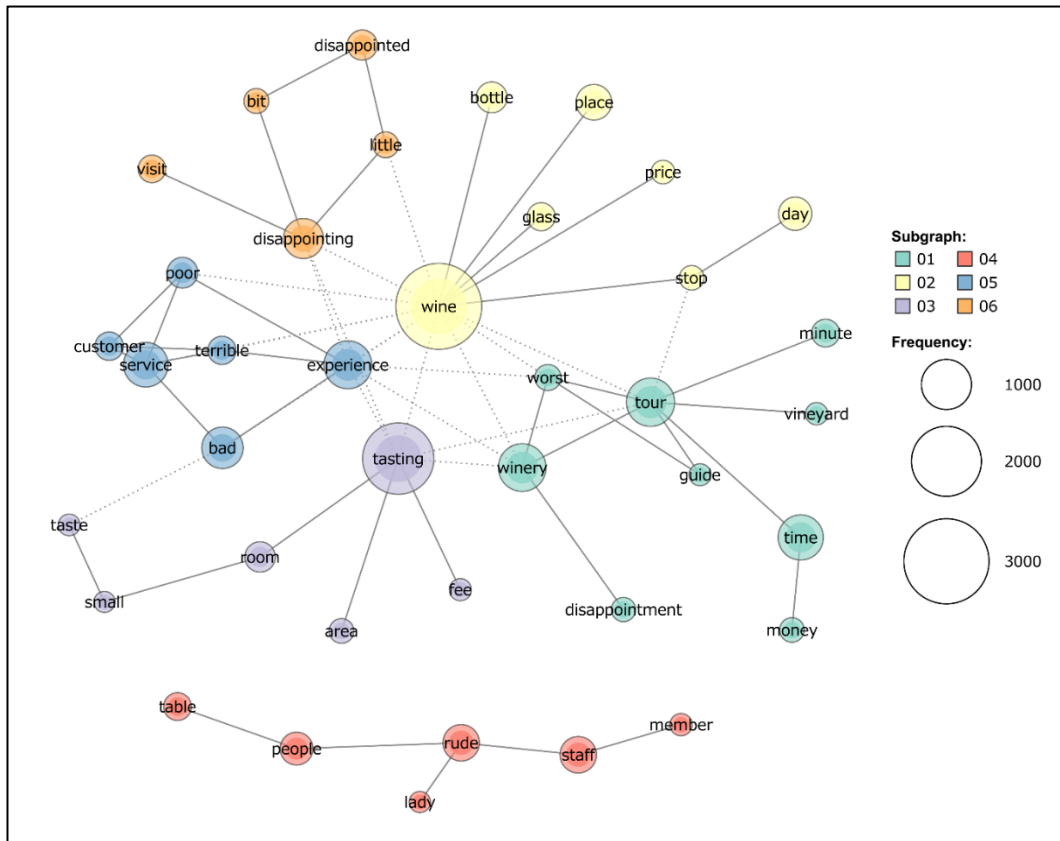


Figure 4. - Co-occurrence of service failure subreviews for all five wine regions.

The global graph includes six subgraphs: “wine” (subgraph 2), “tasting” (subgraph 3), “tour” (subgraph 1), “staff” (subgraph 4), “service” (subgraph 5), and “disappointing” (subgraph 6).

The wine theme

The wine theme is present in all the wine regions. Globally, the graph is not very articulated; “wine” is associated with the nouns “bottle,” “place,” “glass,” “price,” and with the bigram “drop” – “day.” However, in the graphs of the individual regions, the theme is more articulated and diversified. In the Mendoza graph (Figure A.7), “wine” is frequently associated with “tasting” – “price” and “staff”- “worst”- “day” - “tour.” In the Napa Valley graph (Figure A.8), we have a high frequency of co-occurrence for “bad” – “experience” in “winery” – “tasting” – “room.” The Stellenbosch graph (Figure A.9) highlights a “disappointing” – “wine” – “tasting” – “experience,” with also references to the “price.” Even the graph of Tuscany reports “disappointing”-“wine” – “tasting” (Figure A.10). In the case of Hunter Valley (Figure A.6), we have a graph more similar to the global one in which “wine” is directly associated with “tasting,” “place,” and “glass.”

The tasting theme

The tasting theme is present only in the global graph but highlights a rather debated problem (Kolyesnikova & Dodd, 2009; McNamara & Cassidy, 2015): whether or not to charge a “tasting” – “fee” at your cellar door.

The tour theme

The tour theme is presented as a subgraph in the Hunter Valley, Napa Valley, and Tuscany graphs. It is associated with the wine theme in the Mendoza graph. It is not present in the 50 most frequent words in the Stellenbosch graph. In the global graph, the “tours” in the cellars, “winery” and vineyards, “vineyards” cause “disappointment” for the “worst” - “guide,” the loss of “time,” and “money.”

The same themes of the global graph were found in that of Hunter Valley and Napa Valley. In the Tuscany graph, the tour subgraph is also associated with the subgraph “room” – “problem.”

The staff theme

The staff theme is present in the graphs of Hunter Valley, Napa Valley, Stellenbosch, and Tuscany. In the global Hunter Valley, Napa Valley, and

Stellenbosch graphs, the negative term to define a “staff” – “member” is “rude,” often associated with “lady” (global graph and Stellenbosch). In the Tuscan graph, it is also associated with “restaurant.”

The service theme

The service theme is present in the graphs of all wine regions, except in the graph of Tuscany. “Customer” – “service” emerges as a critical factor in the perception of service failure, as it is commonly referred to with strongly negative adjectives: “terrible,” “bad,” and “poor.” In Stellenbosch, it is also associated with “restaurant” and in Mendoza with “course” – “meal.”

The theme of disappointment

The negative theme of “disappointment” appears without relevant information content. It appears in the global Napa Valley and Hunter Valley graphs and is generically associated with “visit.”

The restaurant theme

The restaurant theme does not appear in the global graph but is present as a subgraph in the Hunter Valley, Stellenbosch, and Mendoza graphs. This is because, on the global level, there are not enough negative phrases referring to the term “restaurant” to form an independent cluster. In Mendoza, the theme “restaurants” is associated with terms like “food,” “lunch,” and the bigram “terrible experience.” In Hunter Valley and Stellenbosch, tourists refer specifically to winery restaurants.

Discussion

Previous research (McNamara & Cassidy, 2015; Wilson et al., 2009) has shown that TripAdvisor reviews have inconsistencies regarding the over- all experience rating through the bubbles method. Very often, high-rated reviews also have reports of low quality of service, and low-rated reviews also report positive aspects of an experience. This feature can lead to inefficiencies in the application of natural language processing procedures to identify service quality and failures. Our methodology combines sentiment analysis and natural language processing procedures and has allowed us to break down each review by isolating positive

sentences (service quality subreview) and negative sentences (service failure subreview) by assigning them a scalar score (RQ1). We have applied our procedure to the reviews of visits to wineries in the five regions with the greatest development of the wine tourism sector in the world: Hunter Valley, Mendoza, Stellenbosch, Napa Valley, and Tuscany. The results showed that the five wine regions have very high levels of perceived quality, with an average sentiment score ranging from a minimum of 13 (Hunter Valley) to a maximum of 15 (Tuscany). In comparison, the sentiment scores of service failure are much lower in absolute values: from a minimum of -5.3 (Hunter Valley) to a maximum of -3.9 (Napa Valley). The pairwise multiple comparisons of means allow for a ranking with significant differences for the first and last places. In the case of negative reviews, the values are decidedly lower, and the differences between the averages are not significant. These results are plausible, as we are dealing with regions specialized in wine tourism and, therefore, with an organization of complementary services for wine tasting (wine routes, festivals, events, etc.) that are substantially similar. Even the highest level of perception of quality in the case of Tuscany could be due to synergy with the landscape and historical locations. However, these hypotheses will have to be verified through specific investigations.

The results we obtained in identifying the themes of service quality and service failure are consistent and extend to the knowledge of previous research (RQ2 and RQ3).

The graphs of the results of co-occurrence (Figures 3, 1A-5A) assess the perception of the attributes of winescapes proposed by Thomas et al. (2018): winescape setting, winescape atmospherics, wine product, complementary product, winescape signage, winescape layout, and winescape service staff attributes. The “wine product” is certainly the most frequently perceived attribute in the evaluation of the quality of a visit to a cellar, and in the tasting experience, it is connected through the tasting room to the perception of the winescape atmospherics. The guided tour is the third most-cited theme in positive reviews. This theme is not present among the winescape attributes identified by the authors, and therefore constitutes a new additional attribute. In the global graph, themes refer to the winescape setting attribute (“beautiful-view”) and the winescape service staff attribute (“customer”

and “staff”). Finally, according to our results, complementary product attributes are not pre- sent in the global graph but appear in the graphs of all wine tourism regions with different denominations (see Figures A.1-A.5).

The analysis of service failure (RQ3) is another original result of our study, as this topic has thus far been neglected in the literature. Although reviews related to service failure are fewer (under 10%), evidence suggests that customers are more likely to remember service failures than excellent service (Valdivia et al., 2017). The advent of social media has dramatically changed the way customers convey word-of-mouth information. Previously, customers shared experiences in person with a limited number of social contacts; however, currently, social net- working sites allow them to share their experiences with more people (Lin et al., 2014). As such, word-of-mouth communication influences network members’ product and service choices (Grégoire et al., 2015). In particular, negative word-of-mouth communication can adversely influence customers’ attitudes and purchase intentions and a company’s brand image (Bambauer-Sachse & Mangold, 2011; Verhagen et al., 2013; Titz, 2001).

Thus, to ensure that quality is perceived in ser- vices and that critical episodes of service excellence are remembered better than defects, a comprehensive understanding of service failure processes is necessary.

The themes we identified were similar to those of service quality but expressed with useful information for stakeholders. In the graph of service quality, the staff theme is associated with the dimension of responsiveness for the adjective “knowledgeable” and with the dimension of empathy for the adjective “friendly”; in the service failure graph, instead, there is only the dimension of empathy with the negative adjective “rude” and there are no negative perceptions for responsiveness. This allows us to identify a critical issue and find out the best way to resolve it. The tour theme is also very different in the service failure graph compared to the service quality graph. The criticalities that emerge are logistical and indicate a waste of time or lack of professionalism by the guide.

We can answer RQ4 by comparing the global graph with those of the five wine regions. Looking at Figures A.1-A.5, we find many similarities, but also some

peculiarities. For the quality of service, six or seven themes are calculated for each chart. The themes “wine and tasting” and “personnel” are present in all the graphs and, therefore, represent elements perceived worldwide. Even “view” is another attribute of service quality with a global significance because it is present in four regions as the theme, and Hunter Valley is a word related to the theme “wine.” Regarding peculiarities, Tuscany, and especially Stellenbosch, are characterized by the complementarity between wine and food, and Mendoza, Napa Valley, and Tuscany by the presence of organized tours.

In service failure, the differences between the global graph and those of the wine regions are more marked. The global graph identifies six themes, while in the regions, we find a minimum of seven (Napa Valley) to a maximum of 10 (Mendoza) themes. The only themes common to all the graphs are “wine” and “staff”, while the tasting theme is always present as a linked word in the regional graphs. Tour failure is a common weakness only in Napa Valley and Tuscany, while many graphs highlight critical issues for the restaurant-food theme.

Conclusions

Theoretical implications

Our study proposed a model for analyzing the quality and failure of service in wine tourism and winery visits. It has filled a gap in wine tourism studies by adopting an approach based on the combination of sentiment analysis and natural language processing, as well as a global geographic perspective that has not been applied thus far. Our methodology, comparing five different wine tourism regions around the world, has allowed us to overcome the limitations highlighted by many researchers relating to the poor generalizability of results obtained by questionnaires (O’Neill et al., 2002; Petrick, 2002; Griffin & Loersch, 2006; Gill et al., 2007; Gómez et al., 2019).

Practical implications

The results obtained confirm and extend the findings of previous studies and are useful to both professionals (wineries, tour operators, and travel agents) and in the design of a product that meets the needs of wine tourists.

Analyzing well-developed wine regions for service quality helps to gain a comprehensive view of service quality, which could be useful for emerging wine regions that are just beginning to develop wine tourism services.

The results highlight the most important dimensions of the wine tourism experience. In promoting new regions, entrepreneurs should emphasize the beauty of the wine landscape; they should take care of the settings of wineries and tasting rooms, as well as of historical villages, the quality of the enogastronomical offer, and the possibility of obtaining information from the winemakers of wineries.

Moreover, the results show the need to train operators in aspects relating to oenology and psychology to effectively manage winery visits.

Finally, operators should use electronic word-of-mouth data to monitor tours' perceptions and thus continually improve service design and promptly resolve problems that create inefficiencies.

Limitations and future research

The main limitation of the study relates to the application of the methodology to the five most developed wine regions in the world. This choice made it possible to identify the fundamental themes of service quality, but the results obtained may not be immediately applicable to wine regions that are starting to develop wine tourism. Therefore, additional research will be needed in future to monitor the evolution of reviews in new wine tourism regions over time. Other limitations are common to research that is based on social media data: the results are based on the opinions of only those consumers who use TripAdvisor and, therefore, could be biased. The demographic and psychological data of the reviewers are also missing from the study.

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Appendix A

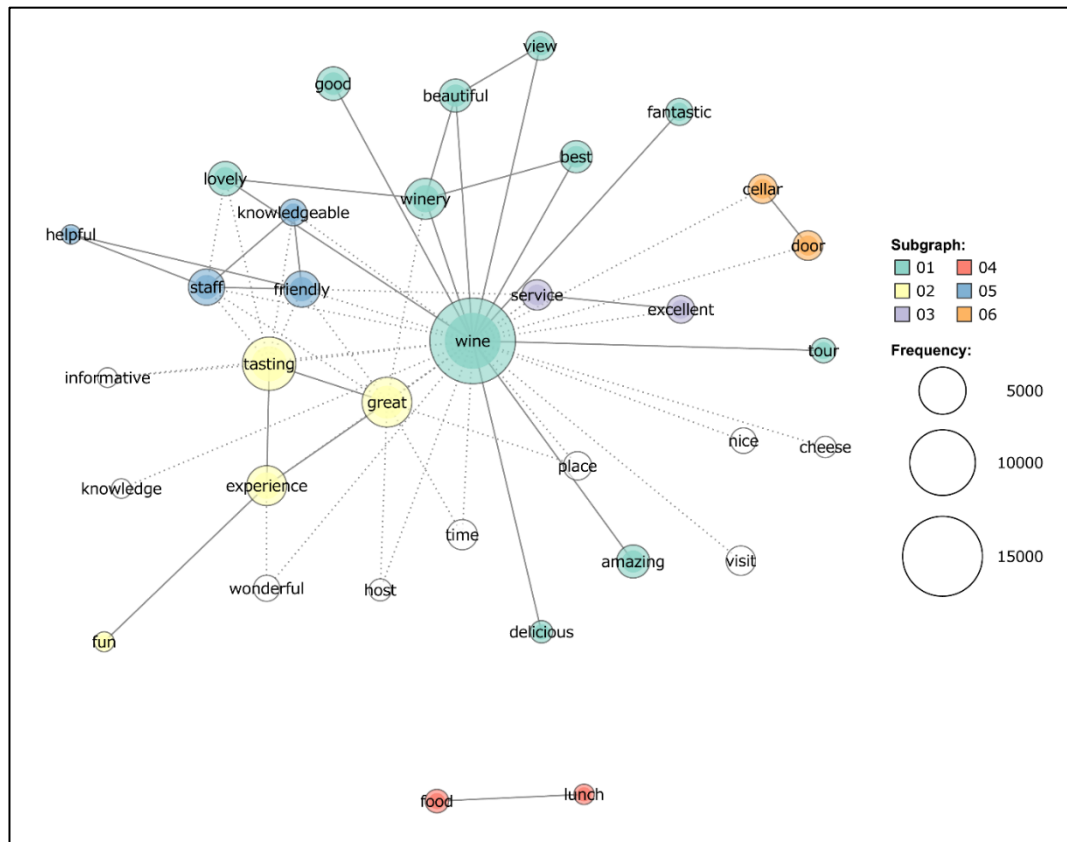


Figure A.1. - Co-occurrence of service quality subreview for Hunter Valley region

