

# SENSORY-MARKETING-EVALUATION OF E-COMMERCE WEBSITES WITH ARTIFICIAL INTELLIGENCE

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**Abstract** Multisensory consumer engagement on e-commerce websites is technically limited to visual, acoustic, and written elements. Consumers communicate, buy, and share products and services via digital environments in which sensory information is limited. To improve consumers' online sensory experience, media types and the content need to be quantitatively assessed and adapted. This project aims to develop a quantitative model, an Online Sensory Marketing Index (OSMI), which assesses e-commerce websites in multisensory communication quality. The OSMI will be supported by an automatic procedure that is based on artificial intelligence. Content of texts, images, and videos is evaluated by natural language processing (NLP), natural language generation (NLG) as well as automatic machine learning (AutoML) procedures. Multiple e-commerce websites from various industries are examined.

**Keywords:**  
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index  
(OSMI)

## 1 Introduction

In the past three decades, researchers have reported that all five human senses have an immense significance towards consumers' purchasing decisions, and many organizations modify their marketing activities accordingly. 'Sensory marketing' is becoming increasingly important in research and practice and is underpinned by the progressive debate in the scientific literature during the last decade (Bleier, Harmeling, & Palmatier, 2019; Krishna, 2012; Peck & Childers, 2008). It is partly due to the increasing number of exchangeable products and an information overload for consumers. Besides, the increasing intensity of competition makes it more difficult for suppliers to attract consumers' attention. Consumer and buyer behavior have also changed dramatically in recent years because today, consumers strive for individualization and personalization. Sensory information about products and services can influence people's attitudes, purchasing intentions, and consumption (Petit, Cheok, Spence, Velasco, & Karunanayaka, 2015). All perceptible stimuli of a product, e. g., a new dress or car, offer valuable information about the product's perceived quality and can have a significant influence on the purchasing decision process (Elder & Krishna, 2010; Krishna, Cian, & Sokolova, 2016). After all, (advertising) messages always have a more substantial effect if they affect the consumer through more than one sense (Krishna, 2012).

As a result of consumer and buyer behavior changes, sensory marketing has increasingly become part of the scientific discourse. Krishna defines sensory marketing as "marketing that engages the consumers' senses and affects their perception, judgment and behavior" (Krishna, 2012). Impressions about seeing, hearing, feeling, tasting, and smelling are decoded in the human brain (Barsalou, 2008). People can react and possibly buy a product or a service. A sensory approach's advantages are obvious: an increase in attention for the product and/or the brand, a resulting higher memorability value, and ultimately faster recognition, combined with the possibility of differentiation from the relevant competition (Krishna, 2012).

The question arises as to which e-commerce strategy should be implemented for sales via the Internet. - The fundamental problem with marketing goods digitally is that some human stimuli cannot be directly addressed or only to a minimal extent because direct contact with the consumer is not apparent. This limitation applies

especially to haptics when consumers cannot feel the quality of clothing, for example, as they are used to in terms of weight or material properties (Klatzky, Lederman, & Matula, 1993). Nevertheless, current statistics confirm that the e-commerce channel is on a growth course, particularly in the US, Asia, and Northern Europe (Pappas, Kourouthanassis, Giannakos, & Lekakos, 2017). Furthermore, forecasts for the coming financial year point to even more significant growth of up to \$4.93 trillion in 2021, which will be more than double compared with the 2017 year's expenses of \$2.3 trillion, driven by about 1/4 of the world's population already shopping online (Adam, Alhassan, & Afriyie, 2020; OECD, 2020).

## **2 Problem definition**

### **2.1 Problem Definition**

Sensory marketing is currently at a tipping point because the challenge lies in transferring the digital world's address. This leads to a complex environment in which e-commerce business constantly demands new communication and style to be resistant to future challenges (Bleier idr., 2019). To enable such a tremendous change, it is required to design a new understanding of sensory marketing in terms of digitization. The literature offers various ways to acknowledge changes and presents some hints towards them. Nevertheless, acknowledging research in sensory marketing of the last two decades leads to the assumption that an overarching viewpoint needs to be taken in a digitally changing world. However, current research does not provide a holistic and measurable view of how an e-commerce website needs to look like from a sensory perspective. The main problem is that current sensory marketing models do not quantitatively incorporate digitization trends and sensory aspects of communication. There is no generic guidance on how to design an e-commerce website in an appropriate way regarding sensory marketing that allows the evaluation of the sensory communication quality.