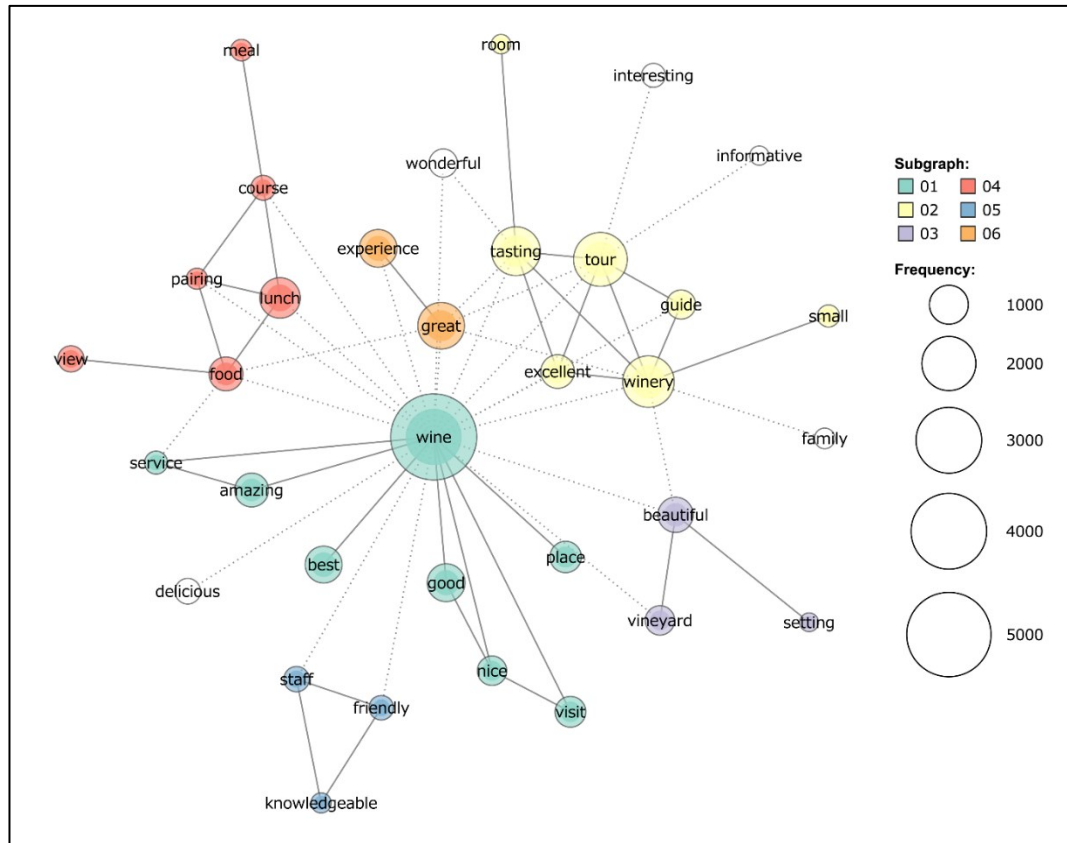


Figure A.2. - Co-occurrence of service quality subreview for Mendoza region

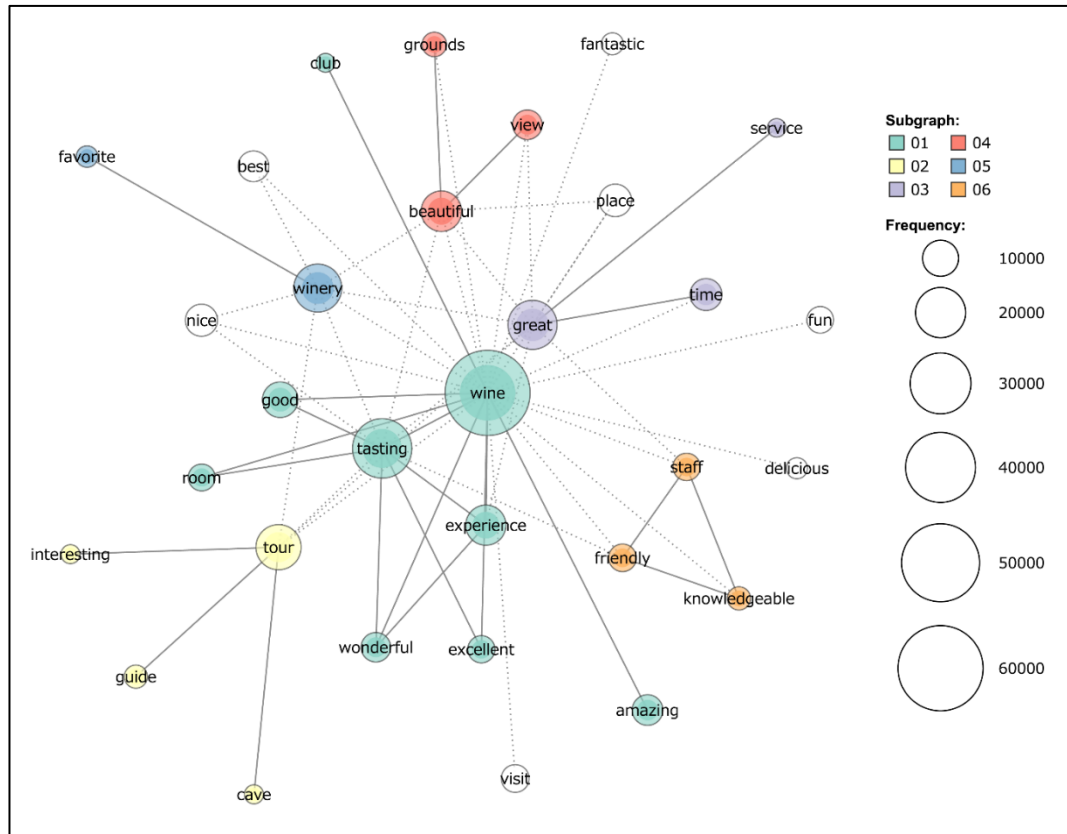


Figure A.3. - Co-occurrence of service quality subreview for Napa Valley region

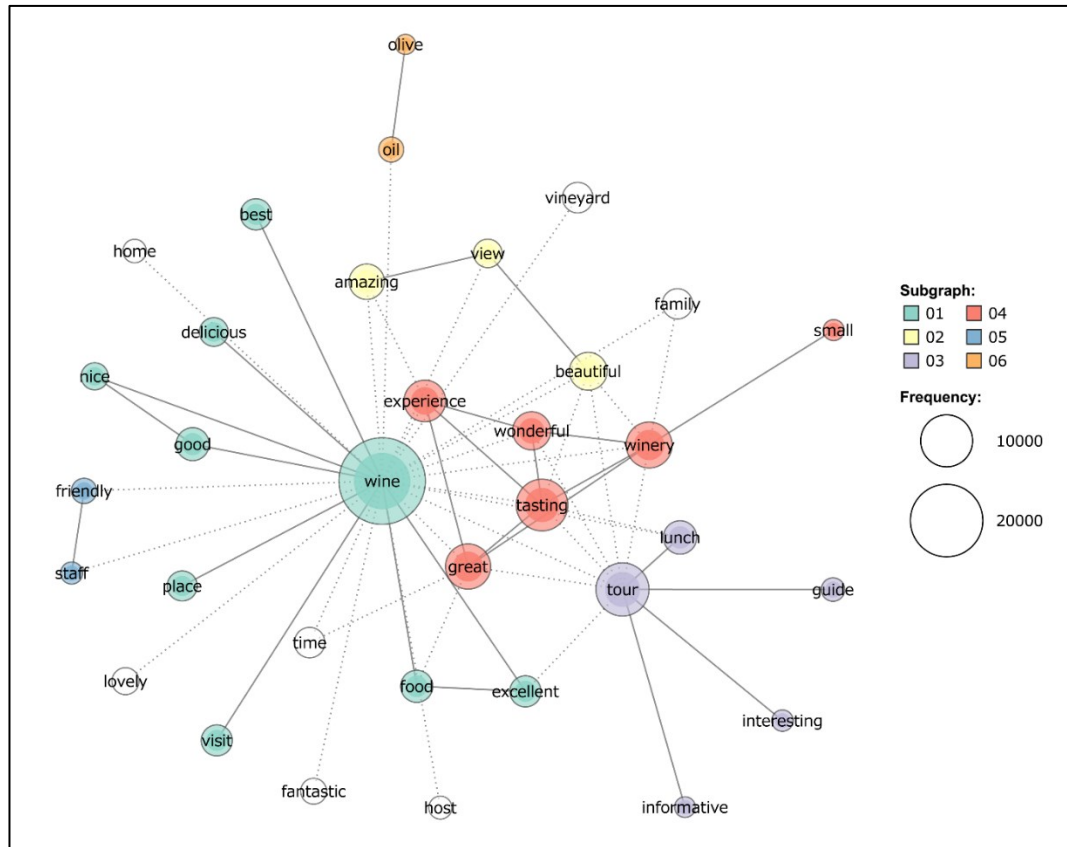


Figure A.4. - Co-occurrence of service quality subreview for Stellenbosch region

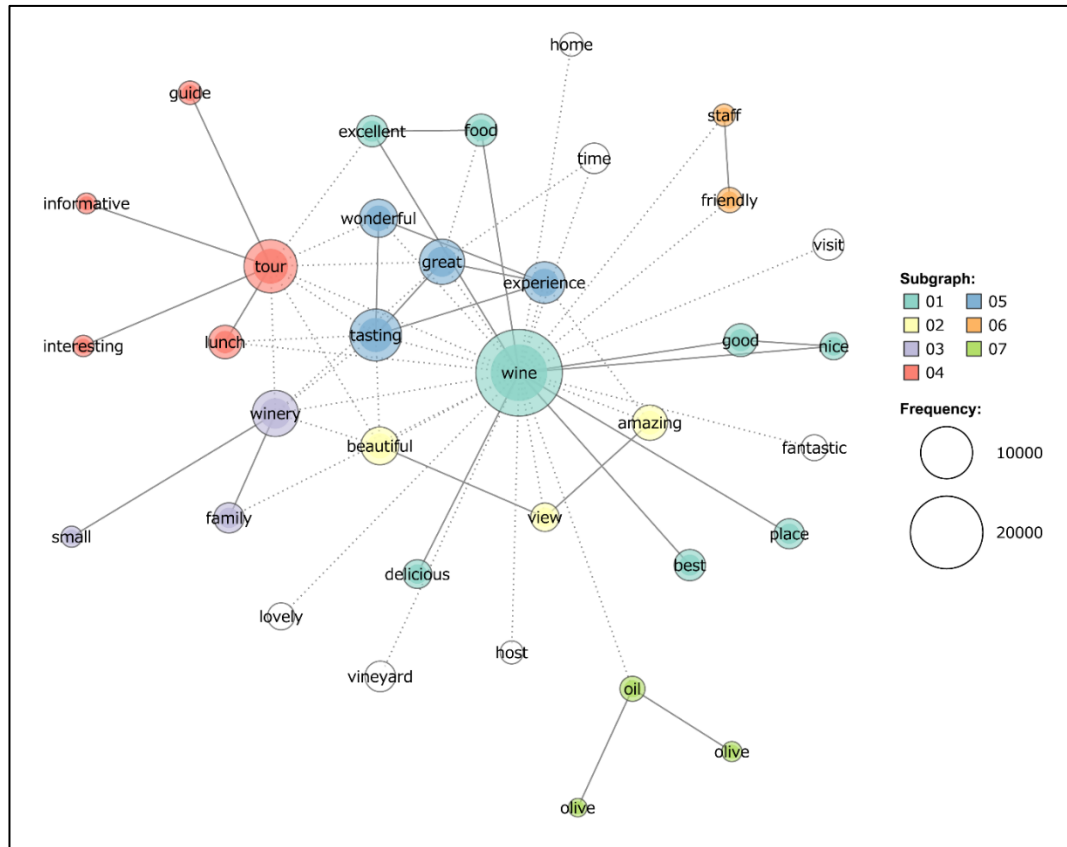


Figure A.5. - Co-occurrence of service quality subreview for Tuscany region

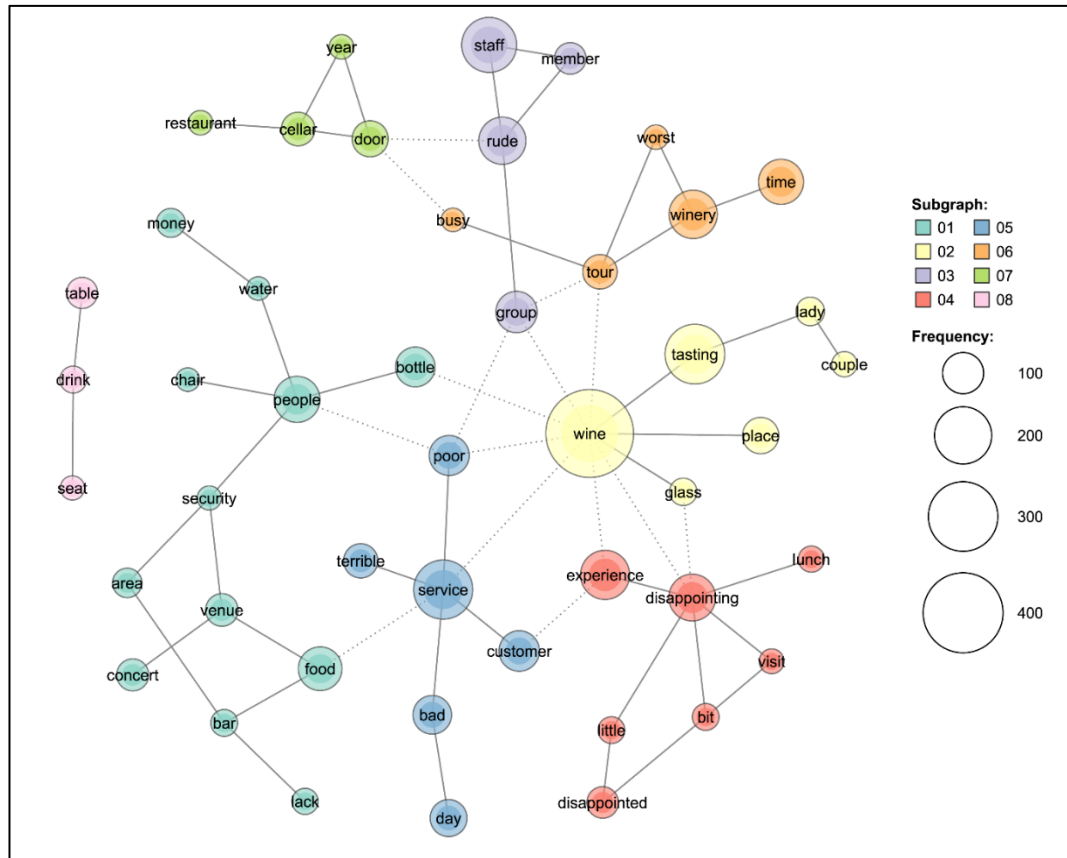


Figure A.6. - Co-occurrence of service failure subreview for Hunter Valley region

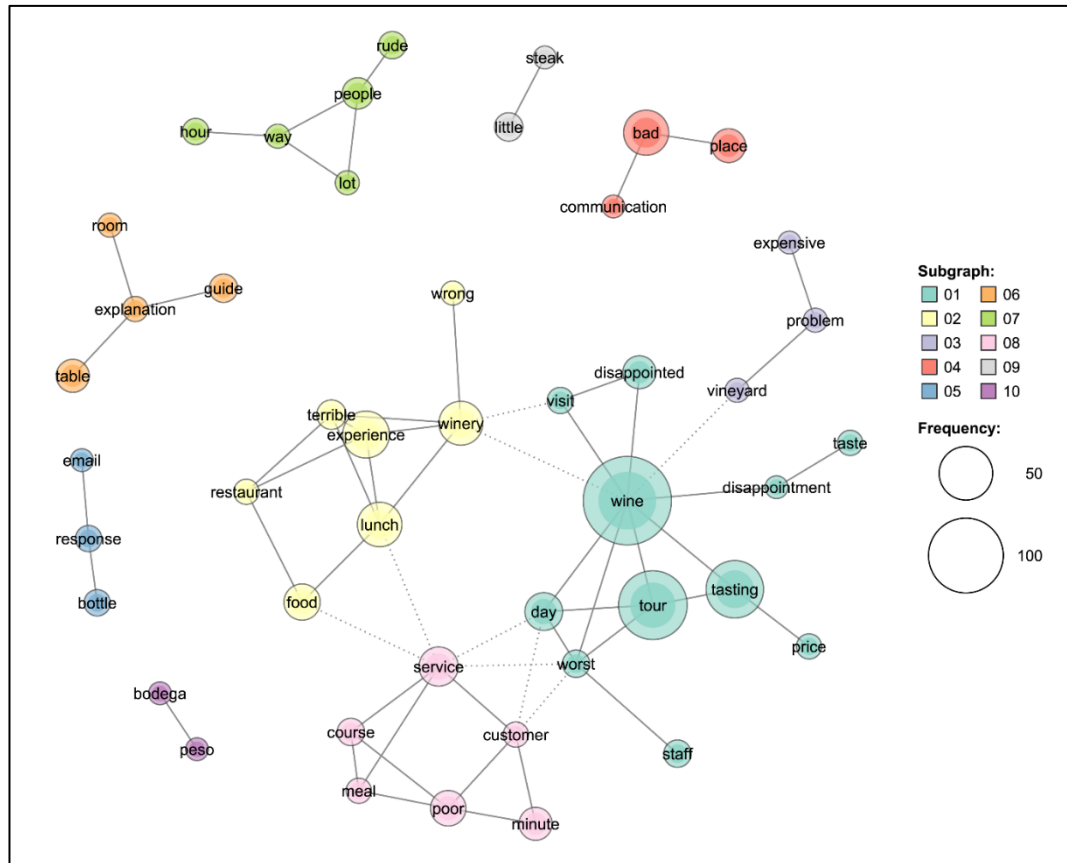


Figure A.7. - Co-occurrence of service failure subreview for Mendoza region

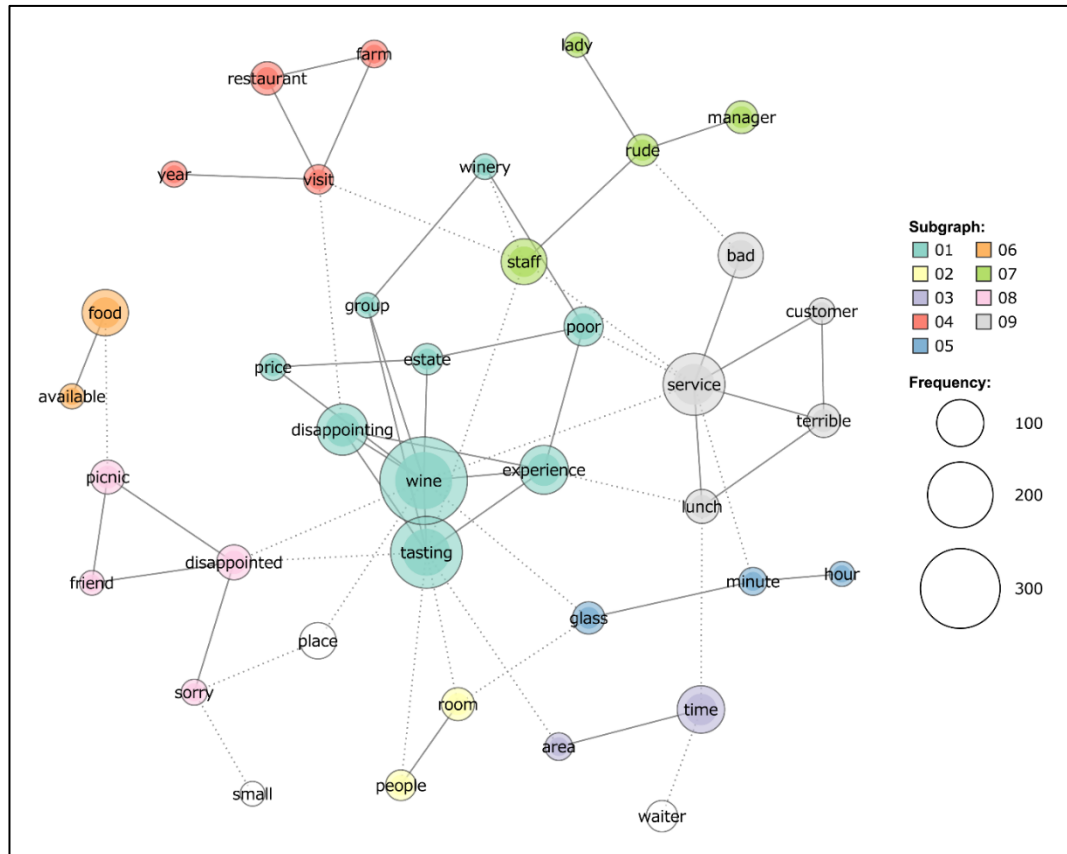


Figure A.9. - Co-occurrence of service failure subreview for Stellenbosch region

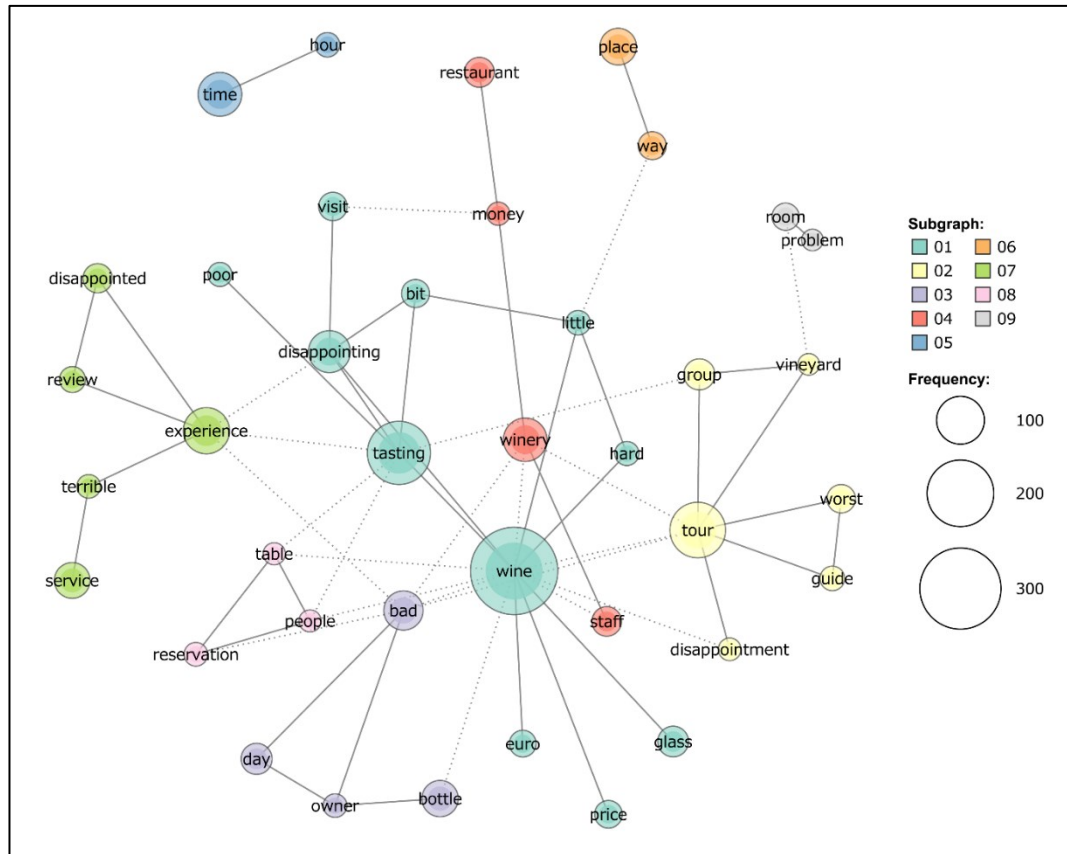


Figure A.10 - Co-occurrence of service failure subreview for Tuscany region

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Chapter 2

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CHAPTER 3: PRODUCT QUALITY

3. Wine product quality

The distinctive and complex characteristics of wine as a product category give rise to a unique decision-making process for consumers, unlike other consumer goods (Hollebeek et al., 2007). In the modern wine market, consumers encounter a large selection of varieties and brands (domestic and imported) when making their purchases (Schäufele et al., 2018). Despite the presence of opportunities to taste wine before purchasing (such as on-site tastings at wineries, retail stores or dining venues), these experiences are more uncommon than a standard practice in the consumer journey. Consequently, when consumers are tasked with buying untested or unfamiliar wine products, they rely heavily on the quality cues provided by the wine label and bottle as pivotal factors guiding their decision-making process (Martinez et al., 2006; Galati et al., 2018).

According to Quester and Smart (1998), wine extrinsic cues are usually classified into two categories: (1) cues related to the product itself such as grape variety, oak maturation and region of origin; and (2) cues that can be altered without changing the product such as price, packaging and brand name.

Many scholars have found that price is the most important quality cue when choosing wine (Chaney, 2000; Hallett et al., 2001; Thomas & Pickering, 2003; Lockshin et al., 2009; Oczkowski & Doucouliagos, 2015). In the wine economic literature, many surveys and experiments analyze the positive relationship between price and quality perception (Combris et al., 1997; Crozet et al., 2012; Oczkowski, 2015; Castriota et al., 2021). The general assumption is that higher prices would reflect a higher quality of the wine and, in turn, would translate into more positive evaluations of pleasantness and preferences of the product (Mastrobuoni et al., 2014).

However, in the marketing literature, it has been shown that price is the main indicator of quality when it is the only available signal. When price is combined with other cues, this evidence is less convincing (Zeithaml, 1988). In particular, price is greatly influenced by the brand name and the label design (Chironi & Ingrassia, 2013). Only when the brand name is unfamiliar is price used as an

indicator of quality to a greater extent than when the brands are familiar (Brucks et al., 2000).

In recent times, the marketing literature has increasingly emphasized the significance of label design and brand names in influencing consumer preferences and choices (Lutskova et al., 2020; Chamorro et al., 2021; Liu et al., 2022). The brand name encapsulates the reputation, value, and resultant quality associated with a product (Jantzi et al., 2020). An established and familiar brand not only enhances recognition but also cultivates trust among consumers, fostering confidence in the wine's quality and consistency, ultimately leading to a higher intention to purchase (Sherman & Tuten, 2011; Smith et al., 2017).

The label design, comprising visual elements and product information, plays a pivotal role in shaping perceptions of quality. Serving as the initial point of contact between consumers and the wine, a well-crafted and visually appealing label becomes essential for standing out in a saturated market (Galati et al., 2018; Gofman et al., 2009; Leder et al., 2016). Moreover, a traditional and simple design often correlates with a heightened perception of authenticity and product quality compared to a more modern and elaborate presentation. Essentially, the design serves as a means of communicating the brand's values and identity, constructing a narrative that influences the consumer's emotional connection with the product.

While various studies have underscored the importance of these cues in the wine selection process, the specific situations in which one prevails over the other, and their intricate relationship, remain somewhat unclear. It is precisely for this reason that this thesis endeavours to address this gap by conducting a comprehensive analysis, with a primary focus on understanding the relationship between these indicators.

3.1. Marketing analysis of product presentation

The study of consumer decision-making has long been of interest to researchers. As a result, a multitude of frameworks and models have been created to better understand buyer behaviour and the external factors that influence their purchasing choices (Bray, 2008). For instance, the Search-Experience-Credence (SEC) model, developed by Nelson (1970, 1974) and Darby and Karni (1973), offers a structured approach to understanding how consumers perceive and evaluate product attributes. This model helps identify search attributes like brand, price and label information easily assessed before purchase, experience attributes involve qualities evaluated during or after consumption, such as taste or aroma, and credence attributes, like terroir or winemaking practices, are more challenging to evaluate but significantly contribute to perceived quality. Marketers utilize this classification to tailor information dissemination about wines, highlighting different attributes to appeal to consumers at various stages of the purchasing process.

Additionally, according to Kotler and Armstrong (2018), it is stated that the indicator of buying interest is through the AIDA stimulus model. The AIDA model (Attention, Interest, Desire, Action) illustrates the stages the phases that a consumer typically goes through when making a purchase decision (Iwamoto, 2023). In the wine industry, this model assists wineries in capturing consumer attention through compelling branding, engaging storytelling, or eye-catching labels. It helps sustain interest by providing detailed information, arousing desire by emphasizing unique qualities, and ultimately prompting action through effective calls-to-action in marketing campaigns or tasting events (Wei et al., 2022).

According to Sáenz-Navajas et al., 2013, methodologies for evaluating the impact of extrinsic cues on consumers' wine choice preferences can be classified into three main groups: (1) surveys, (2) discrete choice experiments and (3) simulated choice experiments.

The first group studies wine purchase behaviour through surveys based on their previous purchase experience. Surveys are collected in various settings such as on the street (Martínez et al., 2006), in wine shops (Lockshin et al., 1997; Loureiro, 2003), at home (Fotopoulos et al., 2003), by e-mail (Jover et al., 2004), or

conducting face to face interviews by an experimenter (Fotopoulos et al., 2003; Guerrero et al., 2000; Loureiro, 2003; Martínez et al., 2006). However, this approach has limitations as it relies on rational considerations recorded in surveys, which are often not in line with actual choice experiences driven by non-rational factors.

The second group uses discrete choice scenarios and conjoint analysis to examine consumer preferences for wine. Respondents have to make choices among hypothetical wine samples with different attributes (Louviere, 1988; Lockshin et al., 2006; Mtimet & Albisu, 2006; Mueller et al., 2010a; Mueller et al., 2010b; Mueller et al., 2010c; Raz et al., 2008; Tempesta et al., 2010; Mehta & Bhanja, 2017). To simplify the process, fractional designs are used, reducing the number of possible attribute combinations and allowing for a more manageable calculation of consumer preferences (Ben-Akiva et al., 2019). However, these methodologies have limitations. They lack realism, as participants are involved in hypothetical scenarios rather than facing real choice situations (Kulshreshtha et al., 2023). In addition, they are “reductive” and do not consider all possible combinations of attributes, losing important information in the analysis of consumer behaviour (Payini et al., 2022).

The third group focused on simulating real choice situations, but there were few studies in this category (Chrea et al., 2011; Williamson et al., 2016). These studies used real commercial wine samples and found differences in results compared to surveys and conjoint analysis. Another experiment involved home-use testing, which yielded more relevant hedonic data despite its uncontrolled conditions (Meillon et al., 2010).

Apart from these choice approaches, some studies used auction methodology to measure consumers’ willingness to pay for wine. However, this approach was less common in the wine research field (Combris et al., 2009; Sáenz-Navajas et al., 2013).

In summary, most research has focused on detecting the impact of extrinsic cues on consumer decision-making and purchasing behaviour. However, there is a limited number of studies that specifically delve into hedonic evaluations, related to the

pleasure, enjoyment, or sensory experiences with a product (Raz et al., 2008; Jaeger et al., 2009; Chrea et al., 2011; Menichelli et al., 2012). In addition, a further limitation is that these approaches often prioritize “rational” responses, directly asking for consumers’ opinions. This sometimes leads to discrepancies between individuals’ actual thoughts and expressed opinions. Responses are often subject to cognitive biases, resulting in potentially inaccurate and unreliable results.

Several authors argue that the consumer evaluation process operates at a subconscious level, with individual emotions and preferences playing a pivotal role (Zaltman, 2003). As a result, the field of Consumer Neuroscience (or Neuromarketing)³ has emerged to delve deeper into the cognitive, psychophysical, and emotional processes that consumers employ when reacting to information and claims about wine. This innovative approach seeks to unravel the hidden intricacies of consumer decision-making, acknowledging that it extends beyond straightforward rationality.

³ Consumer Neuroscience is considered as a scientific approach, while Neuromarketing is the application of Neuroscience methods to sell products (Lee et al., 2006; Hubert & Kenning, 2008; Plassmann et al., 2010; Ramsøy, 2014; Alvino et al., 2020, 2021). For these reasons, Consumer Neuroscience term was preferred for the thesis.

3.2. Neuromarketing analysis of product presentation

Consumer Neuroscience incorporates elements of the Stimulus-Organism-Response (SOR) model, proposed by Lewis (1898), to reveal the hidden complexities of consumer decision-making that extend beyond simple rationality. The SOR model delves into the intricate dynamics of consumer decision-making by examining how external stimuli (product features or signals) influence the internal state of the individual (organism), ultimately leading to observable responses or behaviours (Buxbaum and Buxbaum, 2016). This model, considering the interaction between stimuli, the individual's internal processing and consequent reactions, helps researchers and marketing experts obtain more in-depth information on the factors that influence consumer choices and preferences.

Consumer neuroscience employs physiological and neurophysiological tools, such as electroencephalography (EEG), eye-tracking (ET), and functional magnetic resonance imaging (fMRI), to uncover consumers' subconscious reactions and emotional involvement with products. Consumer neuroscience combines three disciplines marketing, psychology and neuroscience, to understand the neural processes and emotional responses underlying consumers' decision-making and behaviour (Alvino et al., 2020). Neuroscience tools are used to study consumers' reactions to different types of marketing aspects (e.g., pricing, branding) or products (e.g., food, cars) (Alvino et al., 2020; Erk et al. 2002; Schaefer et al., 2006). Neuroscience tools provide a unique perspective on how consumers perceive product quality and many companies (e.g., Coca-Cola, Delta Airlines, Ford, Levi-Strauss, etc.; Horská & Berčík, 2017) are capitalising on such tools to understand how specific marketing cues can affect consumer buying behaviour.

Research in consumer neuroscience has investigated specific product cues (e.g., price, logo, label design, brand name) for different types of beverages, such as coffee, water, soft drinks and beers (McClure et al., 2004; Artêncio et al., 2022; Kokthi et al., 2022; Hinojosa-Aguayo et al., 2022). However, there are only isolating attempts to define which product cues can affect consumers' choices and preferences for wine. Consumer neuroscience literature has shown that the main wine extrinsic cues analysed were label design, brand name, country of origin,

awards and price (Gofman et al. 2009; Laeng et al., 2016; Mokřý et al., 2016; Ramsøy et al., 2017; Koc & Boz, 2018; Němcová & Berčík, 2019; Escandon-Barbosa & Rialp-Criado, 2019; Hsu and Chen, 2019; Monteiro et al., 2020; Alvino et al., 2021; Merdian et al., 2021).

Most of these studies used eye-tracking techniques to identify the information (e.g., brand name, country of origin, etc.) and design characteristics (e.g., colour, images, etc.) that most captured participants' attention and consequently influenced their choices. The central objective was to identify which of these elements exerted a significant influence on the perception of wine quality and, consequently, on decision-making processes. In these studies, researchers monitored the complex mechanisms of visual attention, trying to predict and understand consumer preferences. They attempted to test for potential correlations between observed patterns of visual attention and preferences expressed by participants through surveys or rankings.

Nevertheless, the body of literature on this topic remains constrained, leaving numerous questions unanswered. Firstly, it's crucial to clarify that these researches do not aim to enhance the product design process, but rather focus on evaluating products that are already available in the market. Secondly, a notable gap exists in research regarding the intricate interplay between various extrinsic cues, such as how label design and brand name mutually influence one another. This dearth of exploration has given rise to disparities in comprehension of visual attention and its correlation with preferences, as it has been observed that heightened attention does not invariably translate into product selection (Reutskaja et al., 2011; Milosavljevic et al., 2012; van der Laan et al., 2015; Husić-Mehmedovic et al., 2017). Moreover, it is crucial to acknowledge that eye movements are significantly influenced by higher cognitive processes, implying that they may not provide a complete explanation for why one product garners more attention than another (Rayner & Reingold, 2015; Luke et al., 2018).

Therefore, the thesis attempts to fill these gaps through two experiments that aim to investigate the influence of label design and brand name on consumer preferences and perception of product quality, the visual mechanisms that guide evaluation

processes and the correlation between visual attention and preferences. Research article 3 focuses exclusively on the influence of label design on consumers by monitoring their eye movements through an eye-tracking technique, while Research Article 4 investigates the relationship between brand name and the label design by monitoring changes in brain activity related to visual attention with EEG techniques.

3.3. Research Article 3

Wine label design proposals: an eye-tracking study to analyze consumers' visual attention and preferences

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Abstract

Purpose. The main purpose of this study is to analyse how consumers' visual attention to wine label design correlates with their preferences. Accordingly, this study uses quantitative eye-tracking metrics to understand which design proposal has greater visual salience. A more specific objective was to assess which design proposal was preferred to be marketed.

Design/methodology/approach. The experiment involved evaluating three different labelling proposals of an Italian winery. Infrared eye-tracking was used to measure implicit eye movements on the three bottles displayed, simultaneously, on a computer screen. A generalized linear model was used to test how consumers' visual attention to wine label design correlated with their preferences.

Findings. The design proposals were evaluated significantly differently, with one set being preferred. In general, a strong positive relationship was found between pausing to peruse a specific design proposal and making an explicit choice of the same bottle.

Research limitations/implications. The main limitation of the experiment concerns the sample interviewed. As the sample is homogeneous, the results may

not be generalizable to other segments. Furthermore, the addition of electroencephalographic devices that monitor brain activity could provide crucial information for understanding consumer behaviour during the purchase decision-making process.

Practical implications. Eye-tracking methods could be useful for designers and wine producers during the evaluation process of design projects.

Originality/value. The use of eye-tracking for evaluating design proposals before placing a product on the market is relatively novel. This method provides objective, quantitative and predictive information on consumer preferences contributing guidelines to designers and marketers during the product conception phase.

Keywords. Consumer behaviour, Visual attention, Neuromarketing, Eye-tracking, Wine label design

Introduction

The modern wine market is very competitive, and wine companies must understand the consumers' needs and purchasing decision-making process to achieve the best market positioning and increase profits (Piacentini and Szmigin, 2015). A key determinant of choice is product quality, but this can only be assessed at the time of consumption (Ghidossi et al., 2012). Therefore, in the absence of tasting or prior product knowledge, brands must find innovative ways to communicate their value and quality.

In this context, packaging and labels have become important elements to consider because they are the first points of contact between the product and the consumer (Galati et al., 2018). Therefore, the product must stand out on the shelf, where it competes with many other proposals, to be chosen by the consumer (Gofman et al., 2009). Leder et al. (2016) point out that consumers tend to pay attention to stimuli that they perceive as attractive during the decision-making process. Thus, label design has become an important issue and has been discussed in several academic publications (Silayoi and Speece, 2007; Wells et al., 2007; Gelici-Zeko et al., 2013; Becker et al., 2011; Clement, 2007).

Many scholars have demonstrated that brand perception and product quality are influenced by the visual appearance of the label (Ares et al., 2011; Orth and Malkewitz, 2008; Pantin-Sohier, 2009; Rompay and Pruyn, 2011). Based on these observations, it can be argued that label design is a key tool for companies to communicate about their brands and products and for marketers to understand consumer decision-making processes (Celhay and Remaud, 2018).

Questionnaires, interviews and focus groups are the most commonly used techniques by marketers (Elliot and Barth, 2012; Celhay and Trinquencoste, 2015); however, these are not always able to provide objective results on consumer behaviour regarding product choice (Ariely and Berns, 2010; Babiloni et al., 2014; Alvino et al., 2018, 2019). This is because most people are unwilling or unable to explain their purchasing decision, in fact, 95% of the decision-making process occurs at an unconscious level in the case of consumer goods (Zamani et al., 2017).

To overcome this limitation, the discipline of neuromarketing, which combines neuroscientific techniques, psychology and traditional marketing, has recently been developed in the wine sector to understand the unconscious processes occurring in the minds of consumers (Cruz et al., 2016). The goal of neuromarketing is to establish a solid neuropsychological theory that allows us to understand consumer behaviour by combining different neuroscientific methods and techniques specialized in visual attention and cognitive research (Robaina-Calderín and Martín-Santana, 2021). One of the main techniques is eye-tracking, which studies visual behaviour (e.g. fixation point, gaze and pupil dilation); visual attention mechanisms; and consumer engagement (Alvino et al., 2021).

In the literature, most research on the topic has been carried out using eye-tracking, as not only can eye fixations predict consumer preferences, but also highlight which information and design features influence purchase preferences (Motoki et al., 2021). Laeng et al. (2016) use this technique to investigate how visual attention relates to consumer preference and what information is most observed. Additionally, they test the effectiveness of real-world marketing decisions by comparing a bottle of wine chosen for marketing with three other design alternatives that had been discarded by the producers. Merdian et al. (2020) attempt

to discover how unconscious perceptions and conscious reactions differ when evaluating wine bottles on a shelf based on the expense, by using quantitative eye-tracking metrics and interest- and value-based questions, respectively.

However, only a few studies in the literature have used eye-tracking techniques to analyze the distribution of attention on the labels of wine bottles as a communication tool and, above all, as a means to evaluate different design proposals during product conception, before making marketing choices.

For these reasons, the main purpose of this study is to analyse whether and how consumers' visual attention to wine label design correlates with their preferences, using quantitative measures of gaze. The experiment proposed consists of evaluating three label design projects of a Sardinian company combining implicit data (i.e. eye movement indicators) with explicit preferences, (i.e. participants' preferences). The research uses a paradigm and method similar to that of the above-mentioned studies but proposes an experiment on design alternatives before putting the product on the market.

In the following sections, this document develops as follows. A review of relevant literature on label design and visual attention (Literature review). The explanation of the stimuli used in the experiment (Materials). The introduction of the methodology, passing through the procedures and tasks to be performed in the laboratory, the choice of eye-tracking metrics, and the statistical methods of analysis of the results (Methods). The results obtained from the study, analyzing first the explicit responses (declared responses) and then the implicit responses (eye movement indicators) (Results). Discussion of the results by answering the research questions (Discussion). Finally, we conclude by summarizing the main findings, highlighting the theoretical and practical implications of the research, and suggesting avenues for future research (Conclusion).

Literature review

Wine label design

In the wine market, notoriety is determined by label design. Producers invest in designers and marketers who use a variety of images, colours, fonts and information

to entice consumers to buy the company's products (Vollherbst and Urban, 2011). According to Thomas and Pickering (2003), the front label is more important than the back label for consumers who buy wine online and in brick-and-mortar shops. Therefore, to create a wine label, designers must make decisions regarding the visual appearance of the packaging, influence consumers' expectations and modulate their propensity to purchase (Deliza and MacFie, 1996; Piqueras-Fiszman and Spence, 2015).

Hoegg and Alba (2007) divide bottle claims into two categories: verbal and visual. The former comprises all information that characterizes and details the product, and the latter comprises images, symbols and colours that evoke specific sensations in the minds of consumers, including taste perception. According to Rebollar et al. (2017), in contrast to verbal aspects, there are still some visual aspects that need to be further studied and investigated, in particular, the image displayed, material of the label, position and relationship between these signals.

Images and icons are the most important semiotic signs (Peirce, 1955). In wine labels, icons, such as symbols related to terroirs, landscapes, wineries and grapes, evoke images corresponding to the real world. They are of fundamental importance to enable the consumer to immediately grasp the area of origin, assess the taste of the wine and then, make a purchasing decision. Therefore, the territorial icon is a visual clue that influences purchase decisions, as it generates positive expectations in the minds of consumers by reflecting on the company and evoking the brand.

Colour is an essential semiotic sign in the visual design of wine labels. Kress and van Leeuwen (2020) in their colour grammar model state that, in general, colour can have three different functions: ideational, interpersonal and functional. When it comes to wine, the ideational function is the most representative because it refers to the ability to link visual appearance to taste. Another relevant element for attention and visual perception is label texture. For a brand manager, choosing the right front label front ensures a strong brand vision and differentiation from other brands. The most common choices for the front are paper or film. While the former expresses a traditional idea that evokes a classic and natural look, the latter expresses an elegant and modern look that enhances the product through

transparency, creating the illusion that the label is printed directly on the bottle. Thus, the choice of texture is crucial for evoking specific sensations in consumers.

Finally, the positioning of such clues affects the fluidity of processing and consumer preferences. Sundar and Noseworthy (2014) examine how brand positioning on the packaging affects capitalization, finding that there is a correspondence between logo power and height. Some studies have attempted to investigate consumers' aesthetic preferences through all possible combinations of layouts, colours and icons using traditional questionnaires, thus relying on the explicit responses of the participants (Rocchi and Stefani, 2006; Boudreaux and Palmer, 2007; Pelet et al., 2020).

Based on the previous considerations, the research question was as follows:

RQ1. Is there a significant difference in the visual attention in relation to the wine labelling design?

Eye-tracking techniques in labelling analysis

In addition to being perceived as positive or negative, a stimulus requires a certain level of attention on the part of the consumer, thus competing in terms of attention and design (Merdian et al., 2020). Therefore, attention has become a key concept in consumer behaviour literature (Engel et al., 1995; Hawkins et al., 1992; Peter and Olson, 1998; Schiffman and Kanuk, 2013). Attention is usually associated with how well consumers manage to maintain their concentration on specific stimuli within their viewing range (Solomon et al., 2002), and is measured using eye-tracking technology. Eye-tracking through specific devices, allows eye movements, gaze fixation points and pupillary changes to be monitored (Popa et al., 2015). It measures the distribution of visual attention and allows measuring the unconscious perception processes. Most studies use this technique to analyze and measure consumer preferences for food information labels (Piqueras-Fiszman et al., 2013).

For example, Pieters et al. (1999) examine the role of visual attention in product choice using eye-tracking. They find that consumers under pressure dwell more on visual aspects of the packaging as compared to verbal ones, and vice versa, when high task motivation is present. Clement (2007) demonstrates that packaging design

influences the visual attention of consumers when choosing food products at all stages of the purchasing decision-making process: from the initial stage in which visual attention is captured to the next stage, in which critical thinking develops in the consumer's mind and, finally, to the physical action that leads to purchase. It is well established that visual packaging elements play a crucial role in influencing consumer behaviour in shops (Yu et al., 2022); but this concept only occurs when images evoke simple concepts that are easy for consumers to understand.

In the case of gluten-free food products, Sielicka-Różyńska et al. (2021) find that verbal cues are observed more as compared to visual cues, but when combined, they decrease the level of consumer uncertainty. This technique is beginning to be used in the wine industry. Mokry et al. (2016) use dwell time averaging to analyze which visual attributes of wine labels most influence the choice of Generation Z consumers, specifically focusing on price, type, premium, shape, colour and label information.

Monteiro et al. (2020) focus on the role of wine awards and confirm that visual attention to wine labels influences individuals' desires, which consequently affect individuals' perception of wine quality. Laeng et al. (2016) conducted experiments by using eye-tracking and pupillometry to analyze the different reactions of consumers to labels used commercially and other design projects discarded during the selection of the final product. Researchers demonstrate that gaze is a predictor of preferences, and visual cues capture the gaze of participants to a greater extent as compared to verbal cues, reaffirming the concept that design affects consumers' buying behaviour. Research shows that some designs are preferred over others based on their "perceptual fluidity," i.e. their ability to process information more easily, highlighting that cognitive load can influence users' attention and visual behaviour. (Reber et al., 1998, 2004; Winkielman et al., 2005, 2006; Milosavljevic et al., 2011; Wang et al., 2014; Laeng et al., 2016).

Merdian et al. (2020) conducted a similar study using two eye-tracking indices (total duration of fixation and time to first fixation) to analyze the perceptual differences between four categories of bottles divided by price and style. The results

confirmed a relationship between attention distribution and explicit statements, thus confirming the theories of previous studies.

However, the relationship between attention and choice is more complex. Husić-Mehmedović et al. (2017), found that products that had an attractive design were not chosen, and instead received the lowest ratings. This suggests that attention does not always translate into choice, especially when other more important variables such as familiarity with the brand come into play. This leads to the question of whether attention is a predictive phenomenon of preferences and under what circumstances.

Therefore, this study involves an experiment on the evaluation of three label design projects of different types of wine of a Sardinian company, combining implicit data (eye movement indicators) with explicit preferences (preferences of consumers) to provide guidelines for designers and marketing directors when designing wine bottle labels. To the studies cited above, we want to not only investigate whether there are useful eye-tracking indices other than those used by Merdian et al. (2020) but also understand which sets of bottles communicate the theme of territoriality to consumers the most, without a priori discarding any design proposal, as opposed to Laeng et al. (2016).

The present study analyses consumer behaviour and aims to test whether there is a correspondence between visual attention and product preferences. Indicators of participants' eye movements (implicit data) are combined with explicit evaluations to better understand consumer preferences in the context of wine bottle design and to help designers and marketing directors during wine bottle design.

Accordingly, the corresponding research questions are as follows:

RQ2. Which eye-tracking metrics describe consumer behaviour during the assessment of wine bottles?

RQ3. Is there a significant correlation between preference for wine bottle and eye movements metrics?

Materials

Stimuli

The Palmalias winery produces three different types of wine: red (Cannonau), white (Vermentino) and pink. The winery proposes a new labelling model to meet the needs of today's consumers choosing three different Sardinian icons to express the strong identity and character of the product and its history.

This message is summarized in three design proposals for each type of wine (red, white and pink):

1. Sardinian folk costumes;
2. Sardinian symbols (Sa Pintadera); and
3. Wind-blown oleaster.

Each proposal comprises both visual and verbal cues. The former cover almost the entire label and are considered the most important because they are perceived by consumers the most during product selection. The design proposals are rather simple, ensuring a similar cognitive load so as not to affect consumer observation. Within each set, the chosen territorial icon is designed differently, depending on the type of wine. For example, in the Sardinian folk costumes set, there are two different female images and only one male image, similarly in the Sardinian symbols they vary in shape and colour depending on the type of wine (red, white, pink). Images and colours vary to impart uniqueness and visibility to the brand. Such a proposition is a common choice by designers to help customers identify the winery's brand, and create a unique identity among an array of products (Caldewey and House, 2004). Furthermore, the objective of the study was to understand which design proposal was preferred even if it varied in style and to try to replicate a situation as realistic as possible in which products have multiple attributes to evaluate at the same time.

Sardinian folk costumes

The first proposal is dedicated to telling the story of Sardinia with the help of Sardinian folk costumes. Made of precious and colourful fabrics, costumes are

symbols of different cultures and are still worn today in many traditional and religious festivals. Almost every large town has its typical costume, and there are more than 400 different models. Nevertheless, all costumes have some common features: women wear a veil, cape or shawl, whereas men wear the Sardinian beret. The labels depict two female faces and a male face in the centre and are printed on FSC paper. The visual cues occupy almost the entire label and are depicted in vivid colours, both achromatic (black and white) and chromatic (red, green and blue), whereas the verbal cues (name of the wine and brand) are positioned below the images.

Sardinian symbols (Sa Pintadera)

The second proposal aims to describe the history of the land of Sardinia where the link with symbolism remains strong. The label is inspired by Sa Pintadera, one of the most important symbols of Nuragic Sardinia. It comprises a circle, symbolizing the cyclical nature of life, seasonal cycle, rhythms of nature and thus, abundance and fertility. Sa Pintadera is certainly an emblematic object that personifies archaic Sardinia, such that it has become a symbol of representation as much as the flag of the Four Moors. This indicates a strong brand, representing prosperity that was typical of Sardinia in the past in many ways. The labels are made using the transparent screen-printing technique, in which only the lines of the central symbol are coloured white, with some elements painted in a bright contrasting colour. Similar to the first proposal, the visual cues are predominant, and the verbal information is positioned below the image.

Wind-blown oleaster

The third proposal shows an oleaster, a typical Sardinian plant, bent by the wind with a distant landscape in the background. The plant is screen printed, coloured entirely white and develops vertically, occupying almost the entire front surface of the bottle. In this case, verbal cues are distributed both above and below the image to frame it.

Figure 1 shows the wine labels for each design proposal. For the sake of convenience, in the following text, they will refer to costumes (2a), symbols (2b) and oleaster (2c) bottles. The abbreviations are explained in the image captions.

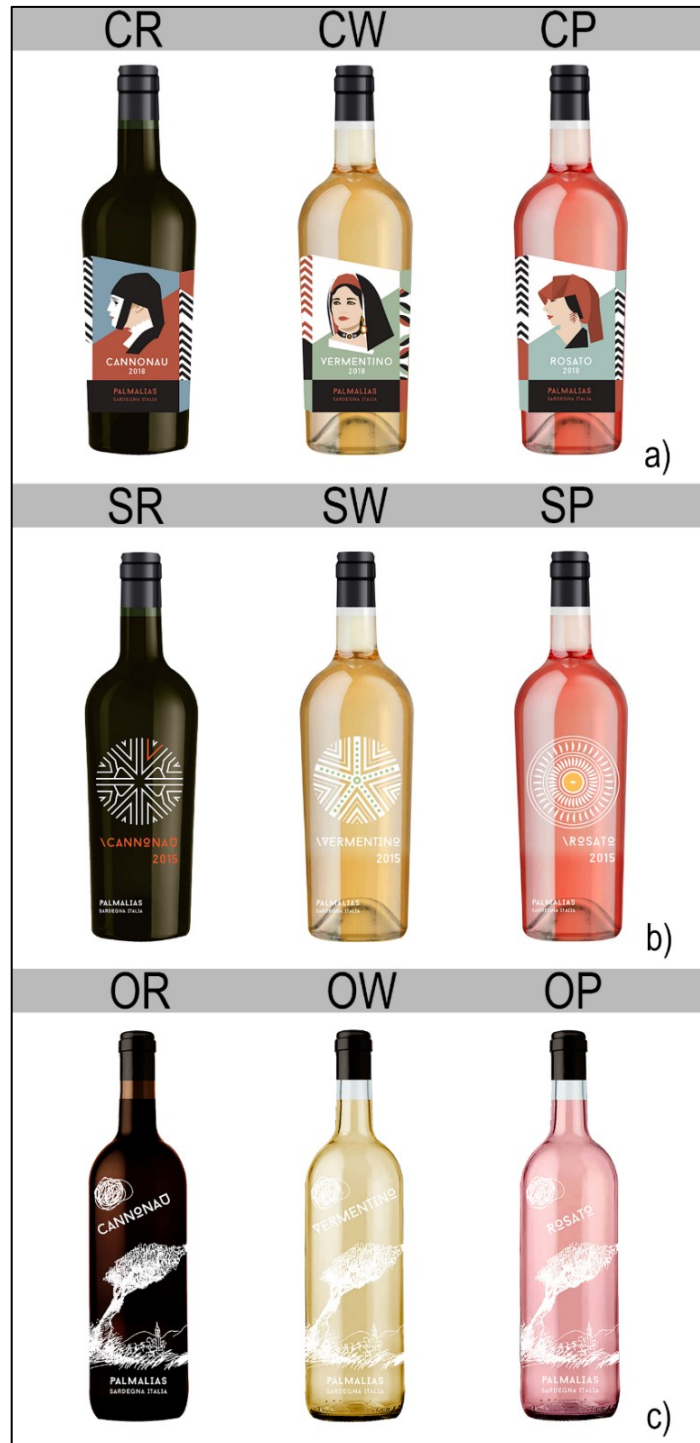


Figure 1. - Experiment stimuli. Three different design proposals for each type of wine (red, white and pink).

Participants

The sample consisted of $N = 60$ participants (31 female and 29 male), who are master's students in the marketing course at the University of Florence. Sixty-five per cent of them are aged between 25 and 39 years, and the rest are aged between 18 and 24 years. Their knowledge of the world of wine was medium to poor, while their consumption frequency varied habit was between three and four times a week (50%), once a week (30%) and once a month (20%). The participants are drinkers of all three wine types. They were chosen as marketing and communication experts. All participants received a red wine bottle from the winery, to make them more motivated and involved in the experiment.

Hardware and software used

Pupil Invisible glasses, a new type of head-mounted eye tracker from Pupil Labs, are used in the experiment. They look like normal eyeglasses but have sensors installed in them. They recorded an IR video at 200 Hz, with a resolution of 192×192 pixels. The device has two eye cameras, one for each eye, next to which is an IR LED to ensure good illumination of the eye and a detachable scene camera that captures a video of the scene. The cameras record all gaze data except the pupil diameter. The glasses are connected to a companion device (android phone) with a USB-C cable, and the app automatically captures a video of the scene during a recording whenever it is connected (Tonsen et al., 2020).

In our case, the device is remotely connected to the computer, on which we run the experiment. The computer monitor is a TFT-LCD with a width of 60 cm and a height of 34 cm, a refresh rate of 60 Hz, a resolution of $2,560 \times 1,440$ pixels, and brightness set to 100%. The experiment is built using EventIDE, which is software created by Okazolab. This software allows the device to be connected such that the recording of eye movements begins at the start of the experiment in a synchronized manner. This software is suitable for neuroscience, behavioural research and usability testing. It allows us to create an automated procedure, setting a specific duration for each image administered and recording data on participants' eye movements and responses.

Methods

Procedure and tasks

Participants who arrived at the laboratory were informed about what the test consisted of and which tasks they were going to perform. Before starting the experiment, participants were shown a presentation summarizing the company's mission to hint at the context. Then, they filled in a questionnaire regarding preliminary information about themselves, their knowledge of wine and their consumption habits and preferences. They were sitting at a desk and wore eye-tracking glasses. Their heads were positioned at a distance of 60 cm from the screen during all experiment with the help of a chin-rest, allowing a more accurate calibration of eye movement, performed before starting the experiment (Figure 2b). Calibration includes looking at several marks on a screen to collect enough data to modify the parameters of an adjustable model (Villanueva et al., 2004).

As Figure 2a shows, each screen is shown for 7 s and comprises three different bottles (costumes, oleaster and symbols) shown simultaneously, categorized by the type of wine (i.e. red, white and pink). The sequence of the screens and the positions of the bottles was random.

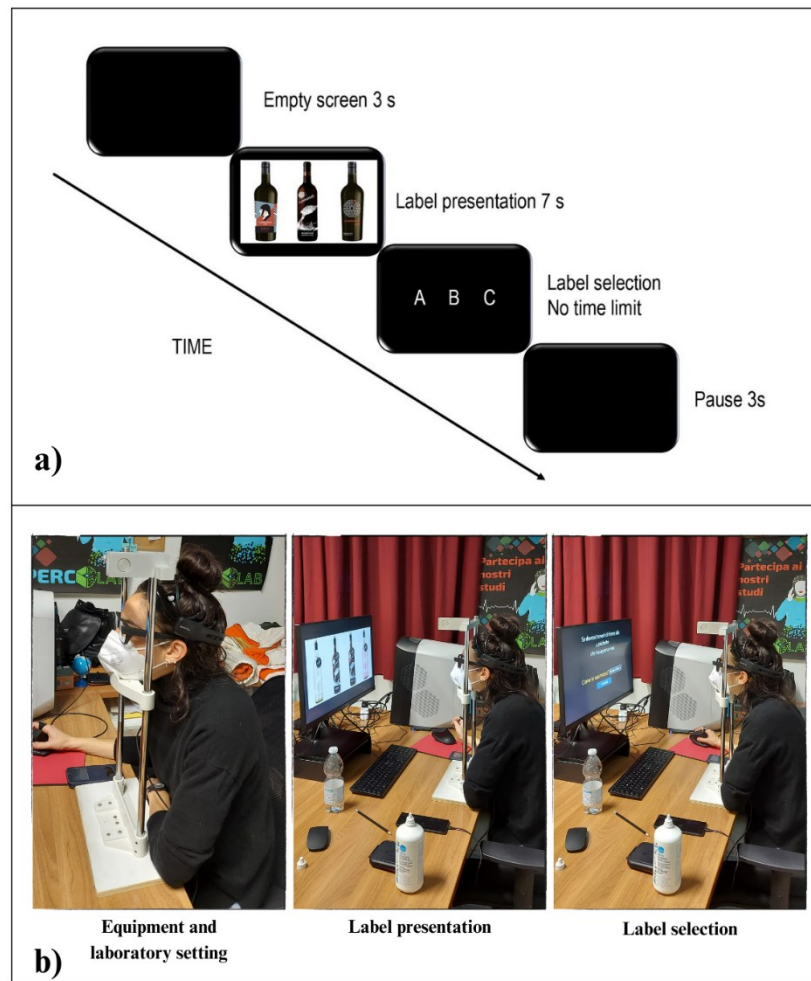


Figure 2. – a) Experiment procedure, b) Experiment equipment and laboratory setting.