The question arises of how sensory elements can be measured on a website. Sensory elements can be accommodated in pictures, texts, and videos and a collection with manual methods is possible and practicable. In recent years, however, artificial intelligence (Ekbia, 2010) has developed to such an extent that automatic acquisition and identification of sensory elements should be possible. The methods of choice for our project are "natural language processing" (Buchkremer idr., 2019) and

"automatic machine learning" (Braka, Buchkremer, & Ebener, 2020) for the acquisition and analysis of text, images, sounds, and videos (Kacprzyk & Zadrozny, 2010; Truong idr., 2019).

Thus, online sensory marketing research is still in its infancy, and a deeper analysis must be carried to fill this gap. Thus, the research project will pick up on the need described above and create an automated assessment framework named Online Sensory Marketing Index (OSMI). The following paragraph highlights the scientific objectives and related research questions.

## 2.2 Scientific Objectives

The related problem scope frames the research area and presents questions that the project will answer. It furthermore details aspects where the OSMI delivers specific answers to the solution. The OSMI is based on two interdisciplinary models. First of all, the Web Quality Index (WQI) can be considered as an assessment measure for websites in general (Fernández-Cavia, Rovira, Díaz-Luque, & Cavaller, 2014). Secondly, the model developed by Hultén (Hultén, 2011) serves as a framework to describe sensory elements in marketing. The digitization trends have no long history, and thus, no generic (online) sensory evaluation model has yet been developed. For this reason, research is based on the problem of the extent to which compensation can be achieved by combining two or even more sensory stimuli and how this affects consumers and their purchasing behavior keeping in mind that direct sensory consumer appeal on e-commerce websites is limited to visuality and acoustics (Bleier idr., 2019; Petit, Velasco, & Spence, 2019; Yazdanparast & Spears, 2013).

An evaluation framework would provide the following benefits to the body of knowledge in online sensory marketing design:

- Pattern search for best practice success factors: initially, an evaluation framework allows to assess existing data. Various dimensions of the OSMI can be evaluated regarding patterns that different e-commerce websites provide. Therefore, presenting guidelines for further implementation of other e-commerce websites is a prerequisite.

- Sales increase: an OSMI-based optimization of e-commerce websites leads to a better consumer approach, a viable generic argument of using the framework for business purposes.
- Cost savings: A practical and validated online sensory consumer experience could, among other things, reduce the cost to retain the customer.

The most significant disadvantage of the digital customer journey is that customers are not directly able to inspect the product and have to wait a particular time for it, under uncertainty of the accuracy of the shown representation (Hong & Pavlou, 2014). A sensory consumer approach could remedy this. For instance, a virtual touch becomes a crucial aspect in online shopping and will be examined in more detail later (Brasel & Gips, 2015).

This research project aims to create an automatic assessment framework for sensory communication quality that answers the problem mentioned above. To reach this goal, the following research questions (RQ) are addressed as the underlying structure that guides the overall research process:

RQ1: To what extent can industry-specific taxonomies be determined based on OSMI measurements?

Based on the current status, OSMI evaluations of e-commerce websites need to be acquired manually. The question arises whether it is feasible to encode the whole website automatically into a keyword catalog/taxonomy related to sensory stimuli.

RQ2: To what extent is the automated extraction and identification of OSMI elements possible through artificial intelligence?

The automated examination of e-commerce websites includes additional components beyond the pure text, such as the image material's quality and the acoustic elements. For this reason, the OSMI needs to be expanded to all media types to be evaluated by artificial intelligence.

RQ3: To what extent is it feasible to quantitatively determine and compare industry-specific OSMI scores?

Building upon RQ1 and RQ2, the next step is to generate an automatically running OSMI framework, which is, in the first instance, able to crawl websites for sensory keywords. Using, e.g., the keyword catalog, a comparison is made to determine whether the automatic assessment result is identical or even better compared to the index from the manual analysis.

RQ4: How can guiding principles for the determination and application of OSMI indices be generated?

Finally, the last research question relates to OSMI recommendations that can be derived predominantly from quantitative research to make the OSMI most useful for practitioners.

### 3 Methodology

We plan to use qualitative and quantitative research methods to specify the final OSMI evaluation framework. Qualitative research is used to develop a set of hypotheses that are tested with a quantitative study. The initial qualitative research uses qualitative content analysis (Hsieh & Shannon, 2005) as the foundation of an exploratory study to develop indicators for each framework's parameter. A qualitative approach is chosen for the exploratory study (Petit idr., 2019). Sensory marketing trends have been researched in terms of digitization to existing frameworks. Within this research scope, it is considered a success factor to include existing sensory marketing insights and assessment tools from scientific disciplines in general into consideration. It is planned to derive the OSMI from analyzing existing literature related to online consumer experience and sensory marketing trends. The chosen research method furthermore concentrates on the reduction of data by paraphrasing and categorizing. Analogous to the study by Fernandez-Cavia et al. (2014) (Fernández-Cavia idr., 2014), the evaluation model makes use of indicators that apply different scales: The scale 0-1 in case a specific characteristic is present or completely absent. The 0-2 or 0-3 scale, on the other hand, in the case of a more specific assessment basis, which allows more factual statements to be made about the quality of the characteristic, e.g., Weak (0); Standard (1); Good (2); Excellent (3). The combined index across all senses can be seen as a general evaluation of the sensory quality of the analyzed e-commerce website. The closer the OSMI value is to 1, the more successful the website communicates concerning