We have chosen the random method to avoid influencing the research unduly, as stimuli located in the centre are usually observed the most. After each screen, the participants had to express their preferences by choosing one of the three bottles they had just looked at. The choice was followed by a 3-s-long black screen to avoid fatiguing the participants (Atalay et al., 2012).

Eye-tracking metrics

Given that one aim was to analyze the visual attention of consumers, the eye movements were recorded for each stimulus. After aggregating the raw eye-tracking data into fixations and saccades, the following information was calculated for each eye fixation: fixation number; x-y coordinates in pixels; and start time, duration and end time in milliseconds. A fixation is considered a cluster of gaze

coordinates within a specified range in space and time, whereas a brief peak in the velocity signal of the gaze signal may correspond to a saccade (Hessels et al., 2018). To obtain this information, the EventIDE software uses the fixation detection algorithm proposed by Engbert and Kliegl (2003) and Engbert and Mergenthaler (2006). The algorithm was designed for microsaccades but is equally applicable to normal saccades with an adapted velocity threshold, which, in our case, is a threshold of 10 degrees of visual angle per second. For a more in-depth analysis of the calculation procedure used by the software, please refer to Engbert and Kliegl (2003) and Engbert and Mergenthaler (2006).

Subsequently, these elements were spatially aggregated into specific areas of interest (AOIs), which in our case are the entire bottles. This decision was taken because to understand which design proposal was preferred by consumers, it was sufficient to select the individual bottles. Furthermore, as the visual cues, such as pictorial information, were the predominant information and the ones that differed most from the verbal ones, it was not relevant to divide the AOIs into several categories. Figure 3 shows the AOIs of each bottle and is a graphical representation of the collected data showing a scanpath plot, which is an ordered set of fixation points (depicted by squares) connected by saccades (depicted by lines).

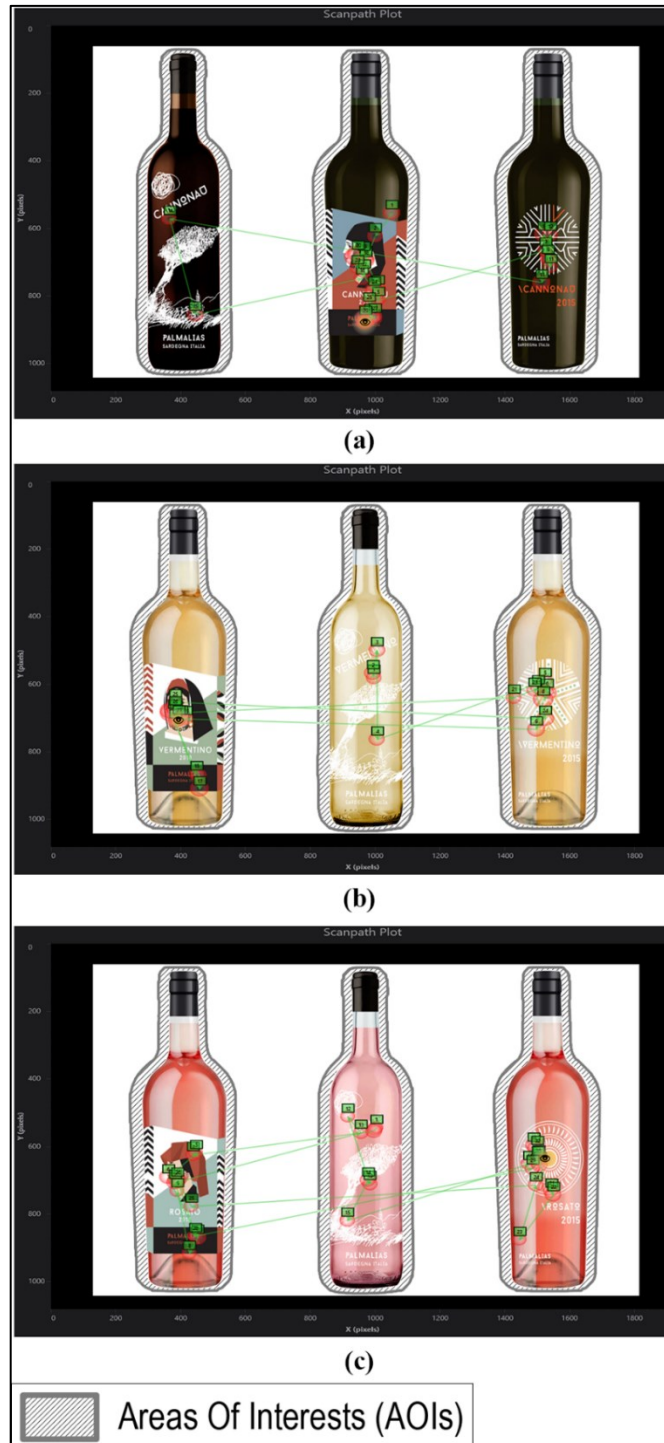


Figure 3. - Scanpath plot and AOIs. The path of the participants' gaze (saccades) and where they focused (fixations) during the administration of the different label design proposals.

After the spatial aggregation of eye movements on AOIs, the movements can be summarized through metrics. Based on Holmqvist et al. (2011), seven metrics were

used, divided into three categories: based on time, space and time-space. Table 1 shows and describes the eye-tracking metrics, wherein j represents each AOI.

Table 1. - Eye tracking metrics.

	Metric	Description
TIME	NFCF	Number of First Consecutive Fixation: number of consecutive fixation points after the first fixation point.
	TFFj	Time of First Fixation: time from the start of the product displayed until the participant fixated on the AOI for the first time.
SPACE	NFF	Number of First Fixation; the bottle that corresponds to the first fixation point.
	MNCFj	Maximum Number of Consecutive Fixation: greatest value of consecutive fixation points for AOI.
	NRAj	Number of Returns of Attention: number of times that a participant returned to an AOI.
TIME &	TNFj	Total Number of fixations: number of times that a participant fixated on an AOI.
SPACE	TTFj	Total Time of Fixation: duration of all fixations within an AOI.

Data visualization and statistical analysis

The metrics obtained were analyzed through both data visualization techniques and statistical methods.

The former consisted of heatmaps, often used in marketing to analyze the visual attention behaviour of consumers. Heatmaps are standard representations composed of 2D matrices, in which each cell is assigned a colour according to its value. In our case, the values were composed of the aggregation of fixations according to their duration (Drusch et al., 2014). The latter was mainly characterized by methods to build a predictive model of preference, to test how consumers' visual attention to wine label design correlates with their preferences. For this reason, the first step was to evaluate the effect of multicollinearity among the different eye-tracking metrics. Common methods used to detect multicollinearity are based on examining correlations between pairs of predictors,

however, this is limiting. It is possible for pairwise correlations to be small but for a linear dependence to exist between three or more variables. Therefore, many regression analysts often rely on variance inflation factors (VIFs) to detect multicollinearity (Graham, 2003). The VIF is the ratio of the variance of a parameter estimate in a model that includes several variables to the variance of a model constructed using only one variable. Thus, it provides an index that measures the extent to which the variance of the regression coefficient increases owing to multicollinearity.

Then, the VIF is computed by following equation (1):

$$VIF = \frac{1}{1-R_i^2} = \frac{1}{Tolerance} \quad (1)$$

where R_i^2 represents the unadjusted coefficient of determination for regressing the i^{th} independent variable on the remaining variables. The reciprocal of the VIF is known as tolerance. Both VIF and tolerance can be used to detect multicollinearity. If R_i^2 is equal to zero, then the variance of the remaining independent variables cannot be predicted from the i^{th} independent variable. Therefore, when the VIF or tolerance is equal to 1, the i^{th} independent variable is not correlated to the remaining variables, which means that multicollinearity does not exist in this regression model. In this case, the variance of the i^{th} the regression coefficient is not inflated.

Generally, a VIF above 4, or tolerance below 0.25, indicates that multicollinearity might exist, and further investigation is required. When the VIF is higher than 10, or the tolerance is lower than 0.1, there is significant multicollinearity that needs to be corrected. The most commonly used method for correcting this problem is to remove highly correlated variables, as this ensures that the individual effects of the independent variables on the dependent variable can be distinguished (Mason et al. 2003).

The second step was to test and train different statistical methods on the entire database consisting of the noncollinear eye-tracking metrics alone to determine the method that performs best in describing the phenomenon.

The following equation (2) is used:

$$P\{\textit{Design proposals}\} = f(\textit{eye - tracking metrics}) \quad (2)$$

where $P\{\textit{Design proposals}\}$ is the dependent variable representing the probability of participants choosing among the three design proposals, which is a function of the independent variable, i.e. eye-tracking metrics.

The utilization of the predictive model enabled us to assess whether and how eye movements could forecast consumer choices. More importantly, it helped us overcome the constraints associated with conventional techniques commonly employed in wine labelling analysis, such as conjoint analysis. Firstly, it facilitated the creation of a highly realistic scenario, departing from the simulated scenarios typically presented in conjoint analysis. Additionally, it empowered us to simultaneously evaluate multiple attributes, a capability not offered by the pairwise comparisons of attributes in conjoint analysis.

Results

The data collected comprised explicit and implicit responses. The former were the preferences expressed by the participants through their preference for wine bottles. The latter were the participants' eye movements recorded as fixations and saccades. The former was analyzed through descriptive statistics, the latter through methods ranging from descriptive statistics to predictive model of preference.

Explicit responses

Figure 4 shows consumer preferences. The results were analyzed according to the type of wine used.

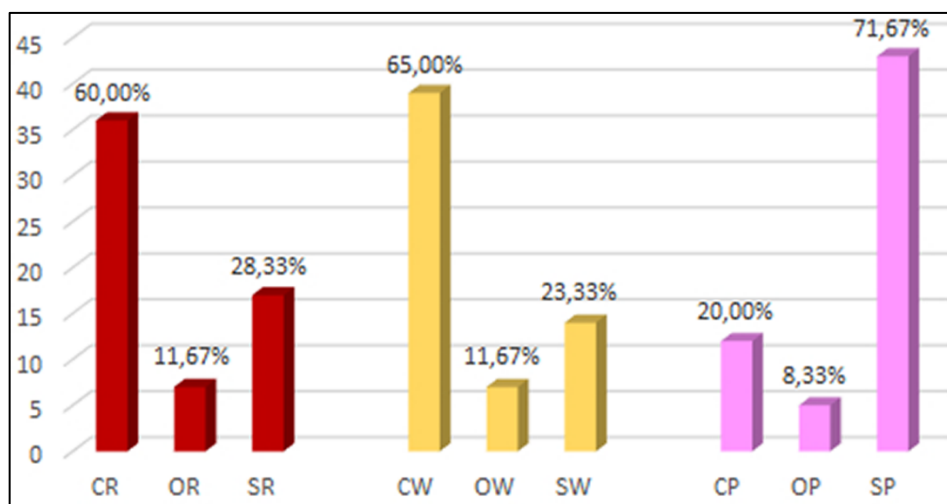


Figure 4. - Wine labelling preferences. Participants' preferences expressed in percentage for each wine bottle.

Among the red wines, bottles depicting costumes were chosen by 60% of the participants, followed by symbols for 28% and finally oleaster for 12%. In the case of white wines, the highest preference, (65%), was for costumes, followed by symbols (23%) and oleasters (12%). As for, pink wines, 72% of participants chose symbols, followed by costumes (20%) and oleasters (8%). For both red and white wines, the most chosen design proposition was costumes, and for pink wine, it was symbols. Therefore, the costume set represents the favoured design proposal for motivating consumers to make the purchase.

Implicit responses

Heatmaps

The first result we calculated is cumulative heatmaps (Figure 5), by aggregating the fixations of all participants it was possible to observe how visual attention was distributed over the submitted design proposals. Figure 5 shows the results for each set of bottles, wherein the warm colours (red, orange and yellow) represent the highest values and thus, the bottles that catch the participants' attention for the longest time. In contrast, the cold colours (green, cyan and blue) represent the lowest values, and thus, the bottles that were looked at very little. The set most looked at was that of the costumes (a), having the highest values in both red and white wines, whereas, for pink wine, we find a preference for symbols. The second

most watched set was that symbols (b), followed by oleaster (c). Additionally, the visual cues were the most observed as compared to the other information presented on the bottle. These results, although preliminary, already confirm the consistency and correlation with the explicit responses of the participants when choosing a bottle.

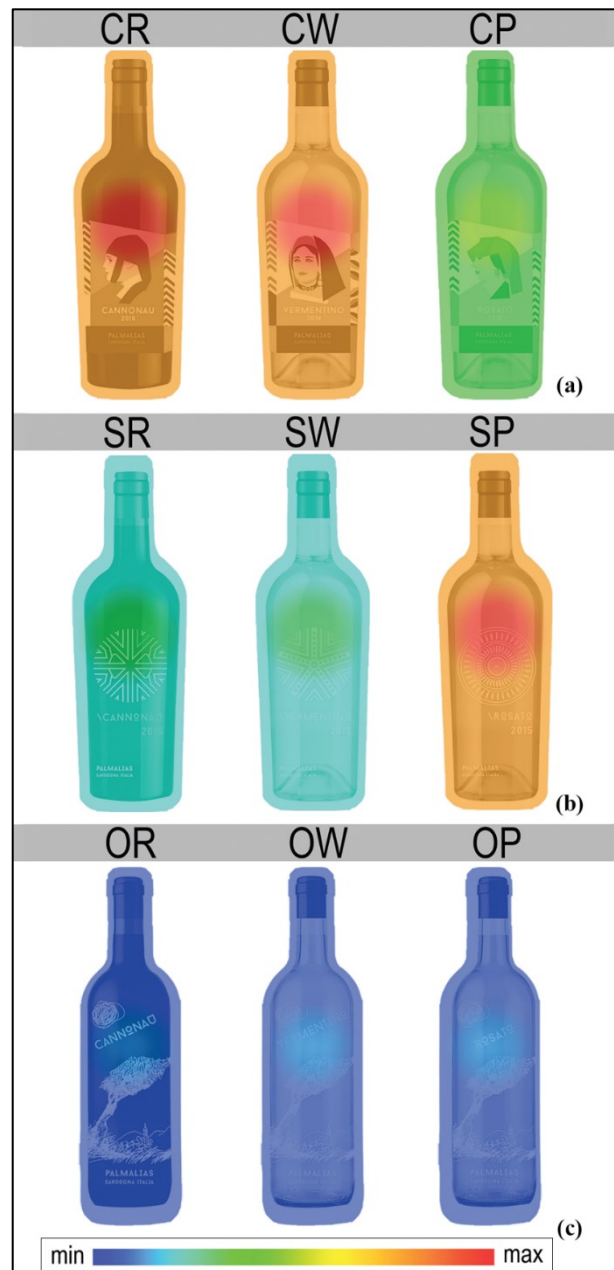


Figure 5. - Heatmaps of bottles. The figure represents the design proposals that garnered the highest participant attraction in the red-orange colour spectrum, contrasting with the least appealing ones depicted in the green-blue colour scale.

Statistics of eye-tracking metrics

Table 2 shows the statistics of the eye-tracking metrics (mean and standard deviation), categorized by wine and label type. Among red wines the values of all metrics are highest for costumes, followed by symbols; the results were similar for white wines, whereas for pink wines, symbols have the highest values for all metrics.

Table 2. - Statistics of eye tracking metrics. Mean and standard deviation for each eye-tracking metric in the three different bottle sets.

Wine Type	Metrics	Statistics	Costumes (N = 60)	Symbols (N = 60)	Oleaster (N = 60)
Red	MNFC	mean.	7.38	5.72	5.03
		sd.	3.82	2.46	2.80
	NFCF	mean.1	1.75	1.05	0.62
		sd.1	2.61	2.00	1.64
	NFF	mean.2	0.47	0.32	0.22
		sd.2	0.50	0.47	0.42
	NRA	mean.3	2.20	2.08	1.72
		sd.3	0.90	0.89	0.88
	TFF	mean.4	99.81	93.50	72.66
		sd.4	90.65	88.64	87.20
	TNF	mean.5	10.87	8.12	6.70
		sd.5	4.66	3.38	3.90
White	TTF	mean.6	1344.63	785.04	527.06
		sd.6	893.11	419.55	360.27
	MNFC	mean.7	7.52	5.90	5.47
		sd.7	4.61	3.39	3.96
	NFCF	mean.8	1.32	0.78	0.98
		sd.8	2.59	1.58	1.76
	NFF	mean.9	0.32	0.32	0.37
		sd.9	0.47	0.47	0.49
	NRA	mean.10	2.02	1.85	1.92
		sd.10	0.97	0.78	1.08
	TFF	mean.11	91.43	79.51	112.17
		sd.11	84.49	72.61	120.44
	TNF	mean.12	10.87	7.68	7.48
		sd.12	5.63	3.98	5.25
	TTF	mean.13	1374.87	761.64	757.67
		sd.13	836.79	546.88	628.98

Wine Type	Metrics	Statistics	Costumes (N = 60)	Symbols (N = 60)	Oleaster (N = 60)
Pink	MNFC	mean.14	5.97	8.15	5.42
		sd.14	3.64	4.31	3.58
	NFCF	mean.15	0.73	1.47	1.00
		sd.15	1.57	2.52	1.76
	NFF	mean.16	0.25	0.40	0.35
		sd.16	0.44	0.49	0.48
	NRA	mean.17	1.87	2.38	1.82
		sd.17	1.03	1.03	0.95
	TFF	mean.18	75.60	81.50	89.70
		sd.18	74.28	61.73	68.09
	TNF	mean.19	8.22	11.53	6.78
		sd.19	4.22	4.55	4.21
	TTF	mean.20	815.97	1264.30	677.15
		sd.20	546.64	738.60	545.64

Predictive models

The VIF was calculated using the “car” library of R software and, according to the literature, the collinear eye-tracking metrics were maximum number of consecutive fixation (MNCF) and total number of fixation (TNF), as they have VIF values greater than 4 and tolerance than 0.1. This collinearity occurred because they are both metrics that measure the number of fixations, and presumably, a bottle that has many consecutive fixations has a high total number of fixations as well. To solve this problem, these metrics were removed. Table 3 lists the VIF values for each metric.

Table 3. - Variable selection using Variance Inflation Factor (VIF). The method allows to eliminate variables that are collinear with each other.

Metrics	Tolerance	VIF
MNCF	0.11392743	8.777518
NFCF	0.35250225	2.836861
NFF	0.34928418	2.862998
NRA	0.29725013	3.364170
TFF	0.76442309	1.308176
TNF	0.08311768	12.031135
TTF	0.36717069	2.723529

The following equation (3) is used to predict consumer preferences:

$$P\{C, S, O\} = f(NFCF, NFF, NRA, TFF, TTF) \quad (3)$$

where $P\{C, S, O\}$ is the dependent variable representing the probability of participants choosing among costumes (C), symbols (S), and oleaster (O), that is a function of the independent variable, i.e. eye-tracking metrics $f(NFCF, NFF, NRA, TFF, TTF)$.

The procedure was carried out by using the “caret” library of R software. To avoid overfitting, 60% of the data was used for training, 20% for validation and 20% for testing. Table 4 shows the results of the methods used: Random Forest (RF), Support Vector Machine (SVM), Generalized Linear Model (GLM), and Linear Model (LM).

Table 4. - Predictive models results. Accuracy, Area under the curve, True and Negative rate for each predictive model tested.

	ACC	AUC	TPR	TNR
RF	77.78	83.74	84.74	64.29
SVM	76.74	84.32	94.21	43.88
GLM	80.56	84.77	88.95	61.22
LM	79.51	84.47	92.11	58.16

As GLM performed better, with a higher area under the curve (AUC) and accuracy (ACC), and a good ratio between the amount of positive (TPR) and negative (TNR) rate results, it was used for data analysis. GLM provides a flexible structure for exploring the relationships between predictor variables (factors that influence an outcome) and the response variable (the outcome we want to predict or understand). This statistical model is supported by certain key assumptions. Firstly, GLM operates under the assumption of a linear relationship between predictors and the expected value of the response variable. This implies that alterations in predictor variables are linked to changes in the response, although this association need not always be direct or proportionate. Moreover, GLM allows for the utilization of various probability distributions for the response variable, such as binomial, Poisson, or gamma distributions. This flexibility goes beyond the constraints imposed by the normal distribution in traditional linear regression, enabling a more adaptable and wider-ranging analysis (Dunteman and Ho, 2006).

We adopted logistic regression, a specific GLM type, due to the binary nature of the dependent variable (0/1), rather than being continuous. In our scenario, participants' preferences serve as the dependent variable, while eye-tracking metrics act as the independent variables (Hilbe, 2011). The basic form of logistic regression within the GLM framework is described by the following equation 4 (Rutherford, 2001):

$$\text{logit}(p) = \log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1x_1 + \beta_2x_2 + \cdots \beta_nx_n(4)$$

where p represents the probability of the event being predicted;

$\text{logit}(p)$ stands for the log of the odds ratio, where the odds ratio is the ratio between the probability of success and the probability of failure;

$\beta_0, \beta_1, \beta_2, \dots, \beta_n$ are coefficients measuring the effect of independent variables $x_1, x_2, \dots, x_n$ on the probability of the event.

Figure 6 shows the GLM results, in particular the ROC curve for the entire database and each type of wine.

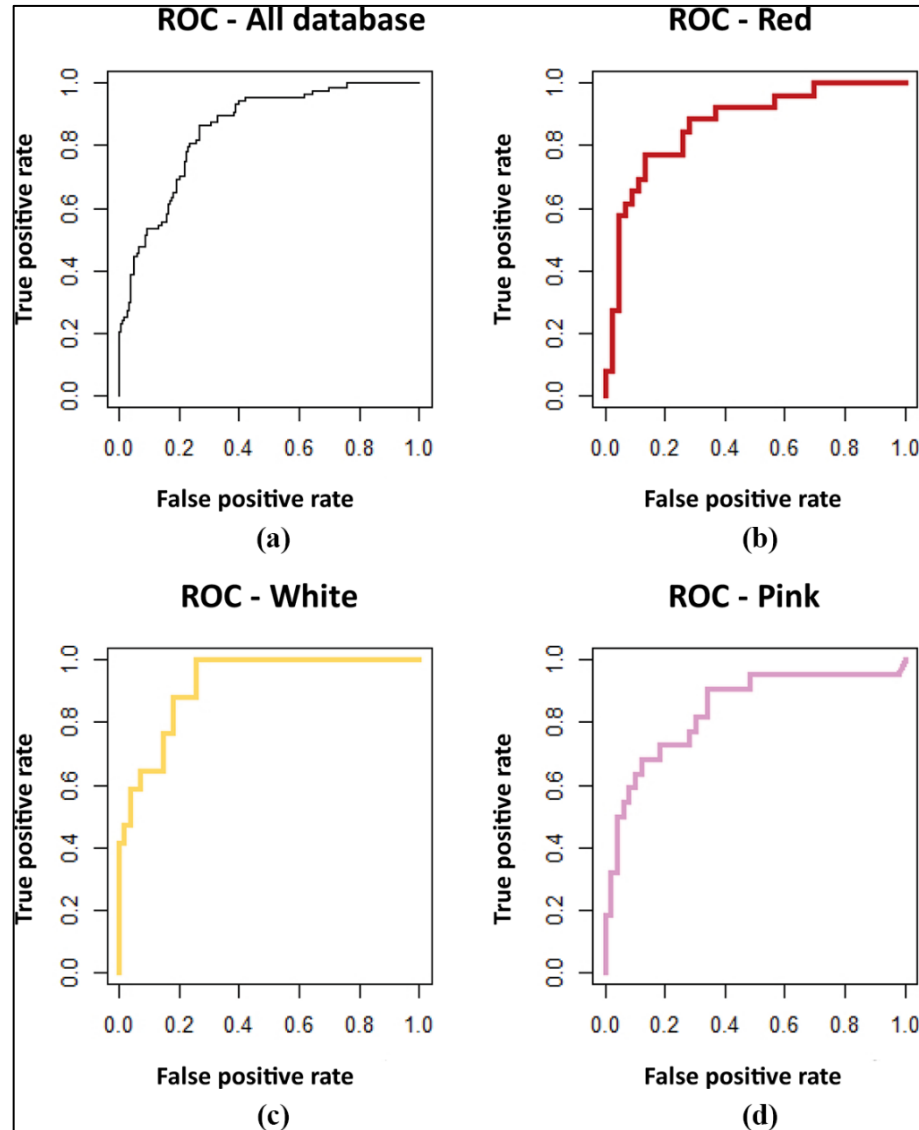


Figure 6. - General Linear Model (GLM) results for each type of wine and design proposals

As Table 5 shows, white wines have the highest accuracy (ACC) and AUC values, followed by red and finally pink wines. In all three cases, the model is good, and the closer the R-Square is to 1, the better. The model explains 70%, 80% and 60% of the variability of the dependent variable in red, white and pink wines, respectively. In addition, considering the design proposals, costumes have the highest value, followed by symbols and oleaster. The results indicate which design proposal has been preferred by consumers and consequently which choice the company should make.

Table 5. - General Linear Model (GLM) results for each type of wine and design proposals.

	ACC	AUC	R-Square
RED	80.56	84.80	70%
WHITE	81.94	92.27	80%
PINK	80.66	81.59	60%
COSTUMES	92.73	93.33	80%
SYMBOLS	81.25	84.61	70%
OLEASTER	78.57	76.66	60%

Table 6 lists the significance of the metrics. The Total Time of Fixation (TTF) metric is highly significant (99.9%) in all three cases. This indicates that the bottles chosen were those that were observed for the longest time. To highlight this concept, the time of first fixation is significantly negative for red wine. In addition, for white and pink wines, the Number of Returns of Attention (NRA) is significant (99%), indicating that the bottle design in this case captured and sustained attention over time.

Table 6. - The significance of the metrics. Statistical significance of the eye-tracking metrics for each type of wine.

Wine type	Metrics	Estimate	Std. Error	z value	Pr(> z)
Red	NFCF	-0.2471138	0.2148056	-1.150	0.249976
	NFF	0.4615107	0.9759322	0.473	0.636290
	NRA	0.4522861	0.3264815	1.385	0.165950
	TFF	-0.0174581	0.0062243	-2.805	0.005034 **
	TTF	0.0032009	0.0006649	4.814	0.00000148 ***
White	NFCF	0.2032563	0.3363929	0.604	0.5457
	NFF	-1.0884086	1.2787723	-0.851	0.3947
	NRA	1.0497623	0.4134461	2.539	0.0111 *
	TFF	-0.0039853	0.0040124	-0.993	0.3206
	TTF	0.0038233	0.0008685	4.402	0.00001071 ***
Pink	NFCF	0.142431	0.177031	0.805	0.42108
	NFF	-0.818781	0.891038	0.919	0.35814
	NRA	0.978226	0.308762	3.168	0.00153 **
	TFF	-0.003674	0.003783	-0.971	0.33150
	TTF	0.002237	0.000498	4.493	0.00000704 ***

Discussion

The experiment demonstrated that there are differences between the proposed designs for the new labelling model. Comparing the explicit answers with the unconscious distribution of attention, as measured by eye-tracking metrics, can be observed that there are strong correlations. The chosen bottles were observed for much longer and at more than one moment of observation. This means that wines with certain territorial icons captured more visual attention because they were more representative of the Sardinian culture. The results showed that the theme was more relevant than the design of each label; therefore, designing the set using different images did not affect consumers' preferences and purchase intentions. Instead, the colour of the wine influenced the preference, but this was an effect derived only from the colour of the bottle and not the label design.

Explicit responses

The results showed that there were clear and significant perceived differences among various label design projects (RQ1). In the case of red wines, the bottles depicting costumes were preferred more as compared to the other two labels, and the symbols were perceived as more pleasant than the oleaster. In the case of the white wines, bottles depicting costumes were more appreciated, and no significant differences emerged when comparing the other two labels. Finally, for pink wines, the bottles depicting symbols were the most attractive as compared with the others. The set that the participants chose most as a territorial icon was the costume label because it is a typical Sardinian icon that is well-recognized and evocative of the land of origin.

Implicit responses

Icons and colours play a key role in the consumer evaluation process (Gil-Pérez et al., 2019). The effect of visual salience (e.g. icons, colours and contrast) on capturing attention in consumer choice situations leads to different perceptions of design proposals, as products that are more visually salient are looked at for longer and are more likely to be stared at first, compared to visually less salient alternatives (Navalpakkam et al., 2012; Orquin and Mueller-Loose, 2013; van der Laan et al.,

2015). Visual salience is defined as the distinguishing perceptual quality by which an element in the world stands out from its alternatives and, therefore immediately attracts attention. Salience depends on information regarding colour, contrast, orientation and intensity relative to the surrounding space (Itti and Koch, 2000).

Icons have had a decisive impact on consumer preferences. In general, visual cues are considered typical elements of labels and their relationship with aesthetic satisfaction is linear and positive (Celhay and Trinquedde, 2015). Consumers have been influenced by the type of territorial icon proposed by its meaning and by the moderately modern and atypical style adopted. Indeed, other studies have however confirmed that a moderate degree of novelty stimulates consumers, attracts their attention in the shopping aisles and, above all, effectively differentiates a brand from its competitors (Talke et al., 2009; Celhay and Trinquedde, 2015).

In the case of pink wine, the colour of the wine probably had a significant influence on the preference of the bottle. The intensity of the pink colour plays a role in the consumer's perception, particularly for Millennials: the transparent screen-printed label enhances the pink of the bottle and the vivid colour of the wine is associated with a higher quality as compared to the more traditional tones of red and white wines (Elliot and Barth, 2012; Iazzi et al., 2019). Lorey (2021) found that the Millennial generation prefers pink wine based on several criteria and dimensions of which one of the most important is colour. This is a real generational and sociological break from traditional patterns known to previous generational groups, particularly the Baby Boomers.

The participants chose the design that best represented Sardinian territorial iconicity and was able to hold their attention the longest. The eye-tracking metrics that defined consumer behaviour are TNF, TTF and MNCF (RQ2), all of which characterize the dimension of gaze persistence and proved to be directly proportional to user preferences. According to van der Laan et al. (2015), the first fixation is not sufficient to determine the probability of consumer preferences; however total fixation duration is closely related to preference formation. Furthermore, the GLM model confirms this result. Considering the correlation between preferences and metrics, TTF is highly significant in all three types of

wines, followed by NRA and time of first fixation (TFF) (RQ3). Another relevant finding can be derived by comparing the variances explained by different design proposals. Costumes were the preferred labels for white and red wines (Figure 4), which have the choice patterns with the highest explained variance (80% and 70%, respectively; Table 5). In the case of pink wine, symbols were most preferred, with an explained variance of 60%. As explained, variance is an index of the correspondence between conscious preferences and unconscious eye-tracking metrics, this could indicate that, in the case of the pink wine, the sample showed some uncertainty in the preference of symbols over costumes. This hypothesis is confirmed by the descriptive statistics in Table 2, wherein the mean values of the most significant eye-tracking metrics exhibit a smaller difference between costumes and symbols for pink wines than for the other wines. This means that the use of eye-tracking and metrics is useful in understanding consumer preferences, and thus, provides very useful insights into design preferences.

Theoretical implications

This study offers insights into the distribution of attention, interest, liking and preferences of wine consumers during their purchasing process. The results provided insights into consumer behaviour and an understanding of the criteria consumers use to choose a product. The results show that a product must be appealing and immediately visible, but it must also sustain consumer attention. Based on the existing literature, we confirmed that TTF and TFF are useful metrics for understanding attentional phenomena and consumer pleasure (Merdian et al., 2020). Furthermore, we confirmed that there is a strong positive relationship between visual attention and bottle preference, with visual cues, such as pictorial information, capturing the attention of consumers the most (Laeng et al., 2016). Furthermore, in contrast to Laeng et al. (2016), who tested the effectiveness of real-world marketing decisions, we tested the effectiveness of design alternatives during the design and concept phases, allowing marketers to choose the product that should be marketed. The main theoretical contribution was the implementation of eye-tracking metrics to test which visual mechanisms played determining roles in stimulus evaluation, in addition to those already used in the literature. In particular, we found that when several simultaneous stimuli are compared, consumers tend to

frequently return to the stimuli that caught their attention. Thus, attention returns are additional preference-related indicators. Finally, we found that the GLM is a good model for predicting consumer preferences.

Practical implications

Both wine label designers and wine producers could benefit from such methods to improve label selection and streamline the wine label design process. Eye-tracking methods could be very useful and supportive for marketing studies on consumer preferences and decision-making. Although eye-tracking in the food and drinks sector is an already established technique for evaluating packaging/labelling and consumer preferences, its use to evaluate design proposals during the product concept phase remains relatively novel and is still quite new. This method provides objective, quantitative and predictive information on consumer preferences. The results can be useful not only for researchers but also for especially to manufacturers, designers and marketing directors.

Conclusions

In this study, participants evaluated and expressed their preferences based solely on the visual appearance of the product. The effects on preferences, aesthetic judgments and oculomotor parameters were evoked by label design. The first objective of this research was to test how alternative labels created for the same wine could be perceived differently, capturing attention differentially. These results make it possible to suggest guidelines for designers and marketing managers during the label concept phase. Furthermore, it was possible to understand the criteria of consumer behaviour when choosing a product based not only on initial attractiveness but also on whether it can sustain consumers' attention over time.

Limitations and future research

The main limitation of the experiment concerns the sample interviewed, as it is a homogeneous sample of Italian marketing students as opposed to experts in the wine sector. Therefore, the results may not be generalized to other segments (e.g. wine lovers); for this reason, future studies must broaden the panels of interviewees and see whether there are any differences between experts and nonexperts. In

addition, there are inherent limitations to the execution of the experiment, as it was carried out on a monitor in the laboratory in an unnatural shopping environment and with a controlled number of products. Accordingly, future studies should carry out experiments in a real environment, with stimuli not in digital format, to avoid losing important information on the perception of the texture of the label. A further limitation concerns the cognitive load, which was not analyzed because the device used does not record pupillary data. In general, pupillometric studies confirm that pupils tend to dilate during the observation of more interesting or more appreciated stimuli (Kuchinke et al., 2009; Johnson et al., 2010). Therefore, it might be interesting to integrate pupillary change data to further confirm the relationship between eye movements and aesthetic preferences. However, measuring eye movements is not always sufficient to understand how consumers focus their attention and why labels capture their attention (Alvino et al., 2021). Some researchers argue that eye movements are a consequence of the cognitive processes taking place in consumers' minds, so the use of electroencephalography (EEG) devices that monitor brain activity adds crucial information to understanding consumer behaviour during their purchase decision-making process (Luck and Kappenman, 2011; Rayner et al., 2015; Luke et al., 2018). In conclusion, future extensions of this study could repeat the experiment using EEG devices that monitor brain activity. This will not only allow EEG metrics to be added and compared with eye-tracking metrics, but also to analyze cognitive load and most importantly provide the possibility to polarize the participants' attention as positive or negative phenomena without having to ask them for an explicit preference.

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3.4. Research Article 4

Brand Name and Label Design Effect: A Neuroscientific Exploration of Attentional Preferences through EEG and Sentiment Analysis

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Working paper

Abstract

When choosing alcoholic beverages (e.g., wine, champagne), customers often rely on external cues (e.g., brand name and label design) to make their decisions. Hence, external cues play an important role in shaping consumers' choices and preferences towards alcoholic beverages. Despite increasing interest in the topic in wine marketing literature, it is not clear how multiple cues compete and drive consumers' attention, and how consumers' attention shapes and influences consumer preferences for a product. To fill this gap, our study uses a multi-method approach that combines Sentiment Analysis and Electroencephalography (EEG) on champagne labelling to investigate how external cues influence individuals' visual attention and preferences and whether visual attention mechanisms influence purchasing decisions. Our findings indicate that the brand name carries significant weight in shaping consumer preferences, with consumers showing a clear preference for familiar brands over unfamiliar ones. Conversely, while a visual salience design successfully captures consumers' attention, it does not wield

enough influence to impact their preferences. This study provides insights to researchers and practitioners studying the impact of extrinsic cues on consumer neuroscience and practical recommendations for tailoring marketing strategies to specific product attributes.

Keywords: consumer neuroscience, EEG, Sentiment Analysis, decision-making process, consumer behaviour, brand name, label design, champagne.

Introduction

Consumer behaviour research has highlighted the key role of product signals in the decision-making process. These signals convey information about the product, including its quality, value, and overall characteristics, significantly shaping consumer choices (Yan et al., 2019). Specifically, when consumers have no prior knowledge of a product or its intrinsic qualities, they turn to external information, known as extrinsic cues, to guide their decisions. These signals include factors such as price, brand, and packaging, which serve as critical benchmarks for product evaluation (Galati et al., 2018). This reliance on extrinsic cues is particularly pronounced when dealing with products that require a certain level of knowledge or familiarity on the part of the consumer, such as wine, champagne and similar products.

The food and beverage literature shows that the extrinsic cues that most influence consumer decision-making and purchasing behaviour are label design and brand name (Rodríguez et al., 2023). Consumers tend to prefer established and familiar brands as they convey reliability and quality (Smith et al., 2017; Ma et al., 2021). Conversely, when dealing with unfamiliar brands, consumers tend to place more emphasis on the design to form their impressions of product attributes (Underwood & Klein, 2002).

The design of a label plays a crucial role in shaping consumer preferences and decisions by communicating essential information about the brand (Chamorro et al., 2021). Typically, consumers favour simple and traditional designs, as they tend to convey authenticity, quality, and a higher level of reliability compared to complex and modern designs (Corsi et al., 2020). Moreover, consumers are more

likely to notice and consider products with visually appealing designs, enhancing the likelihood of selection (Leder et al., 2016).

Despite the growing interest in these extrinsic cues, it remains unclear whether design or brand name exerts more influence on consumer-product choice. Research results appear rather inconclusive on the issue. Some emphasize the brand for its reliability and association with quality (Smith et al., 2017), while others claim that design is the main factor guiding their choices (Alvino et al., 2020, 2021).

Marketers often rely on conventional methods like observation, focus groups, and questionnaires to delve into consumer decision-making processes. However, these traditional marketing techniques may not always provide a comprehensive and objective understanding of consumer behaviour, particularly in the context of wine selection (Ariely and Berns, 2010; Babiloni et al., 2014; Alvino et al., 2018, 2019). To address these limitations, businesses have increasingly turned to neuroscientific tools and techniques to decipher consumers' subconscious reactions during product evaluation and gain deeper insights into their decision-making processes (Lange et al., 2002; Barber et al., 2006; Elliot and Barth, 2012; Celhay and Trinquedecoste, 2015).

In the domain of extrinsic cues, much of the research has centred on eye-tracking methods, aiming to uncover the prominent cues that influence consumers and the critical product attributes that effectively capture their attention (Gofman et al., 2009; Laeng et al., 2016; Merdian et al., 2021; Barbierato et al., 2023). For instance, Barbierato et al. (2023) using eye-tracking technology revealed that visual cues, such as images, are more effective in capturing attention compared to verbal cues like brand names. Additionally, the researchers identified a positive correlation between attention and choice, indicating that design proposals that were observed for longer durations were more likely to be chosen.

However, the relationship between attention and choice is more complex. Husić-Mehmedović et al. (2017) found that when the brand is familiar, products with greater visual salience captured consumers' attention but were ultimately not chosen because they were unfamiliar. Therefore the question between visual attention and choice needs further investigation to be clarified.

In addition, some studies have pointed out that eye movements are influenced by higher cognitive processes, such as brain activity, and may not fully elucidate why one product garners more attention than another (Rayner & Reingold, 2015; Luke et al., 2018). To overcome these limitations, some scholars have proposed incorporating electroencephalogram (EEG) measurements to monitor brain activity and unravel the intricate mechanisms of visual attention (Van der Lubbe & Utzerath, 2013; Parr et al., 2019; Alvino et al., 2021).

For instance, Alvino et al. (2021) utilized EEG to explore how the design of various wine labels impacted individual preferences, as reflected in neural activity associated with visual attention. More specifically, they analyzed the posterior contralateral negativity (PCN) to gauge whether a specific wine label captured participants' visual attention based on its external characteristics. The researchers hypothesized that a more negative PCN would indicate a greater preference for the label. Their findings supported this hypothesis, indicating that PCN can serve as a predictive measure for product selection based on design characteristics.

Given these considerations, this study aimed to fill gaps in the marketing literature by investigating the effects of brand name and label design on consumers' visual attention and preferences. We proposed a multi-method approach, combining Sentiment Analysis and Consumer Neuroscience techniques, to examine the relationship between visual attention and preferences for different champagne labels in more depth. The central research question that guided this study is the following: *How do different extrinsic champagne labelling cues influence individual preferences and how are they reflected in neurophysiological activity related to visual attention?*

The study objectives encompass understanding: (1) the extrinsic cues shaping consumers' visual attention and preferences, (2) the role of visual attention in the purchase decision process, and (3) the interplay between visual attention and preferences.

In the subsequent sections, this paper unfolds as follows. The literature review section provides a review of pertinent literature on brand names, label design, visual attention, and purchase intent. The Materials and Methods section outlines the

research methodology, covering experimental design, stimuli, and the sample. The results section presents the study's results, analysing shifts in brain activity, consumer preferences, and the impact of brand and label design on visual attention. The discussion section delivers theoretical insights and practical implications for the wine industry. Finally, the Conclusions section concludes by summarising key findings and suggesting avenues for future research.

Literature review

In this section, we present the theoretical framework that underlies our study and outline the hypotheses derived from existing literature. We review the relevant literature on consumer behaviour, product cues, and their impact on purchasing decisions, with a specific focus on brand name, labelling design and cutting-edge methods for analysing consumer behaviour.

Brand name

Literature shows that the familiarity of a brand evokes a sense of comfort, trust, and security among consumers, positively influencing their perceptions and decisions. (Lockshin & Rasmussen, 2000; Ha & Perks, 2005; Kelley et al., 2015; Creusen et al., 2018).

The existing literature on brand familiarity in the context of wine choice is notably limited and inconclusive despite its undeniable importance and relevance. Smith et al. (2017) conducted a wine-tasting experiment to explore the impact of brand familiarity, exposure, and knowledge on consumers' quality perceptions. The study found that brand familiarity had a significant positive effect on consumers' quality perceptions, with participants rating wines with familiar brands higher in quality. Sherman & Tuten (2011) also investigated wine-buying behaviour and highlighted the importance of brand familiarity as a critical factor in consumer choice.

On the other hand, Payini et al. (2022) conducted research among female wine consumers in India and found that brand familiarity was ranked as the second least essential attribute of wine. This discrepancy highlights the need for further clarification on the role of brand familiarity in wine consumption. To address this issue, we propose the following hypotheses:

H1: Brand familiarity has a positive influence on consumer preferences

H2: Consumers prefer familiar brands over unfamiliar ones

This hypothesis aims to explore the relationship between brand familiarity and consumer preferences, particularly in the context of champagne products.

Labelling design

Academic research on labelling has analysed several vital dimensions, examining how label elements influence product quality perception, purchase intention, risk perception, brand image and personality (Henley et al., 2011; Wang et al., 2020; Lunardo & Rickard, 2020; Alić et al., 2020).

Quality and sensory perception are prime concerns for wine consumers. Wine label design's impact on perceived quality and sensory experiences has been investigated. Lunardo & Livat (2016) observed that design elements like colour and shape affect sensory expectations and quality evaluations. Similarly, Chrea et al. (2011) explored how label information, like grape variety and region, shapes perceptions.

Studies on wine labels also highlight the label's pivotal role in shaping brand image and the overall wine experience. Visual aesthetics, branding, and label content are key factors that significantly impact consumer decisions and preferences. Orth and Malkewitz (2008) highlighted how appealing, cohesive designs bolster brand impressions and purchasing behaviour.

Wine label design serves as a powerful communicator of authenticity, reliability, and brand personality. It communicates attributes and evokes emotions in consumers (Razak, 2020). For instance, traditional designs give trust and loyalty, while modern ones evoke playfulness (Sherman & Tuten, 2011; Tang et al., 2015; Corsi et al., 2020; Chamorro et al., 2021). In addition, simple designs, especially in Champagne, positively impact brand perception (Favier et al., 2019).

In summary, academic research on wine label design has explored multiple dimensions, demonstrating the multifaceted nature of wine label design and its importance in influencing consumer behaviour and brand management strategies.

By understanding the implications of label design, wine producers and marketers can optimise their efforts to create compelling labels that resonate with consumers and improve brand perception and preference. Despite being of fundamental importance in marketing research, one aspect that has not yet been addressed is the relationship between label design and brand familiarity. Indeed, consumers rely more on label design elements to infer brand characteristics of unfamiliar brands rather than familiar brands (Underwood and Klein 2002).

Therefore, our paper aims to answer the following hypotheses:

H3: An unfamiliar brand with a traditional-simple design negatively influences consumer preferences compared to a familiar brand

H4: An unfamiliar brand with a modern-complex design positively influences consumer preferences compared to an unfamiliar brand with a traditional-simple design

This research investigates the impact of label design on consumer brand impressions. It provides insights into the holistic approach to package design, including label design, and its influence on consumer perceptions of brand familiarity.

Consumer preferences and Visual attention

The literature highlights the central role of visual attention in consumer decision-making, as information must be visually noticed to influence choices (Clement et al., 2017). Furthermore, research suggests that consumer preferences are intrinsically linked to the degree of attention products get during the decision-making process (Krajbich et al., 2010; Glimcher and Fehr, 2013; Chen et al., 2019).

In the field of consumer behaviour, various studies have carefully examined alterations in consumers' visual attention mechanisms. These investigations aim to identify which elements of a wine bottle capture consumers' attention most effectively (Gofman et al., 2009; Laeng et al., 2016; Němcová & Berčík, 2019; Monteiro et al., 2020; Liu et al., 2022; Barbierato et al., 2023). For example, Liu et al. (2022) identified that the participants paid more attention to the brand name than other elements on the wine labels. In contrast, Laeng et al. (2016) pointed out that

consumers pay more attention to visual elements such as images, logos and colours, compared to verbal components such as brand names and other information describing the product.

At the same time, other studies delve into the intricate aspects of label design, aiming to decipher which design styles are preferred by consumers (Alvino et al., 2021; Merdian et al., 2021; Barbierato et al., 2023). Merdian et al. (2021), investigate how visual attention corresponds to subjective ratings of interest and value regarding various wine bottle design choices. They found that wines with modern designs captured consumers' attention, but this appeal did not automatically translate into higher value predictions or explicit consumer interest.

Finally, it has been investigated whether the mechanisms governing visual attention can serve as predictors of consumers' preferences and purchase intentions (Laeng et al., 2016; Ramsøy et al., 2017; Escandon-Barbosa & Rialp-Criado, 2019; Barbierato et al., 2023). In particular, Barbierato et al. (2023) established a robust correlation between visual attention and consumer preferences, revealing that consumers are inclined to select products that effectively capture and sustain their attention throughout the decision-making process.

On the contrary, some studies suggest that attention does not universally translate into effective selection (Reutskaja et al., 2011; Milosavljevic et al., 2012; van der Laan et al., 2015). For instance, a study by Husić-Mehmedović et al. (2017) discovered that beer can designs featuring highly conspicuous visual elements such as bright colours and strong contrasts grabbed the most attention from participants. However, interestingly, these eye-catching designs received the lowest ratings in the conscious evaluation process when participants were asked to provide post-test feedback. This phenomenon was attributed by the researchers to the influence of brand familiarity, as the most favourably rated designs were associated with brands that participants were already familiar with.

In an attempt to clarify these issues and explore the role of visual attention during the decision-making process and how extrinsic cues influence it, the following hypotheses are formulated:

H5: Brand familiarity has a positive influence on consumer visual attention

H6: The label design has a positive influence on consumer visual attention

These hypotheses aim to elucidate the impact of these extrinsic cues on consumers' visual attention, offering valuable insights to marketers and designers for product enhancement and strategic decision-making.

Materials

This section describes the pre-test used for stimuli selection and shows the stimuli chosen for the experiment.

Pre-test

An online pre-test was conducted to choose the stimuli to be used in the experiment. This practice, widely endorsed in research methodologies, ensures the efficacy, pertinence, and alignment of chosen stimuli with the study's overarching objectives (Lunardo & Rickard, 2020; Kapoor et al., 2023). Particularly in our study, this pre-test served the dual purpose of eliminating potential confusion stemming from the interplay between champagne familiarity and labelling design.

The pre-test involved an international sample of sixty-two participants (comprising 29 males and 33 females), aged between 20 and 39 years, residing in the Netherlands. These participants were drawn from the pool of wine consumers possessing moderate levels of knowledge in this domain. The pre-test process encompassed the rating of 50 champagne brand names based on their familiarity and recognition. This was executed through a Likert scale, with participants indicating their level of agreement with the statement *"I know this champagne brand name very well"* on a scale from *"1=strongly disagree"* to *"7=strongly agree"*. In addition to evaluating champagne brand familiarity, participants also evaluated champagne labelling designs, considering traditional/contemporary and simple/complex categories (*"To what extent do you find this label?"*, *"1=Not at all"* to *"7=Very much"*).