sensory marketing theoretically by excluding possible sensory overloading effects. A score close to 0, on the other hand, suggests that the website does not contain sensory elements and does not meet the indicators for successful sensory consumer demands that are necessary and relevant for an e-commerce website. The general advantage of the method chosen here is that these indicators allow comparisons to be made between the websites analyzed, and those can be identified that have received a positive rating and can be compared with one another based on individual indicators. In this way, examples of good and less good sensory designs can be identified. An analysis of the improvement potential is easily possible by the specific details to be used fundamentally for pointing out sensory optimizations. According to this, the research methods of the research can be classified as follows:

At the early stage of research, it is planned to conduct expert interviews with marketing leaders to obtain opinions and suggestions for improvement on the status quo of the OSMI. Besides, a taxonomy for the five human senses (classification scheme) must be built manually about qualitative research. In this, a keyword catalog is created, which bundles related sensory terms per sense. The associated goal is to visualize patterns for various branches and relationships of sensory information represented in texts used on these e-commerce platforms to point out best-in-class sensory communication quality.

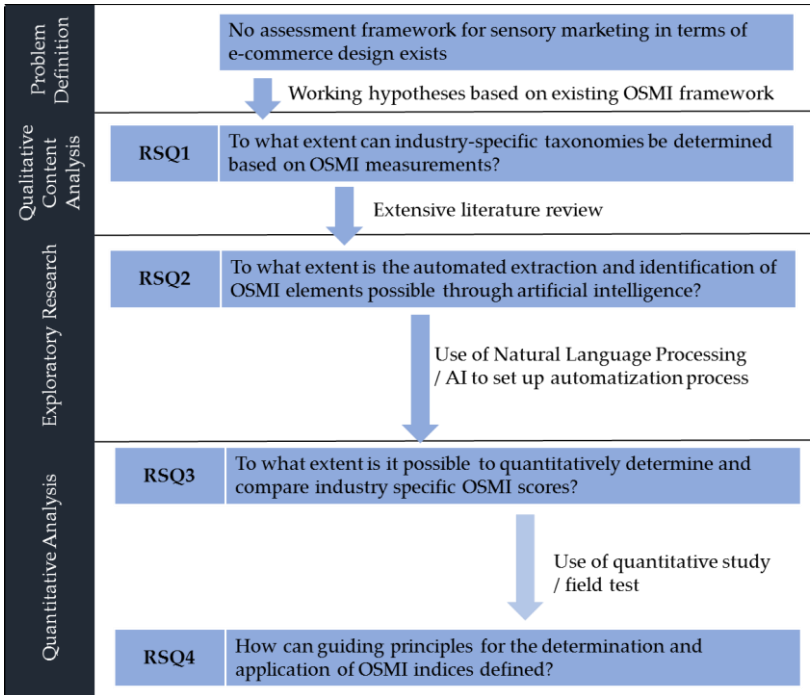
In a second step, the manually based keyword catalog will be developed within the framework of an automated tool, enabling to crawl off the e-commerce websites according to the compiled terms, and a score is automatically generated. At this research project level, the Online Sensory Marketing Index will be combined with Artificial Intelligence (AI). The aim of this idea is that the OSMI becomes an automatically running system to check and evaluate an e-commerce website in terms of sensory communication quality. AI has to evaluate e-commerce websites fully automatically, including presenting an overview of rankings for each examined parameter. Based on rankings, further recommendations are possible and should also be automatically displayed by the OSMI and its use of AI. In detail, it is planned to make use of natural language processing (NLP) as a text mining method (Manning, Bauer, Finkel, & Bethard, 2014). It is not intended to use a cluster analysis as an approach since the dimensions investigated have already been determined with the five human senses. With the use of NLP, it will be possible to be focused on keyword extraction on the one hand but also spoken language in audio or video

elements, the so-called speech processing, on the other hand. Further, it is under consideration to extend the new OSMI framework towards sentiment analysis to extract meanings of sensory formulated texts automatically (Collobert idr., 2011). This information extraction technique should also include metaphors, which usually require learned interpretation patterns.