The pre-test results showed that the most recalled brands were Dom Pérignon, Moët & Chandon, and Veuve Clicquot. Repeated Measures ANOVA revealed significant

differences in familiarity among brands ($F(48, 2928) = 33.61, p < .001$). Most champagne names presented were perceived as unfamiliar by respondents.

Participants also evaluated sample champagne labelling images based on their style (traditional/modern) and layout (simple/complex). Significant results were found in the repeated measures ANOVA analysis, revealing a significant effect of the “Design” factor ($F(3, 183) = 20.11, p < .001$). This suggests that participants’ ratings differ significantly depending on the specific design category (traditional, modern, simple, complex). Moreover, to categorize and group the champagnes according to their similar design features, a Principal Component Analysis (PCA) followed by a Cluster Analysis was conducted. PCA reveals two main dimensions and the Elbow method for determining the optimal number of clusters identifies 4 distinct groups (Syakur et al., 2018). Cluster 1, labelled “modern-complex”, encompasses Armand De Brignac and Laherte Freres champagne. Cluster 2, termed “traditional-complex”, encompasses Dom Pérignon and Ployez Jacquemart. Cluster 3, denoted as “modern-simple”, is represented by Mumm and Jacques Chaput. Lastly, Cluster 4, characterized as “traditional-simple”, comprises Moët & Chandon and Bollinger champagne. Figure 1 shows the results of the Cluster Analysis.

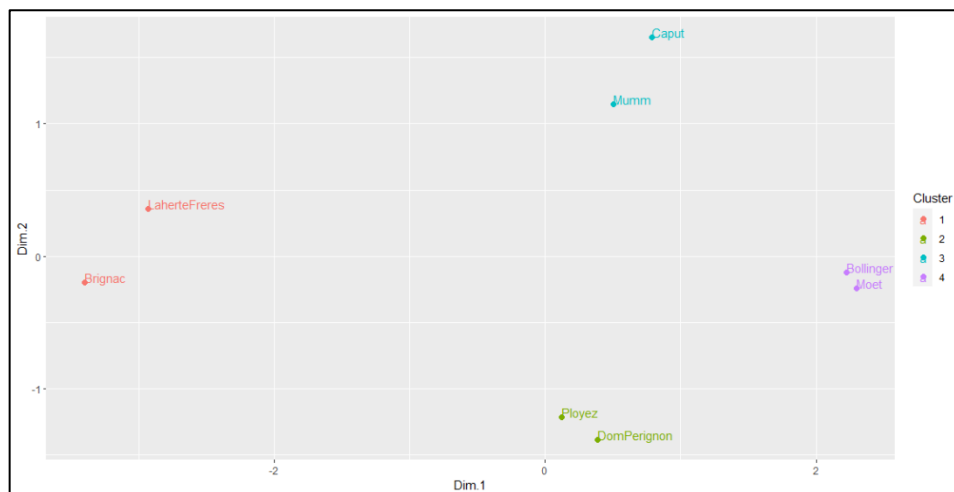


Figure 1. - Cluster Analysis to classify the champagne bottles according to their similar design features (traditional, modern, simple, complex).

The data clearly illustrated that traditional design typically exhibits characteristics such as a white or yellow background, prominent and occasionally italicized text, centred and symmetrical layouts, as well as a composition that includes both

horizontal and vertical lines. Conversely, modern design tends to feature poured or dark backgrounds, thinner fonts, graphic design elements, layouts that are off-centred or justified, and a prevalence of asymmetrical, vertical, and diagonal lines. Furthermore, the combination of these design elements contributes to the visual complexity of the labellings. Simplicity is achieved when the design is minimalistic, whereas complexity arises when it incorporates embellishments and intricate details. In conclusion, considering the pre-test findings and the research aims, four bottles were selected for the experiment based on brand familiarity (less/most familiar) and the labelling design (traditional-simple/modern-complex).

The *most familiar* brand selected was Moët & Chandon, and the *unfamiliar* brand was Piper Heidsieck. Both brands were represented by two different labelling designs: *traditional-simple* and *modern-complex*. Figure 2 displays the selected labellings⁴. The first labelling (L1) corresponds to the most familiar brand with a traditional-simple design, the second (L2) is the less familiar brand with a traditional-simple design, the third (L3) consists of the most familiar brand with a modern-complex design, and finally, the fourth (L4) depicts the less familiar brand with a modern-complex design.

⁴ In this study, wine labelling refers to both the front wine label design and bottle shape, as Elliot and Barth (2012) and Laeng et al. (2016) reported.

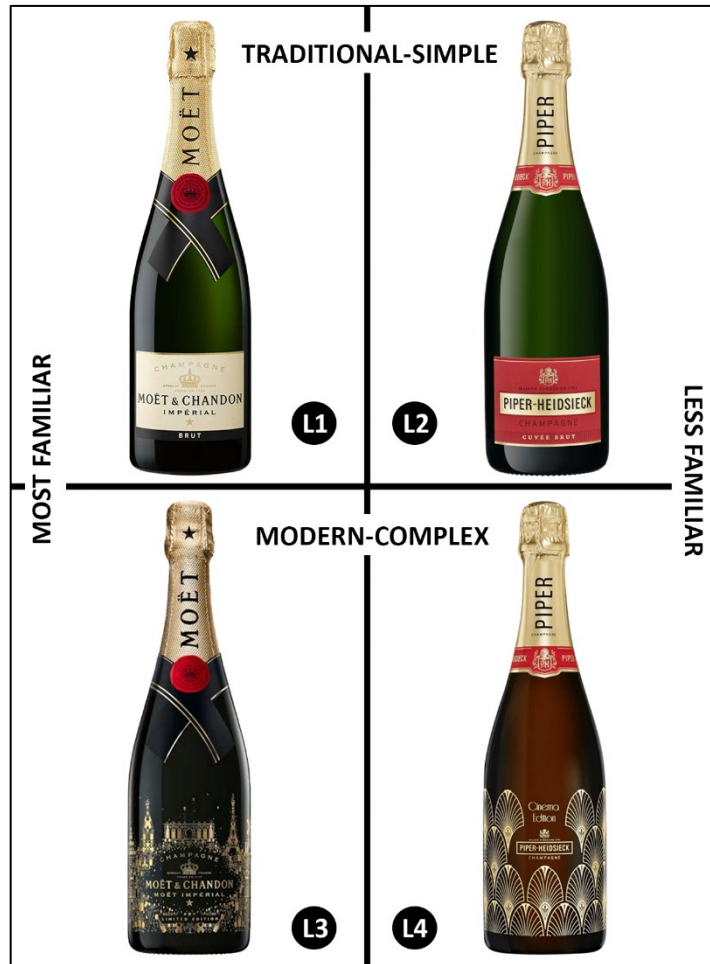


Figure 2. – Stimuli selected for the experiment. Moët & Chandon with a traditional-simple design (L1), Piper Heidsieck with a traditional-simple design (L2), Moët & Chandon with a modern-complex design (L3), Piper Heidsieck with a modern-complex design (L4).

Methods

This section offers a comprehensive overview of our adopted multi-method research design, which combines electrophysiological (EEG) and post-test data (preferences expressed). This research approach draws inspiration from recent consumer neuroscience studies (Venkatraman et al., 2015; Shen & Morris, 2016; Vila-López & Küster-Boluda, 2019; Hernández-Fernández et al., 2019; Kumar et al., 2019).

The subsequent paragraphs furnish comprehensive information about the experiment, encompassing details on the sample, procedure and tasks undertaken by participants during both the experimental and post-experimental phases.

Furthermore, we provide comprehensive information regarding data acquisition and analysis processes.

Sample

A different group of participants was recruited for the laboratory experiment. The sample consisted of $N = 35$ participants, but 10 participants were excluded from the original sample because of excessive artefacts in their EEG recordings. The final sample consisted of $N = 24$ participants (11 female and 13 male), between 18 and 31 years of age, recruited among students or employees of the University of Twente, who received school credits or a gift card to participate in the experiment.

A questionnaire and some tests (Alcohol Use Disorders Identification Test (AUDIT) and Ishihara test), sent by e-mail were used to decide whether subjects should be allowed to participate in the experiment. The questionnaire asked for some information about the participants, their consumption habits, their knowledge of wine and the factors that could guide their choices. The Alcohol Use Disorder Identification Test (AUDIT) identified participants who exhibit dangerous (or risky) drinking behaviours, harmful alcoholism, or alcohol addiction. Participants scoring above 19 on the AUDIT were to be excluded as they may be considered alcohol abusers, which can lead to deviant results (Lacoste-Badie et al., 2020). In our case, all selected participants scored less than 18. The Ishihara test was used to detect possible colour vision defects since participants were asked to rate their preferences for labelling wine with different designs and colours. The test consisted of coloured plates, each containing a circle of dots that appeared random in colour and size (Birch, 1997; Ekhlasli et al., 2021). Participants were asked to write the coloured numbers in the pictures. All participants had normal colour vision.

We also used the Annett Handedness Inventory (Annett, 1970) to test handedness, as this is an important factor in investigating brain lateralization (van Strien, 2003). The handedness test revealed that twenty-one participants were right-handed, and three were left-handed. The participants came from 10 countries (Azerbaijan, England, Bulgaria, Canada, the Netherlands, Finland, Germany, Italy, Romania and Spain) and were all consumers and buyers of wine or champagne but with a limited or moderate knowledge of the wine world. Most of them replied that when choosing

a bottle of champagne, the brand name is not very important, unlike the design of the label (colour, drawing, texture, etc.) and the characteristics of the bottle (colour, size, shape, etc...). Seventy per cent preferred a traditional (e.g., white/yellow background, symmetrical and drawing related to the wine world) rather than a modern (e.g., all coloured, funny drawings, Swarovski, metallic, particular shape, etc.) design of champagne labelling.

Procedure and tasks

Participants were asked to sign an informed consent form when they arrived at the laboratory. Participants received detailed written and verbal instructions on all the tasks they would perform in the experiment. Using the Freiburg visual acuity test, participants were asked to sit in a comfortable chair in front of a computer monitor to determine the clarity or sharpness of their vision before the experiment (Bach, 2007). All participants were fit to experiment.

The experiment took place in a soundproof and illuminated room. Participants were placed at approximately 70 cm at eye level in front of a 24-inch AOC G2460P LED computer screen. Participants were asked to relax and reduce sudden movements and blinking to avoid distortion of the EEG signal. Each participant completed ten practice trials to get familiar with the task before the real experimental phase.

The study employed a Visual Stimulus Discrimination task to investigate how the brain processes and attends to visual information (Druker & Anderson, 2010). During the experiment, the champagne labellings were presented in random pairs simultaneously on the computer screen, one on the left and the other on the right. Participants used the keyboard to express their preferences (left or right Ctrl key).

The experiment was divided into six blocks, and the participants had 1 min of rest at the end of each block. The blocks contained 96 stimuli each. Overall, the participants saw a succession of 576 sets of pictures of four different examples of champagne labelling. The average duration of the task was between 50 min and 1 hour, including a time break between the blocks. An experimenter sat nearby for the duration of the experiment to monitor the procedure and answer any questions. The procedure and tasks used are similar to the experiment performed by Alvino et

al. (2021). Figure 3 shows the experimental procedure (3a), the equipment used and the laboratory setting (3b).

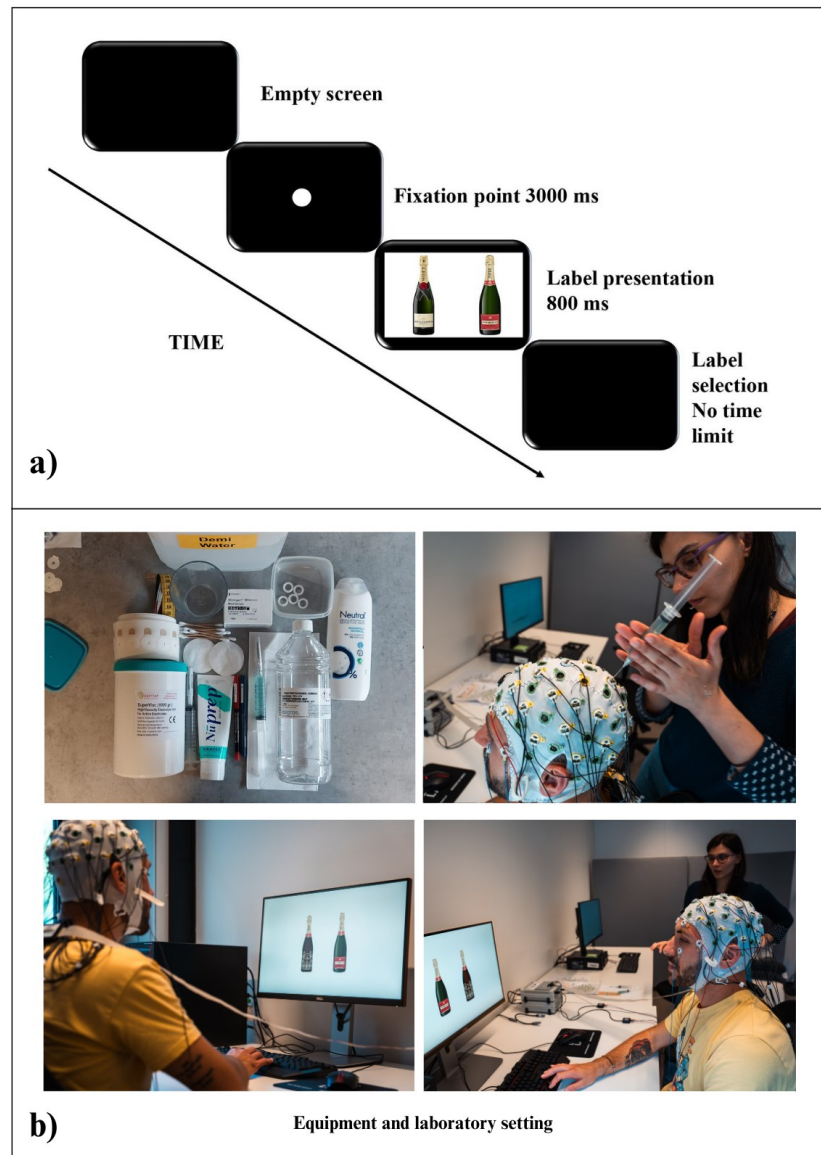


Figure 3. – a) Experimental procedure, b) Experiment equipment and laboratory setting.
Participants were asked to choose the preferred champagne after viewing the labelling presentation

Post-test

Following the conclusion of the experiment, participants were directed to engage in a ranking task, whereby they were required to assign a numerical rating on a scale ranging from 1 to 4. This rating scale corresponded to their preference level, with

“1” signifying their most preferred choice and “4” representing their least preferred choice among the various champagne labellings presented.

Moreover, to gain deeper insights into the reasoning behind their ranking decisions, participants were further prompted to provide succinctly written justifications for each of their assigned rankings. These justifications aimed to elicit participants’ subjective perspectives, allowing for a more comprehensive understanding of their preferences and providing valuable qualitative data for subsequent analysis.

Data acquisition and analysis

The data collected during the experiment included the participants’ EEG signals and behavioural data (preferences during the experiment) containing reaction time and their preferences. In addition, rankings and explanations of the order of their choices were collected after the conclusion of the experiment. Data acquisition and analysis are explained in detail below.

EEG data. The EEG was recorded continuously from 32 active Ag/AgCl electrode (wet electrodes) sites using an EasyCap-62 channel cap (standard international 10–20 system layout) connected to an ActiChamp amplifier, with BrainVision Recorder software (version 1.21.0102). The electrodes were located at the following sites: AFz, AF3, AF4, AF7, AF8, F1, F2, F5, F6, FCz, FC3, FC4, FT7, FT8, C3, C4, C5, C6, CPz, CP3, CP4, TP7, TP8, P1, P2, P5, P6, POz, PO3, PO4, PO7, and PO8. The horizontal and vertical electro-oculogram (hEOG and vEOG) were also recorded. Two electrodes were placed at the side of both eyes to measure the electrical activity generated by horizontal eye movements. Electrodes located on the infraorbital and supraorbital regions of the left eye placed in line with the pupil enabled to measure vertical eye movements and blinks. The resistance of the electrodes was kept below 10 k Ω by using electrode gel and standard procedures to improve conductivity.

EEG data were analyzed with BrainVision Analyzer v. 2.1.1 software. The continuous data were epoched from 500ms prior up to 2500ms after presenting the champagne labellings. An initial baseline was set from –100 to 0ms before presenting the stimuli. EEG was corrected for eye movement-related artefacts via

artefact rejection and Ocular Correction ICA (Independent Component Analysis). Trials with amplitude differences exceeding $\pm 50\mu\text{V}$ on the hEOG channel and $\pm 100\mu\text{V}$ on the vEOG channel were marked to remove segments with horizontal eye movements and eye blinks from 200ms before until 320ms after presenting the stimuli. In addition, epochs were removed when there were premature or too early responses (-200 and 150 ms). This procedure left on average 87.0% (SD=7.5%) of the presented trials per participant. After the Ocular Correction, another artefact rejection was applied (criteria were set to remove trials with differences of more than $\pm 150\mu\text{V}$, a gradient criterion of $50\mu\text{V/ms}$, and a low activity criterion of $0.1\mu\text{V}$ for 50ms). EEG channels with artefacts were marked and were not included in the data analysis. Finally, lateralized EEG potentials as a function of the to-be-attended side (details below) were determined for all homologue electrode pairs and labels.

To precisely trace the allocation of visual attention, we determined the PCN. Increased negativity above visual brain areas contralateral to the relevant visual stimulus (here, the relevant champagne labelling) was expressed by detecting potential changes in the PCN (Jolicoeur et al., 2008; Vossel et al., 2014). The presence of a PCN on a specific label indicates a preference for paying attention to that label, and the more negative the PCN, the more we assume this labelling seems to be preferred. The amplitudes of the PCN were assessed within 40 ms time windows from 0 ms to 320 ms post-stimulus at the components' most typical electrode sites PO7/8, by determining lateralized potentials. Here is an example of the procedure of computing the PCN for Label 1: $\{[\text{PO8-PO7 (Label 1 left visual field (LVF) - Label 2/3/4 right visual field (RVF)}] + [\text{PO7-PO8 (Label 2/3/4 LVF - Label 1 RVF)}]\}/2$. Thus, the PCN for each label was computed by comparing it with all other labels on the ipsilateral side. We applied the same procedure for all symmetrical electrode sites (e.g., C3 and C4) to create topographical maps displaying event-related lateralizations (ERLs; e.g., Van der Lubbe et al., 2001). According to Töllner et al. (2011, 2012), the PCN is present from 175 to 300ms after stimulus onset. For the analysis, eight different time windows (from 0 to 320ms) were selected. A repeated measures ANOVA was used to analyze the EEG for the four labellings using R software.

Behavioural data. During the experiment, we recorded their preferences for champagne labelling and their reaction times (RT). To indicate their preferred champagne label, participants used either the left or right Ctrl key on the keyboard, depending on the location of their preferred label on the screen. This allowed us to determine labelling preferences based on the total number of trials in which a specific champagne label was chosen. Reaction time refers to the duration taken by participants to respond to a task (Ramsøy, 2014). A shorter reaction time indicates greater confidence in their preference (Calvert et al., 2019). Hence, in this study, we measured the time taken by participants to select their desired champagne label to explore if there were any differences among the labellings. The collected data underwent analysis using descriptive and inferential (ANOVA) statistics.

Post-test data. The post-test data, consisting of rankings and their corresponding justifications, served as valuable tools for delving into both the participants' explicit and implicit preferences articulated after the experiment. These data offered a dual benefit: firstly, the ranking exercise not only enabled the assessment of preferences but also allowed for an exploration of potential correlations with responses given during the experimental phase. Secondly, the succinct descriptions provided by participants to justify their rankings played a pivotal role in elucidating the rationale behind their categorizations, thus shedding light on the specific attributes and characteristics that influenced their evaluations.

The analysis of the ranking data was conducted using descriptive statistics with R software. Meanwhile, to glean deeper insights from the qualitative textual data, we employed a multifaceted approach encompassing Sentiment Analysis, Co-occurrence Network, and Cluster Analysis. Sentiment Analysis enabled the discernment of semantic orientation, encompassing both positive and negative sentiments, as well as the underlying emotions conveyed in participants' justifications. On the other hand, Co-occurrence Network and Cluster Analysis served to highlight the defining elements characterizing the champagne labellings and how participants perceived them. In this study, Sentiment Analysis was executed utilizing the "syuzhet" library within the R software platform, leveraging the NRC Emotion Lexicon (Azam et al., 2020). According to Barbierato et al. (2022), the Co-occurrence Network and Cluster Analysis were performed using the

KH Coder software. We only used nouns and adjectives, as they are parts of speech with the highest information content (Hu et al., 2017; Kobayashi et al., 2019). We divided the databases into two parts. One database comprised entries characterized by positive sentiments ($NRC > 0$) and favourable labelling rankings (ranking ≤ 2). In contrast, the second database included entries associated with negative sentiments ($NRC < 0$) and less favourable labelling rankings (Ranking ≥ 3).

Results

This section describes all the results collected during the laboratory experiment (EEG and Behavioural data) and post-test data collected after the experiment, specifying the statistical methods used for the analysis.

Experiment results

Behavioural data

A repeated measures ANOVA of the consumer preferences revealed significant differences among champagne labellings ($F(3, 69) = 5.51, p < .001$). In the selection of champagnes, brand familiarity emerged as the most influential and statistically significant factor ($F(1, 23) = 17.68, p < .001$). On the other hand, neither the design factor ($F(1, 23) = 0.79, p = 0.38$) nor the interplay between brand familiarity and design ($F(1, 23) = 0.78, p = 0.07$) demonstrated significant effects. Figure 4 illustrates the participants' preferences as they were expressed during the experiment, depicted in the form of the number of selections for each specific labelling option. There was a distinct preference for the L3 (71%) as compared to the other champagne labellings. The second preferred was L1 (60%), followed by L4 (39%) and finally L2 (31%).

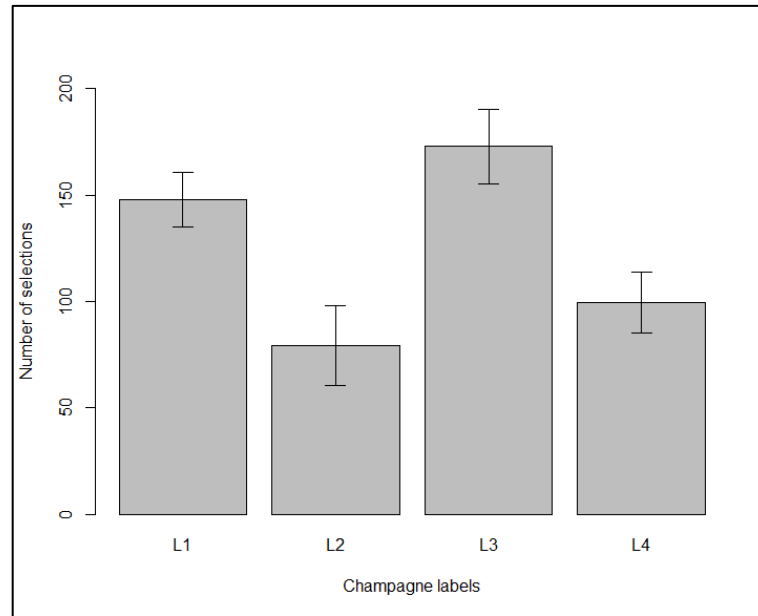


Figure 4. - Participants' preferences for champagne labelling (number of times the participants selected the champagnes).

To comprehend the impact of brand name and label design on participants' preferences, we conducted distinct comparisons among various champagne labellings. Specifically, there was a significant difference in the number of times that the Moët & Chandon brand (L1, L3) was selected as compared to the Piper Heidsieck (L2, L4) [$t(47)=5.3476$; $p<.001$]. However, no significant differences were found between Traditional-Simple (L1, L2) and Modern-Complex design (L3, L4) [$t(47)= -1.2053$; $p=0.2341$]. The results revealed that brand had a more significant influence on champagne choices than design.

A repeated measures ANOVA was also conducted on RT. The results show that there were significant effects on participants' reaction times for the brand factor ($F(1, 23) = 4.426$, $p <.001$) and design factor ($F(1,23) = 4.4303$, $p <.001$). The data presented in Table 1 show the mean of the participant's reaction times for each factor of champagne labelling and the standard error of the mean. The findings suggest that participants exhibited consistent and swift responses throughout the experiment, irrespective of the labels presented. Their primary focus appeared to be on the choice they desired to select.

Table 1. - Mean of the participants' reaction times for each example of champagne labelling and standard error of the mean.

Factor	Mean	Std. Error
Brand		
Moët & Chandon	558.603	18.220
Piper Heidsieck	603.056	31.744
Design		
Traditional-Simple	550.634	20.420
Modern-Complex	605.793	27.832

EEG data

To verify whether there were changes in the PCN amplitudes as a function of brand familiarity (2), labelling design (2) and Time window (8), a repeated measures ANOVA was performed. The findings revealed significant differences in changes over time among factors. The influence of brand name was notably significant during the evaluation process ($F(1, 23) = 4.52, p < .001$), in contrast to the design factor, which did not exhibit a substantial main effect. Additionally, the variable of time windows (TW) failed to show a significant impact, indicating that alterations in the time window did not markedly affect the evaluation.

Of particular interest, however, are the interactions between these factors and the time windows. Notable interactions were observed between “Design” and “TW” ($F(7, 161) = 2.64, p < .001$) as well as between “Brand” and “TW” ($F(7, 161) = 2.09, p < .001$). These findings underscore that these factors exert varying degrees of influence on the evaluation outcome, contingent upon the specific time frames considered. The changes over time are visible in Figure 5.

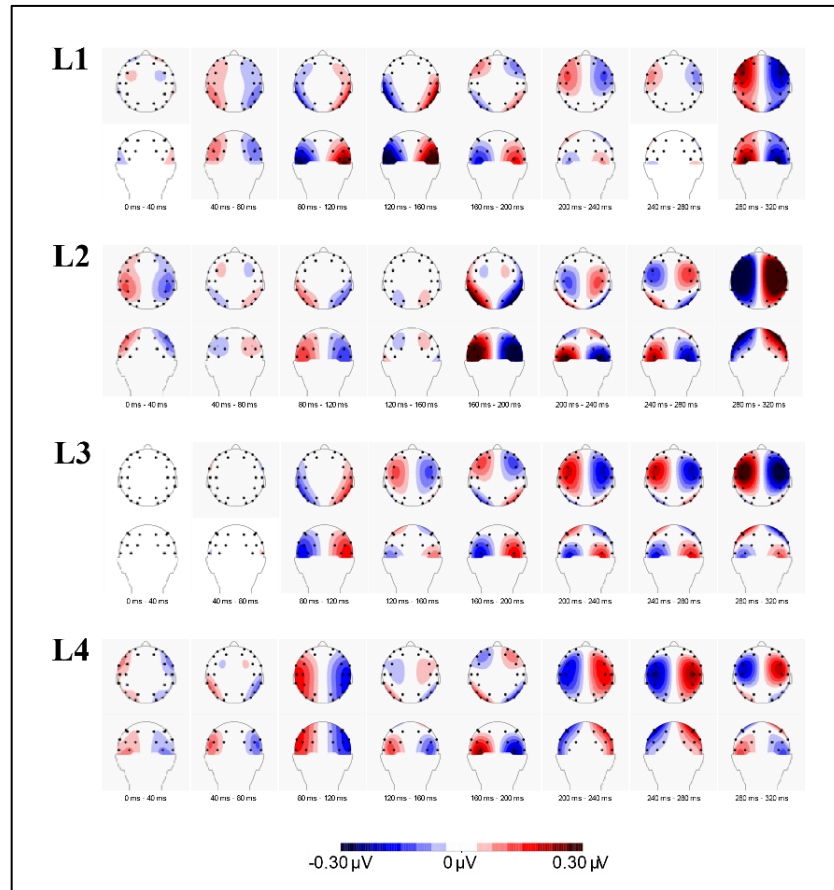


Figure 5. - Topographical maps determined for 40-ms time windows (from 0 until 320ms) after stimuli presentation for all four champagnes: Moët & Chandon with a traditional-simple design (L1), Piper Heidsieck with a traditional-simple design (L2), Moët & Chandon with a modern-complex design (L3), Piper Heidsieck with a modern-complex design (L4). Contra-ipsilateral differences relative to the label of interest are projected on the right hemisphere, while ipsi-contralateral differences are projected on the left hemisphere.

Figure 5 shows the topographical maps determined for 40-ms time windows (from 0 to 320ms) after stimuli presentation for all four champagnes. Contra-ipsilateral differences relative to the label of interest are projected on the right hemisphere, while ipsi-contralateral differences are projected on the left hemisphere.

To analyse changes in participants' brain activity over time as a function of labelling, separate analyses were performed for the eight-time windows. We employed a critical value of p of 0.05. For both the first (0 to 40ms) and second (40 to 80ms) time windows, results show no effects of Brand and Design (Brand: $p = 0.426$ and $p = 0.740$ respectively; Design: $p = 0.518$ and $p = 0.838$ respectively) on PCN amplitudes.

In the third time window (80 to 120ms), an effect of Brand was observed ($F(1, 23) = 4.553$, $p = 0.043$), but not a Design effect ($F(1,23) = 0.119$, $p = 0.732$) nor the relationship between them ($F(1,23) = 0.469$, $p = 0.500$). Contrast analysis for the third time window revealed major differences among L4 and L3, and also between L2 and L1. Table 2 shows the comparisons among the champagne labellings. The critical value of p was not crossed for the other contrasts. The mean amplitudes show a PCN for the L4 and L2, while an opposite effect is present for the L3 and L1, suggesting that within this time window participants attend to the unfamiliar brand (Piper Heidsieck) rather than the familiar one (Moët & Chandon).

Table 2. - Multiple Comparisons using Tukey Contrasts Analysis for the TW3.

Champagne labellings	Means	St. Error	Contrasts	Estimate	t ration	p-value
L1	0.233	0.130	L3 – L4	0.3253	2.999	0.0180 *
L2	-0.149	0.118	L3 – L1	-0.0315	-0.291	0.9914
L3	0.144	0.083	L3 – L2	0.2938	1.915	0.2288
L4	-0.123	0.097	L4 – L1	-0.3568	-2.326	0.0995
			L4 – L2	-0.0315	-0.291	0.9914
			L1 – L2	0.3253	2.999	0.0180 *

In the fourth time window (120 to 160ms), an effect of Brand was observed ($F(1, 23) = 5.338$, $p = 0.030$), but not a Design effect ($F(1,23) = 1.798$, $p = 1.193$) nor the relationship between them ($F(1,23) = 0.101$, $p = 0.752$). Contrast analysis for the fourth time window revealed major differences between L4 and L1. Table 3 shows the comparisons among the champagne labellings. The critical value of p was not crossed for the other contrasts. The mean amplitudes show a PCN for the L4 and L2, while an opposite effect is present for the L3 and L1, suggesting that within this time window participants attend to the unfamiliar brand (Piper Heidsieck) rather than the familiar one (Moët & Chandon).

Table 3. - Multiple Comparisons using Tukey Contrasts Analysis for the TW4.

Champagne labellings	Means	St. Error	Contrasts	Estimate	t ration	p-value
L1	0.289	0.104	L3 – L4	0.2526	2.226	0.1237
L2	-0.004	0.151	L3 – L1	-0.1688	-1.488	0.4486
L3	0.079	0.072	L3 – L2	0.0837	0.522	0.9536
L4	-0.131	0.113	L4 – L1	-0.4214	-2.627	0.0487*
			L4 – L2	-0.1688	-1.488	0.4486
			L1 – L2	0.2526	2.226	0.1237

In the fifth time window (160 to 200ms), an effect of Brand was observed ($F(1, 23) = 14.003$, $p < .001$), but not a Design effect ($F(1,23) = 0.276$, $p = 0.603$) nor the relationship between them ($F(1,23) = 0.001$, $p = 0.970$). Contrast analysis for the fifth time window revealed major differences among L4 and L3 and L2 with L1. There are also significant differences between L2 and L3, and L4 with L1. Table 4 shows the comparisons among the champagne labellings. The mean amplitudes show a PCN for the L4 and L2, while an opposite effect is present for the L3 and L1, suggesting that within this time window participants attend to the unfamiliar brand (Piper Heidsieck) rather than the familiar one (Moët & Chandon).

Table 4. - Multiple Comparisons using Tukey Contrasts Analysis for the TW5.

Champagne labellings	Means	St. Error	Contrasts	Estimate	t ration	p-value
L1	0.170	0.106	L3 – L4	0.4757	4.630	0.0001***
L2	-0.309	0.116	L3 – L1	0.0498	0.484	0.9624
L3	0.215	0.087	L3 – L2	0.5255	3.616	0.0027**
L4	-0.255	0.099	L4 – L1	-0.4260	-2.931	0.0217*
			L4 – L2	-0.0498	0.484	0.9624
			L1 – L2	0.4757	4.630	0.0001***

In the sixth time window (200 to 240ms), an effect of Design was observed ($F(1, 23) = 6.847, p = 0.015$), but not a Brand effect ($F(1,23) = 2.595, p = 0.120$) nor the relationship between them ($F(1,23) = 5.281, p = 0.474$). Contrast analysis for the sixth time window revealed major differences between L2 and L3. The critical value of p was not crossed for the other contrasts. Table 5 shows the comparisons among the champagne labellings. The mean amplitudes show a PCN for the L2 and L4, while an opposite effect is present for the L3 and L1, suggesting that within this time window participants attend to the traditional-simple unfamiliar brand (Piper Heidsieck) rather than the modern-complex familiar one (Moët & Chandon).

Table 5. - Multiple Comparisons using Tukey Contrasts Analysis for the TW6.

Champagne labellings	Means	St. Error	Contrasts	Estimate	t ration	p-value
L1	0.102	0.134	L3 – L4	0.3108	2.203	0.1301
L2	-0.316	0.153	L3 – L1	0.2137	1.515	0.4329
L3	0.207	0.135	L3 – L2	0.5245	2.629	0.0485*
L4	0.004	0.141	L4 – L1	-0.0971	-0.486	0.9619
			L4 – L2	-0.2137	1.515	0.4329
			L1 – L2	0.3108	2.203	0.1301

Finally, in the eight-time window (280 to 320ms), an effect of the relationship between Brand and Design was observed ($F(1, 23) = 6.518, p = 0.053$), but not a Brand effect ($F(1,23) = 0.058, p = 0.809$) and the Design effect ($F(1,23) = 1.367, p = 0.245$). Contrast analysis for the eight-time window revealed major differences between L1 and L3. The critical value of p was not crossed for the other contrasts. Table 6 shows the comparisons among the champagne labellings. The mean amplitudes show a significant PCN for the L1, suggesting that within this time window participants attend to the Traditional-Simple familiar brand (Moët & Chandon) rather than the Modern-Complex one.

Table 6. - Multiple Comparisons using Tukey Contrasts Analysis for the TW8.

Champagne labellings	Means	St. Error	Contrasts	Estimate	t ration	p-value
L1	-0.311	0.126	L3 – L4	-0.2327	-1.193	0.6290
L2	-0.009	0.159	L3 – L1	0.4337	3.708	0.00387**
L3	0.122	0.104	L3 – L2	0.1322	0.709	0.8918
L4	-0.110	0.169	L4 – L1	0.2010	0.969	0.7642
			L4 – L2	-0.1006	-0.441	0.9708
			L1 – L2	0.3015	1.514	0.4293

The outcomes related to visual attention allocation reveal that Piper Heidsieck labellings managed to capture the participants' attention. Additionally, a pivotal observation pertains to the C4 channel, which correlates with hand motor activity during the selection of the preferred labelling. A contrasting trend emerges when comparing the averages' distribution for visual attention (PO8 channel) and expressed preference (C4). Figure 6 shows the means distributions for each labelling in the eight-time windows. The last three-time windows (from 200 to 320 ms) are to be considered the most significant since the EEG changes are evident with prolonged exposure to a stimulus. The analysis of the distribution of average values within the C4 channel offers valuable insights into the preferences associated with Moët & Chandon. Specifically, it highlights a clear preference for L3, followed closely by L1, signifying a clear inclination towards this brand name. On the other hand, when we examine the distribution within the PO8 channel, a different aspect of visual attention emerges. Here, our observations indicate that L2 attracts considerable visual attention and occasionally L4 as well. What is particularly interesting is the revelation in the last time window (280 to 320ms). During this period, it becomes evident that the L1 label attracts participants' attention the most.

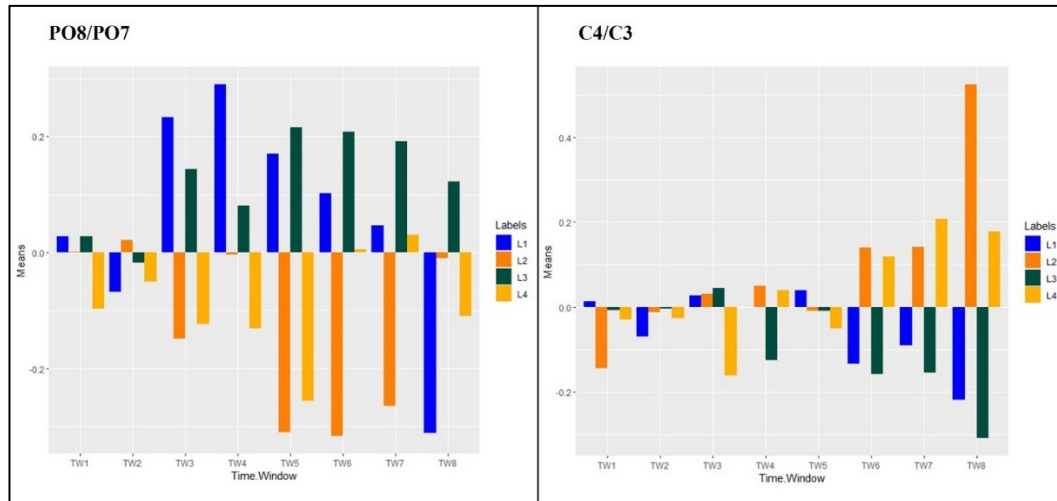


Figure 6. - Average distributions of PO8/PO7 and C4/C3 for each champagne labelling in TWs.

Post-test results

The champagne labelling ranking shows the participants' preferences. Figure 7 shows the ranking distribution from the most preferred (the first position) to the least preferred (the fourth position). The results show that the most preferred was L3, followed by L1, L4 and finally in the last position L2.

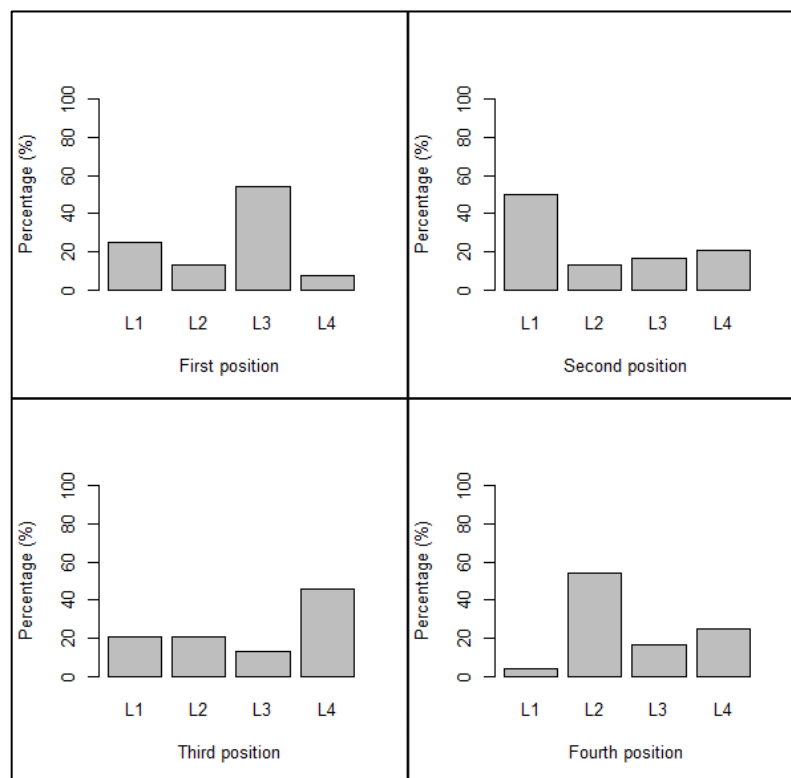


Figure 7. - Ranking distribution of champagne labellings

These results confirm the results of the behavioural data expressed during the experiment. The Ordinal Logistic Regression shows the perfect correlation between the preferences expressed during the experiment (behavioural data) and the ranking (Figure 8).

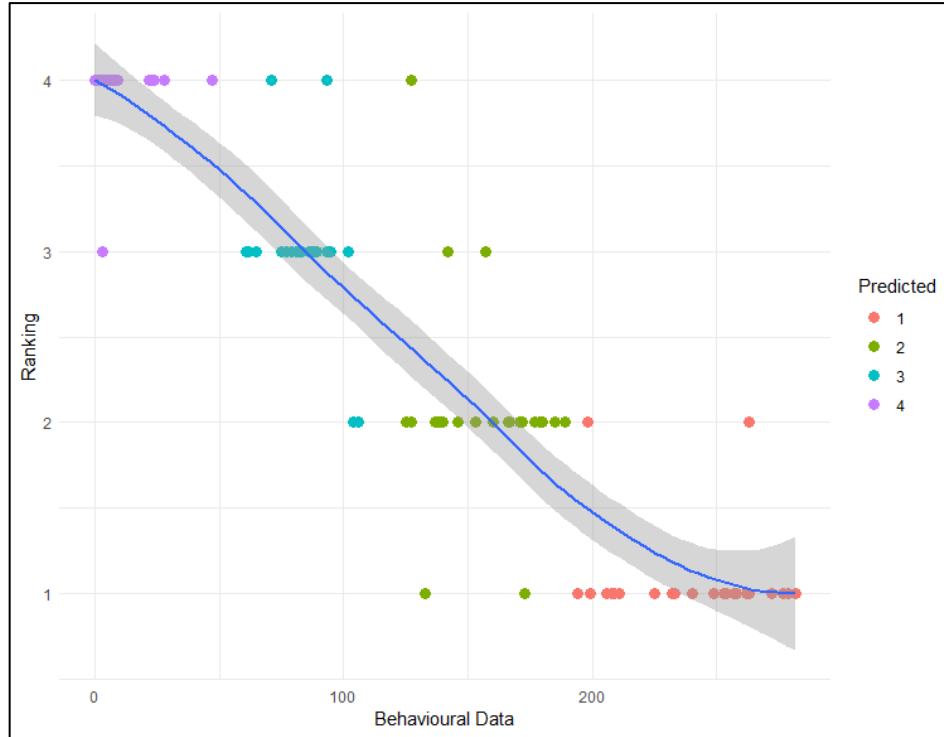


Figure 8. - Ordinal Logistic Regression between behavioural data and ranking post-test

In addition, the Co-occurrence Network and Cluster Analysis, based on databases with positive sentiment according to the NRC dictionary ($NRC > 0$) and positive rankings ($Ranking \leq 2$), highlighted the elements that guided participants' preferences and perceptions.

The analysis identifies five prevalent themes of most preferred labellings (Figure 9): “colour,” which characterizes subgraph 1; “brand”, subgraph 2; “quality,” subgraph 3; “ribbon” subgraph 4; “appearance,” subgraph 5.

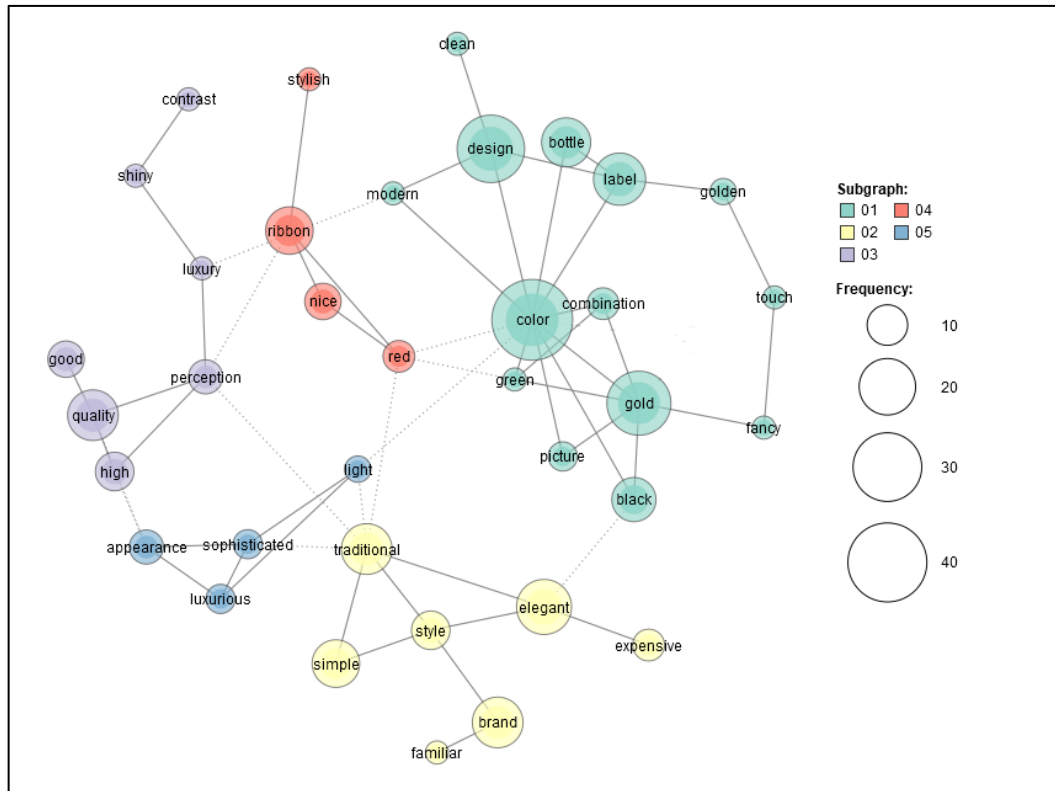


Figure 9. - Co-occurrence Network of positive reviews

Meanwhile, the analysis identifies five prevalent themes of least preferred labellings (Figure 10): “colour,” which characterizes subgraph 1; “design”, subgraph 2; “bottle,” subgraph 3; “brand” subgraph 4; “appearance,” subgraph 5.

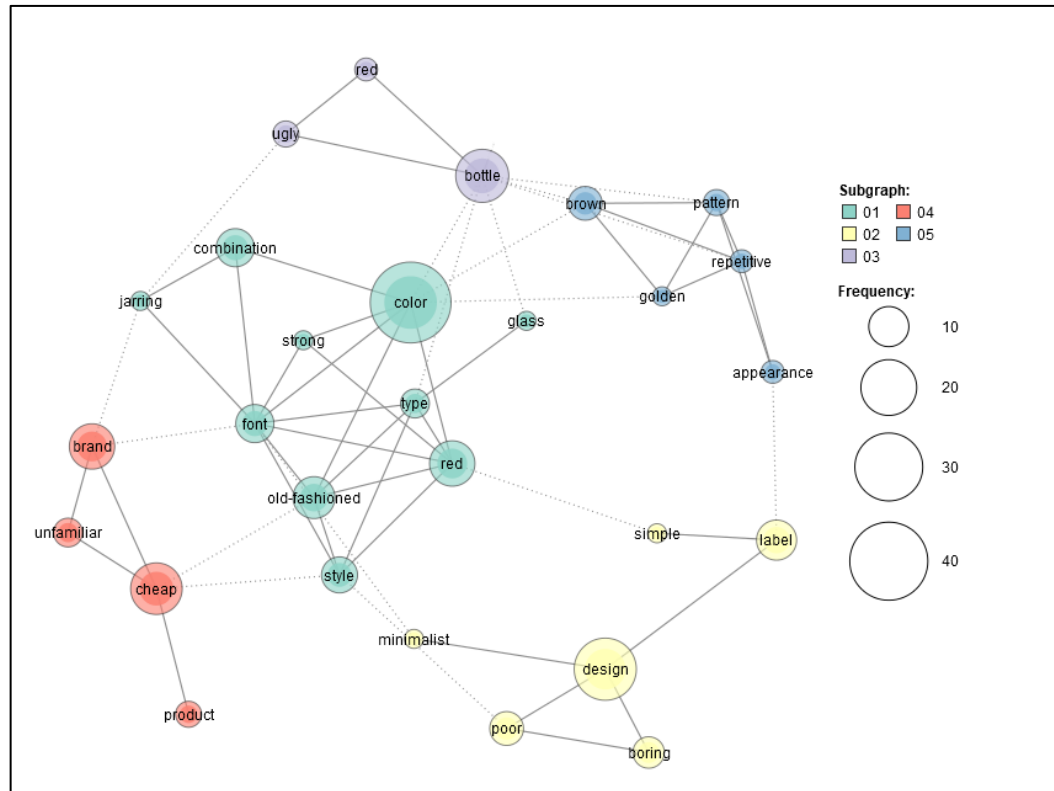


Figure 10. - Co-occurrence Network of negative reviews

The findings offer valuable insights into the factors influencing participants' preferences, with a distinct focus on design elements. Among the most favoured labellings, colours played a pivotal role, particularly the striking combination of gold and black, which imparted a touch of opulence to the product. Participants also valued the familiarity of the brand and the perception of elegance, tradition, and simplicity in the style, which collectively conveyed a sense of high-quality luxury. Another notable element that garnered appreciation was the addition of a “nice” red ribbon, contributing to the preference for the bottle’s overall presentation. In sum, the product exuded an aura of sophistication and luxury. On the other side, the least preferred labellings were characterized by their colour choices, especially the less appealing combination of brown and gold, and the overly aggressive use of red. Additionally, the font used for the brand name contributed to an old-fashioned style. The design was too simple, minimalist, poor and boring. The colour of the bottle and the repeating pattern design were not appreciated. Unfamiliarity with the brand and design gave the product a “cheap” appearance.