To complement the new OSMI approach, the automated assessment tool will also be extended to analyze other relatively objective website components and sensory indicators like, for instance, 3D-elements, background colors, or the resolution of product or mood pictures in general via automated machine learning using Cloud AutoML. This allows generating a grammatical score to be recorded with a “complication index” based on the text length. In this context, the weighting of individual keywords and their positioning within texts or web pages is to be examined, which could then be taken into account in automatic indexing.

Finally, the automated AI OSMI framework is to be compared quantitatively with the analogously determined values employing a field test of approximately 80 to 100 e-commerce websites of mainly global brands. Implementation will be done in collaboration with companies from various industries to determine the OSMI in a feasible way.





**Figure 1: Research Process**

As depicted above, the research process is vertically divided into four phases, four research questions, and a plan for writing papers. It starts from the problem definition and qualitative content analysis over the exploratory research towards the quantitative analysis and summing up with the research results. The size of each box represents the scope of investigation of the respective phase of the research. Starting with the first phase, the research process initially needs to be framed within guiding hypotheses as a foundation. The problem definition phase is mainly intended to show, based on current scientific literature, that no model exists that is capable of generating qualitative assessments of the sensory consumer appeal on e-commerce websites. As mentioned above, also expert interviews are to take place at this point to critically review the current OSMI approach and to get further improvement.

The second phase, the qualitative content analysis, follows this and examines the current scientific literature concerning the topicality of the sensory indicators. It will also be examined whether additional sensory indicators could supplement the OSMI approach.

The exploratory research, the third phase, will then deal with the new OSMI approach based on artificial intelligence. Therefore, as mentioned above, NLP methods, including keyword extraction, and AutoML will be examined. This phase's results will be published within a paper to document the current status of the research.

With the previously developed automated evaluation model, a quantitative analysis can then be aimed at the fourth and last phases. In this section, the automated evaluation of numerous practical examples with the manual evaluation of sensory communication quality will be compared. Finally, we will critically examine the effectiveness of the new OSMI approach to give practitioners advice.

#### **4 Preliminary/Expected results**

Within the experimental quantitative phase, we expect that some sensory communication aspects can be evaluated via machine-based methods in principle. We recently conducted an extensive test in a big data project with 40 students to support our assumption. Here, students had to independently analyze different senses on given, international e-commerce platforms with big data methods. After crawling text and images using various methods, they could intensively evaluate data and assess the quality of sensory communication. For this purpose, texts were evaluated using word embedding technologies on the one hand (Horn, Erhardt, Di Stefano, Bosten, & Buchkremer, 2020), (Hussain idr., 2020), and elements of images were recognized using object recognition via a Google cloud framework on the other. Interesting results can already be seen, for example, in the fact that concerning examined e-commerce websites for wines, tendencies are recognizable to the effect that the taste and associations of red wines are often related to images with chocolate - white wines, on the other hand, relates to pictures of lemons. We already presented this first investigation's approach in a technical article published at the INTED 2021 conference (Hamacher & Buchkremer, 2021).

#### **5 Future development**

Some researchers present ongoing developments towards digitizing of senses - see also Spence, Obrist, Velasco, & Ranasinghe for an overview (Spence, Obrist, Velasco, & Ranasinghe, 2017). Knowledge from the field of sensory marketing can often be transferred to the digital space. Thus, e-commerce consumer experience, as

a particular field of online consumer experience, has enormous potential to be enriched with sensory communication aspects. For instance, a good mood can compensate frustration caused by a lack of haptics (Yazdanparast & Spears, 2013). An appealing design of the online shop, positive product descriptions or ratings, chats with friendly consultants, plenty of humor, and/or stimulating images can attract people with a high need for touch to online shopping (Roggeveen, Grewal, Townsend, & Krishnan, 2015; San-martín, González-benito, Martos-partal, & San-martín, 2017; Yazdanparast & Spears, 2013). For this and other reasons, the intersection of these two dimensions is extensive.

Assessment frameworks for the two dimensions only exist to a minimal extent. Some key performance indicators in online consumer experience are known, for example, a bounce rate or a click rate, but there is a lack of qualitative metrics, especially in terms of online sensory communication quality. An overall assessment framework for offline and online communication elements is missing in sensory marketing but very important due to the findings described in this paper. Going along with this argument, artificial intelligence is the key to fill existing technology knowledge gaps. Accordingly, AI will have a crucial role in designing online sensory consumer experiences in the future. For the time being, it is evident that sensory marketing, in particular, does not have extensive research contacts with AI. Therefore, the overall goal is to connect these dimensions more closely and thus close the mentioned knowledge gap.

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