Discussion

Multi-method research has shown that extrinsic product cues significantly influence consumer preferences. When comparing conscious responses with the distribution of attention, measured by PCN changes, it can be observed that some discrepancies exist. Favourite labelling didn't capture as much attention as the visual saliency proposals. This means that the design captures the consumer's initial attention but when there is familiarity with the brand it is not sufficient for choice. In essence, our findings underscore the critical importance of studying visual attention as one of the fundamental mechanisms for comprehending consumer behaviour. Moreover, they emphasize the need to consider the signals that characterize a product before introducing it to the market.

Behavioural data

The behavioural data revealed distinct participant preferences for the four labellings examined. Notably, participants exhibited a preference for Moët & Chandon's labellings (L3 and L1) over those of Piper Heidsieck (L4 and L2). While label design played a significant role, it was the familiarity of the brand that exerted a more substantial influence during the decision-making process. These findings underscore the positive impact of brand familiarity on consumer preferences (H1), with well-known brands like Moët & Chandon garnering higher favourability compared to their less familiar counterparts (H2). These observations align with existing literature, which emphasizes the significant role of brand names in purchase decisions (Lockshin & Rasmussen, 2000; Ha and Perks, 2005; Kelley et al., 2015; Creusen et al., 2018).

Furthermore, our research delves into the interaction between label design and brand familiarity, illuminating how this interplay shapes preferences. The results indicate that, within the context of familiar brands, it's not just the brand name that matters; a contemporary and intricate labelling design (L3) gains preference as it reinforces the brand's image. This underscores that innovative designs, when coupled with well-known brands, have a significant influence on consumers' purchasing decisions and preferences. Conversely, for unfamiliar brands, the design serves as a tool through which consumers assess the brand's enigmatic attributes.

Piper Heidsieck, an unfamiliar brand with a traditional and simple label design, ranked as the least preferred (H3). The pivotal role of design in evaluating unknown brands is further underscored by the preference for modern and intricate designs over traditional ones (H4). These findings validate existing theories regarding the impact of label design on consumer preferences (Barbierato et al., 2023; Liu et al., 2022; Alvino et al., 2021; Gofman et al., 2009; Laeng et al., 2016; Merdian et al., 2021). Furthermore, our research introduces fresh insights and intriguing results regarding the interplay between traditional and contemporary design and their correlation with visual complexity.

EEG data

The EEG data unveiled the impact of different label characteristics on brain activity, with distinct patterns observed among the champagne labels. Notably, the width of the Posterior Contralateral Negativity (PCN) varied across the labellings. Specifically, the data indicated the presence of a PCN for the unfamiliar brand (Piper Heidsieck labellings, L2 and L4), signifying heightened attention towards these labels, except for the last time window where the traditional-simple familiar brand (Moët & Chandon, L1) caught the attention compared to all the others. These effects also manifested over time, with the initial signs of the PCN appearing for L2 and L4 labels between 80 and 120ms, for L4 between 120 and 160 ms, intensifying in the time window between 160 and 200 ms, for L2 between 200 and 240 ms, and finally for L1 between 280 and 320 ms.

A noteworthy observation regarding this PCN is that, in most cases, it remained confined to posterior brain areas, indicating its association with attentional selection rather than hand motor activation, which typically occurs over central areas (C4 channel). However, this effect does not manifest itself in the last time window in which a strong correlation is noted between the visual and motor attention areas. This highlights that the PCN has changed over time, from an initial phase in which the unfamiliar brand captured more attention to a final one in which the familiar brand with a traditional and simple design emerged more correlated with the preference. This supports the findings of Favier et al. (2019), which suggest that a straightforward design has a favourable influence on brand perception. It is

important to underline that there was a discrepancy between the EEG results and the behavioural data, where L2 and L4 labels were consistently the least preferred. This confirms the findings of previous research, highlighting that consumers may be initially attracted to unfamiliar brands that raise doubts about their quality, but ultimately choose not to select them (Lockshin & Rasmussen, 2000; Ha & Perks, 2005; Kelley et al., 2015; Creusen et al., 2018). In this context, our interpretation of these results highlights the positive impact of brand familiarity on attention and visual preferences only in the final phase of the evaluation process (H5). In fact, in the last time window (TW8), the familiar brand with a traditional and simple design garnered increased attention and emerged as the preferred choice. Furthermore, design takes on a secondary role, serving mainly to strengthen the brand image, partially rejecting Hypothesis 6 (H6). Consequently, it becomes imperative for visual label attributes not only to initially attract but also to sustain consumers' attention throughout their decision-making process. In the specific context of evaluating champagne labels, this underscores the need for marketers to employ targeted promotional strategies aimed at enhancing the brand image, thus increasing the product's competitiveness in the market.

Post-test data

The post-test data provided additional validation of the preferences observed during the experiment, reiterating consumers' clear preference for labels associated with the familiar brand Moët & Chandon over those of Piper Heidsieck. Furthermore, the analysis of participant reviews added valuable insights into the rationale behind their preferences. Notably, it became evident that the colour schemes used in the label and bottle design played a pivotal role in shaping their choices. The combination of gold and black emerged as a favoured choice among participants due to its ability to imbue the labelling with an idea of elegance and luxury. This colour pairing was perceived as sophisticated and aesthetically pleasing, aligning with participants' preferences for a premium and refined image in their champagne selection. In contrast, the use of red and brown colours, particularly in conjunction with gold in the case of the Piper Heidsieck labellings, did capture participants' attention due to their high salience. However, this combination was deemed overly strong and "jarring" by consumers, resulting in the labels being characterized as

old-fashioned and having a “cheap” appearance. These findings underscore the critical role of design in the decision-making process when choosing champagne bottles, as it not only attracts consumers’ attention but also provides cues regarding the perceived quality of the product. Such preferences align with existing literature on the significance of design in consumer product evaluation (Husić-Mehmedovic et al., 2017). In summary, this study reinforces the importance of thoughtful label and bottle design, particularly within the context of champagne selection, as it can significantly influence consumer perceptions and choices, ultimately impacting the perceived quality of the product.

Conclusions

This study sets out to bridge the gaps in the consumer neuroscience literature, specifically focusing on extrinsic product cues such as brand name and label design and their influence on product choice. The primary objective was to gain insights into how various extrinsic cues in champagne labelling influence individual preferences and manifest in neural activity associated with visual attention. The findings offer valuable insights for designers, marketers, and researchers in deciphering consumer behaviour. These findings underscore the substantial influence of brand familiarity on participants’ preferences. Furthermore, particular design elements, notably colour, capture attention due to their visual prominence, but they do not consistently lead to selection. Therefore, for champagne products, companies should prioritize the establishment of brand familiarity over investments in labelling design.

Theoretical contributions

This study addresses gaps within the consumer neuroscience literature concerning extrinsic product cues, specifically delving into the impact of brand name and label design on consumer choices in the context of champagne products. The results provided detailed information on consumer behaviour and an understanding of the criteria consumers use to choose a product.

Our research contributes significantly to the existing body of knowledge in several keyways. Firstly, we investigate the potential influence of brand familiarity and

various design elements on both consumer preferences and brain activity, confirming the results of some research (Sherman & Tuten, 2011; Smith et al. 2017). The exploration of these interconnections, while vital for choice-making, has remained uncharted territory in the realm of wine products. Furthermore, we employ EEG to study visual allocation, a departure from the prevalent use of eye-tracking in most related studies (Alvino et al., 2021). This novel approach allows us to delve into the mechanisms reflected in brain activity even before the actual choice-making process. Lastly, we employ an innovative multi-method approach, prioritizing the identification of emotional and subconscious factors guiding decision-making (Venkatraman et al., 2015; Shen & Morris, 2016; Vila-López & Küster-Boluda, 2019; Hernández-Fernández et al., 2019; Kumar et al., 2019). By combining neuroscientific techniques with Sentiment Analysis, we gain an understanding of the intricate relationships between preferences and visual mechanisms. This holistic approach sheds light on previously concealed aspects of the decision-making process.

Practical implications

The managerial implications of our study extend beyond academia and hold particular relevance for businesses, designers, and marketing professionals, with a significant focus on the potential benefits for wine producers. In today's landscape, the creation of a compelling wine label and effective product marketing has evolved into intricate and costly endeavours, making streamlined methods essential.

Our examination of visual attention mechanisms offers valuable insights for companies seeking to navigate the complexities of consumer preferences. It aids in distinguishing scenarios where a product's appeal is primarily tied to its visual prominence from those where more intricate information plays a role. This understanding allows businesses to strategically capture consumer attention and subsequently influence their preferences. Concurrently, the application of sentiment analysis proves invaluable for uncovering latent and emotional insights about products. This provides experts with the tools necessary to craft precise and impactful marketing strategies for product enhancement and promotion.

Limitations and future research

It's vital to acknowledge the limitations of this study, which should be considered in future research endeavours. Initially, our analysis of visual attention mechanisms and consumer preferences was based on a limited selection of just four champagne bottles. To enhance the robustness of future investigations, we recommend incorporating a broader range of bottles, encompassing different traits related to both brand familiarity and label design. This approach would better simulate real-world scenarios, where participants encounter a diverse array of choices.

Furthermore, it is suggested to use other data analysis methods, especially EEG data since the PCN method did not allow us to understand which product was presented next to the chosen one, which can be relevant data in the study of consumer behaviour.

Finally, it's essential to emphasize the significance of meticulous experiment design in enhancing the quality of research within the realm of Consumer Neuroscience. In this specific study, our primary objective was to explore potential links between changes in brain activity and individual preferences for champagne labellings. Consequently, we consider this study to be exploratory. We extend an invitation to fellow researchers to replicate this study, expanding their efforts to refine various aspects, including sample size and concurrent data collection from various consumer neuroscience tools. This collective endeavour holds the potential to significantly enhance our understanding of consumer preferences and the intricate mechanisms governing visual attention.

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Chapter 3

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CHAPTER 4: CONCLUSIONS

4. General Discussion

The main aim of NEUROWINE was to delve into the complexity of consumer perspectives and behaviours within the wine industry. This effort has placed significant emphasis on understanding consumer experiences at the macro and micro levels. The discovery of the main extrinsic factors that exert a substantial influence on how consumers perceive and evaluate the quality of wine allows us to identify useful guidelines for enhancing the product.

As explained in Chapter 1, in the context of wine marketing research, it is the perceived quality that has fundamental importance, transferring the responsibility of evaluating quality directly onto the shoulders of the consumer. For this reason, extrinsic signals play a fundamental role in modern wine consumption and the purchasing experience.

The thesis attempted to fill the gap in the wine marketing literature by investigating the concept of quality in wine-related services and products, with a specific focus on understanding which extrinsic signals exert the greatest influence on consumer preferences and opinions.

The following paragraphs provide comprehensive answers to the research questions, highlighting the key findings and illustrating comparisons and contrasts between the research conducted.

4.1. RQ1 and objectives

In this section, we will delve into the outcomes of the first research question (RQ1) and its associated research objectives (RO1.1. and RO1.2.) that explore the components of quality and failure in wine tourism services, as presented in Research Articles 1 and 2.

***RQ1:** Which extrinsic cues influence consumers' assessment of service quality and their overall satisfaction with the experience?*

The exploration of service quality within wine tours and winery visits has yielded valuable insights that are of significance to both researchers and practitioners, offering a pathway for enhancing the quality of services provided within the wine tourism domain. Both of these studies have identified common factors that characterize the essence of wine tourism experiences. To encapsulate these findings, six fundamental dimensions have emerged, similar to Terziyska & Damyanova (2020): the professionalism of the tour guide, the competence of winery staff, the quality of their explanations, logistical and organizational aspects, the quality of the wine, the quality of the food, complementary tourist and recreational activities, landscape and historic villages.

The main extrinsic factors that characterize the quality and failure of wine tours and winery visits are delineated below. These findings serve as practical guidelines to help tour operators and wineries improve and organize their services, and consequently satisfy their customers.

Role of Tour Guides and Winery Staff

The roles of the tour guides and the winery staff are the most crucial cues. Serving as intermediaries between tourists and the destination, these individuals serve as the initial point of contact between visitors and the wine region they are about to explore (Rabotic et al., 2010). According to Maguire et al. in 2020, the concepts of storytelling and cultural intermediaries are recognized as fundamental for engaging with tourists at wineries. The ultimate success or failure of the entire wine tourism experience hinges significantly on these figures and the quality of their explanations. This is evident from the fact that they feature prominently in both

positive and negative reviews. Indeed, tourists frequently mention tour guides and staff in their reviews across all the wine regions under investigation. The most frequently used adjectives include “knowledgeable”, “informative”, “helpful” and “friendly”. Thus, good knowledge of the place, the ability to know how to present and convey it and friendliness are the main characteristics that good organizers and hosts must possess. The enthusiasm and passion displayed by these individuals in their roles are attributes that readily resonate with tourists and often correlate with higher sentiment scores in reviews.

Logistics and Planning

Logistical and planning aspects are more often the focal points of dissatisfaction, typically surfacing in nearly all negative reviews. The primary grievances typically revolve around travel logistics, particularly concerning issues such as the “meeting point”, “time waste” and “lack of professionalism”. Once again, these failings can be traced back to operational shortcomings, underscoring the pivotal role of these factors in shaping the overall wine tourism experience.

Sentiment Analysis on Service Assessment

Sentiment analysis has emerged as a valuable tool for evaluating consumer satisfaction. It empowers researchers and businesses to delve into the nuances of customer feedback, classifying reviews based on their content into positive and negative sentiments. Previous research (Wilson et al., 2009; McNamara et al., 2015) has shed light on the inconsistencies in customer reviews, particularly on platforms like TripAdvisor, where the overall evaluation of an experience, often represented by user ratings, may not align with the detailed content of the reviews. Surprisingly, reviews with high ratings sometimes contain negative feedback about service quality, while low-rated reviews may also highlight positive aspects of an experience. This incongruity can pose challenges for natural language processing methods attempting to identify service quality and failures.

Sentiment analysis was applied in various ways to achieve specific objectives. For instance, Research 1 and 4 employ sentiment analysis to assign an overall score to each user or participant review. This approach simplifies the evaluation process by

providing a single, summarizing metric for each review, making it easier to compare and rank customer satisfaction. On the other hand, Research 2 takes a more granular approach, breaking down each review into positive and negative sentences. By assigning scalar scores to these individual sentiments, no valuable information is lost. This method allows for a comprehensive understanding of the evaluation of the wine tourism experience, capturing both the positive and negative aspects as reported by consumers.

In summary, integrating Sentiment Analysis with NLP techniques allowed us to extract authentic preferences and ratings from honest consumer reviews, thus bypassing the strategic responses that often characterize traditional questionnaires. The selection of a sentiment analysis methodology should be guided by the specific research objectives at hand, and it's worth noting that both approaches presented here offer distinct merits. In essence, the overarching advantage of sentiment analysis lies in its capacity to effectively polarize reviews, enabling us to isolate and extract the specific elements that either satisfy or dissatisfy customers, without losing valuable information and providing a comprehensive understanding of their sentiments and ratings.

4.2. RQ2 and objectives

In this section, we will explore the second research question (RQ2) and its corresponding research objectives (RO2.1. and RO2.2.) regarding the extrinsic cues influencing consumer perceptions of product quality and purchasing decisions, as detailed in Research Articles 3 and 4.

RQ2: *Which extrinsic cues shape the consumers' perceptions of wine quality and their decision-making processes?*

The results of both experiments present similarities, useful for companies, marketers and designers both in the product design phase and in marketing activities. The primary discovery was that visual cues, such as images and colours, have a greater ability to grab consumers' attention compared to verbal cues for both wine and champagne labelling. Nevertheless, capturing attention doesn't always translate into selection, since a product can only capture the consumer's attention in the initial phase of the decision-making process

The main extrinsic cues that convey and influence consumers' perceptions of wine quality are defined below. These findings offer practical guidance to companies, marketers, and designers for enhancing product presentation and, in turn, increasing the likelihood of them being chosen.

Visual Cues

Visual cues, including images and graphic elements, hold remarkable sway over consumer attention and quality perception (Pieters et al., 1999; Celhay and Trinquécoste, 2015; Laeng et al., 2016). This phenomenon aligns with a broader body of research confirming the impact of visual aesthetics on brand perception and product quality (Ares et al., 2011; Orth and Malkewitz, 2008; Pantin-Sohier, 2009; Rompay and Pruyn, 2011).

For instance, in Research Article 3, the choice of territorial icons and a modern style played a pivotal role in influencing consumer preferences, particularly resonating with Millennials and Generation Z (Talke et al., 2009; Celhay and Trinquécoste, 2015). Images that encapsulate information about the country of origin, its history,

and its traditions are favoured because they effectively convey the essence and identity of the brand.

In Research Article 4, it becomes evident that, particularly in the case of champagne, graphic design plays a primary role in conveying information about the brand's image and identity. The design serves to bolster the brand's image when it's already familiar to consumers, while also providing vital insights for unfamiliar brands. A traditional and simple design captures consumers' attention and is often preferred because simplicity is associated with product reliability and authenticity (Favier et al., 2019).

The Role of Colours

In product evaluation, colour stands as a pivotal visual element, often capturing consumer attention and wielding considerable influence over their choices. The findings from both Research Articles 3 and 4 consistently highlight the presence of recurring colour types: vibrant and heraldic. According to Pelet et al. (2020), even if the colours in wine labels take on a secondary role to images, the preference leans toward bright hues, both achromatic (black and white) and chromatic (red, green, and blue), signifying modernity. In the case of champagne bottles, heraldic colours, particularly metallic shades like gold, convey authenticity and quality. Notably, combinations of heraldic colours, especially gold, and bright achromatic shades find favour with consumers, whereas bright chromatic combinations, like red and gold, attract visual attention but don't necessarily align with aesthetic preferences.

The colour red possesses the ability to evoke various emotions. On one hand, it is sometimes associated with negative and perilous feelings due to its symbolic connection with fire, blood, and anger (Moller et al., 2009). Conversely, red can also elicit positive emotions, such as when it appears in food, particularly in ripe fruits, or as a captivating biological signal (Milinski and Bakker, 1990; Waite et al., 2006). The emotional connotation of red can shift from negative to positive. Nonetheless, in both emotional extremes, red serves as a powerful stimulus that demands attention redirection (Fortier-Gauthier et al., 2013; Kuniecki et al., 2015). Hence, using the colour red in labelling requires caution, as it undeniably ensures visual attraction but not necessarily a subsequent preference.

Not to be overlooked is the colour of the bottle itself, encompassing the glass colour and, at times, the product hue when the glass is transparent. For rosé wine, the intensity of the pink colour significantly influences bottle preference, particularly among Millennials and Generation Z, as the vivid wine hue is associated with higher quality compared to the more conventional tones of red and white wines (Elliot and Barth, 2012; Iazzi et al., 2019). Conversely, in the case of champagne, brown glass tends to convey a perception of cheapness and lower quality.

The Brand Name's Influence

The brand name is a critical cue that significantly shapes consumers' perceptions and, consequently, their choices (Lockshin and Rasmussen, 2000; Ha and Perks, 2005; Kelley et al., 2015; Creusen et al., 2018). Research article 4 aims to delve into this topic by examining the interplay between brand familiarity and label design when evaluating champagne bottles.

In the realm of champagne, branding and design are pivotal attributes that convey the product's quality. The research's findings reveal that brand familiarity exerts a positive influence on consumer choices, with individuals favouring products bearing a brand name they recognize. In this context, the design serves to reinforce the notions of luxury, refinement, and product quality, albeit as a secondary factor compared to the brand.

Conversely, when it comes to products from lesser-known brands, the modern and intricate design - rich in details - significantly sways consumer preferences, steering them away from bottles with a more traditional and simple design, which tends to evoke perceptions of a cheaper and lower-quality product.

Hence, a comprehensive examination of the brand's effect, particularly in the case of luxury items such as champagne, is essential for gaining insights into consumer preferences and, more importantly, for identifying the requisite marketing strategies that should be implemented to enhance the product's market positioning.

Finally, the role of visual attention during the evaluation of these products is decisive for the choice. On one hand, consumers may be attracted to unfamiliar or less well-known brands, they may have doubts, they can choose the quality of the

product and choose the familiar brand because it is perceived as more reliable. Therefore enhancing the product through advertising campaigns could be an excellent solution to strengthen the brand image.

Consumer Neuroscience on Product Assessment

Consumer neuroscience techniques represent a burgeoning area of study aimed at comprehending the impact of extrinsic cues on product assessment. Within this domain, we harnessed the power of both eye-tracking techniques and EEG methods to delve into the intricacies of visual attention mechanisms and their role in influencing consumer behaviour.

The use of eye-tracking and EEG offered a comprehensive perspective, allowing us to discern peculiarities, similarities, and differences in the results obtained. Eye-tracking, in particular, not only unveiled which aspects of a product proposal held the greatest sway over consumer attention but also served as a predictive model of choice, shedding light on the factors that guided consumers in their decisions. In contrast, EEG analysis did not provide predictive insights into participants' choices but highlighted how the visual attention reflected in the brain behaves even before the eye movement. It also revealed that visual attention mechanisms change over time, evolving from an initial phase to a final one that constitutes the decision-making process.

A recurring theme that emerged from both experiments was the importance of visual salience in label design. But products must also sustain the consumer's attention during his decision-making process. Furthermore, familiarity with the brand, especially in the case of champagne, plays a decisive role in the choice, shaping consumer preferences. These notions highlight the multifaceted nature of consumer preferences and the intricate interplay between initial attraction, sustained involvement, and final choice.

4.3. Theoretical and Practical Implications

This thesis aims to contribute to the ever-evolving field of wine marketing research by delving into the intricate realm of consumer behaviours and opinions. The primary goal is to provide valuable information and knowledge that can be leveraged by researchers, wineries, marketers and designers to enrich and elevate the overall wine-drinking experience.

Moving from a macro perspective, which focuses on wine regions, to a micro perspective, focused on specific viticultural products, this research effort aspires to address and fill existing gaps in the literature. It does this by systematically investigating several crucial aspects of consumer perception and behaviour. Specifically, the study examines:

1. Extrinsic cues and their influence: The aim is to uncover how external factors affect consumers' perception of wine quality, revealing their pivotal role in shaping consumer preferences and overall wine consumption experiences. This understanding can empower stakeholders in the wine industry to craft more impactful marketing strategies.
2. The power of user-generated reviews: In today's digital era, user-generated reviews wield considerable influence over consumer satisfaction. This research explores the potency of such reviews in evaluating customer contentment, shedding light on their significance in the modern wine market landscape.
3. Visual attention and decision-making: To investigate the interplay between visual attention and the decision-making processes of wine consumers. This analysis offers valuable insights into the cognitive mechanisms that drive consumer choices, which can, in turn, inform design and marketing strategies.

In summary, this thesis strives to provide both theoretical and practical contributions, offering guidance and recommendations for the valorisation of the product and the winescape.

4.4. Limitations and Future Directions

The studies documented in this thesis present some limitations, which in turn open promising avenues for future research. Despite efforts to mitigate methodological shortcomings, it is essential to recognize that this thesis is not entirely immune to errors. Therefore, the reliability and validity of the research study can be further improved in future experiments. In this regard, I wish to outline several directions that are worth exploring in future investigations.

First, I used a limited number of stimuli, both regarding the chosen wine regions and the bottles of wine/champagne. Researchers might consider increasing the number of stimuli involved in the study. A greater number of stimuli could provide a more accurate analysis of individual preferences for wine products and services. Second, future research could increase the number of extrinsic cues analyzed in the experiment. For example, researchers could analyze the effect of other extrinsic cues, such as price or country of origin, on individual preference for wine/champagne. Ultimately, researchers could study the combined effect of multiple extrinsic cues on the subject's eye and brain activity and preferences. This, in turn, could shed light on which extrinsic cues exert the greatest influence on individual preferences.

A third avenue of exploration concerns sample segmentation. Both in the evaluation of services and products this aspect was relatively underestimated. On the one hand, platforms such as TripAdvisor often lack comprehensive social and personal information about the tourists who contribute reviews and, on the other hand, product rating studies have predominantly presented a homogeneous sample of Millennials and Generation Z individuals with rather similar. Consequently, it would be valuable to discern consumer preferences across various market segments, thus enabling the formulation of more targeted marketing strategies.

Furthermore, the integration of eye tracking and EEG, as undertaken in this study, presents an intriguing approach to understanding the interplay between individual preferences, eye and brain activity, and the evaluation of extrinsic signals. Future investigations could consider consolidating these tools into a holistic evaluation framework to unravel the mechanisms governing consumers' visual attention,

preferences, and behaviours. In addition, researchers can explore the use of additional neuroscientific tools that monitor aspects beyond visual attention, including hormonal responses, heart rate, respiratory rate and skin conductance responses. For example, the incorporation of a Galvanic Skin Response (GSR) device, which measures subjects' electrodermal activity (EDA), can serve as a psychophysiological indicator of emotional arousal, offering valuable insights into the emotional impact of products and their components, such as label and packaging design.

Finally, it is imperative to underline the importance of conducting a comprehensive analysis of the economic implications arising from this research. Such analysis can provide insight into potential impacts on industries, markets and policy decisions, providing valuable guidance for future strategies and efforts in this area.

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Chapter 4

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