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KRISTIAN PENTUS

A Conjoint-Enriched Neuromarketing Research Framework for Package Design Research

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School of Economics and Business Administration, University of Tartu, Estonia

This dissertation is accepted for the defence of the degree of Doctor Philosophiae (in Economics) on electronic voting from the 24th of April 2026 by the Council of the School of Economics and Business Administration, University of Tartu.

Supervisors: Prof. Andres Kuusik, PhD, University of Tartu, Estonia;

Prof. Andero Uusberg, PhD, University of Tartu, Estonia;

Opponents: Jesper Clement (PhD, Associate Professor, Department of Marketing, Copenhagen Business School, Denmark)

Tim Holmes (PhD, Independent Neuroscientist, affiliated with Royal Holloway, University of London, United Kingdom)

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- **Dorokhova, L.; Pentus, K.; Kuusik, A.; Dorokhov, O**. (2023) Comparison of Pharmacy Websites: An Integrated Approach Based on Consumer Perception and Technical Parameters, *Studies in Business and Economics*, 18(1), 101–117.
- **Pentus, Kristian; Ruusu, Mariia; Kuusik, Andres; Dorokhova, Liudmyla; Ploom, Kerli.** (2023) How sexualised images in advertisements influence the attention and preference of consumers with a modern view*, Organizations and Markets in Emerging Economies, 14(2), 366–385.*

Conferences and Presentations

1. The effect of element design in package designs evoked emotions and attention. 25th Innovation and Product Development Management Conference (IPDMC), 10–13 June 2018, Porto, Portugal.
2. Does sex sell – adverts eye tracking study. Proceedings of the European Marketing Academy (EMAC) 2022 Regional Conference, 21–23 September 2022, Kaunas, Lithuania.
3. The impact of package label's design preference on consumer's attention and purchase intention. Proceedings of the European Marketing Academy (EMAC) 2023 Annual Conference, 24–27 May 2023, Odense, Denmark.
4. Enhancing Pension Engagement: The Impact of Visuals and Interactivity. IAREP 2025 – The International Association for Research in Economic Psychology Annual Conference, 17–20 June 2025, Tartu, Estonia.
5. Social Density and Perception of Urban Nature and Built Environments. Reading Emotions – Facial Expressions of Emotion Conference, 26–27 June 2025, University of Reading, Reading, United Kingdom.

INTRODUCTION

List of original studies

This dissertation is based on the following original publications:

- **Article I:** Pentus, K., Ploom, K., Mehine, T., Koiv, M., Tempel, A., & Kuusik, A. (2020). Mobile and stationary eye-tracking comparison: Package design and in-store results. Journal of Consumer Marketing, 37(3), 259–269. https://doi.org/10.1108/JCM-04-2019-3190
- **Article II:** Pentus, K., Mehine, T., & Kuusik, A. (2014). Considering emotions in product package design through combining conjoint analysis with psycho physiological measurements. Procedia – Social and Behavioral Sciences, 148, 280–290. https://doi.org/10.1016/j.sbspro.2014.07.044
- **Article III:** Pentus, K. (2023). A systematic review of food product conjoint analysis research. ACCESS: Access to Science, Business, Innovation in Digital Economy, 4(3), 480–502. https://doi.org/10.46656/access.2023.4.3(11)

Topicality, research problem and motivation

In today's saturated consumer marketplace, packaging design is a crucial tool for standing out from competitors and influencing point-of-sale decisions. While earlier literature has suggested failure rates as high as 80%, Castellion and Markham (2013) empirically place the new product failure rate at approximately 40%. This is still quite a high rate; Nielsen (2014) links many of these failures to insufficient consumer insight, a perspective complemented by Dijksterhuis (2016), who argues that the inadequate use of behavioural science also heavily contributes to new product failure. Before a product can be considered or purchased, it must first be noticed. Research consistently demonstrates that atypical packaging shapes and bold, contrasting colours stand out on crowded shelves, rapidly capturing consumer visual attention (Schoormans & Robben, 1997; Garber et al., 2000; van der Lans et al., 2008a). Conversely, uninspired or visually indistinct packaging risks being entirely overlooked by consumers during the decision-making process (Vermeir & Roose, 2020). Once attention is successfully captured, the packaging must then communicate value. Ren and Anuar (2024) and Belliza and Kusumawati (2024) demonstrate how visual elements effectively convey product attributes. Meanwhile, Yadav (2024), Li et al. (2024) and Priyanto and Yeh (2024) find that clear labelling supports trust. Thus, package designs must be optimised for the target consumer, which demands research, not just intuition.

Traditional marketing research methods, such as surveys and interviews, are often limited by social desirability bias. Consumers may report what they believe is expected of them or what aligns with social norms, rather than what they actually prefer or what motivations (subconscious) they have (King & Bruner,

2000). Neuromarketing addresses these limitations through neuroscientific and physiological tools that capture subconscious processes and emotional responses beyond self-report (Alsharif, Md Salleh, & Baharun, 2021). Neuromarketing aims to understand how marketing stimuli (in this case, package design) influence consumer attention, emotion and choice. It extends beyond brain imaging to include tools such as eye tracking and facial expression analysis (Lee et al., 2007; Alvino et al., 2019). In this dissertation, it is viewed as an interdisciplinary toolbox that links psychological constructs with measurable biological responses to packaging design (Morin, 2011; Fortunato et al., 2014).

The question then becomes which neuromarketing research methods should be used to understand which packages would perform better for a target customer. Package design consumer research is usually concerned with which package designs would be chosen and would do better in the market. This links the research to consumer behaviour and the choice behaviour process, which consists of three broad stages (cognitive, affective and behavioural) (see Figure 1). In those stages, package design can attract attention, generate emotion and influence people to choose a product. Based on this, the research methods used here are eye-tracking (attention/cognitive), facial expression measurement (emotion/ affective) and conjoint analysis (choice/behavioural). Eye-tracking can reveal how people find, compare and process package design information and visual cues. Facial expressions can reveal emotional valence, indicating how much a person likes a package. Conjoint analysis can reveal the consumer evaluations driving eventual choice. This approach introduces a problem: package design is always a combination of elements, and it is not easy to quantify or narrow down which visual elements contribute to positive emotions or faster shelf recognition. However, conjoint analysis – which uses an orthogonal design for the design cards – can address this when it is combined with eye-tracking and emotion measurement. Eye-tracking attention and emotion measurement data can be used as inputs to the conjoint model.

Classical conjoint analysis assesses the importance of different package design elements in consumer choices, but does not indicate whether consumers pay attention to them. Eye-tracking can complement conjoint analysis by showing which elements are viewed (Ellis & Smith, 1985; Wästlund et al., 2015; Chandon et al., 2009). While eye-tracking can effectively identify which specific design elements capture a consumer's visual attention in-store (Gidlöf et al., 2013), this observational data alone cannot easily disentangle the specific drivers of that attention. For example, eye-tracking can confirm that an image was seen. However, it cannot mathematically isolate whether the attention was due to the image itself, the background colour, or their interaction. To overcome this and quantify the specific 'part-worth' importance of each element (an isolation difficult to achieve with standard A/B testing), this research employs conjoint analysis. Combining eye-tracking with conjoint analysis offers a refined view of how design features influence consumer attention and choice (Vidal et al., 2013; Ma & Zhuang, 2021). This same logic can be extended by simultaneously using emotion measurement data as input for conjoint analysis.

This dissertation addresses three gaps in the research on neuromarketing package design: its theoretical, methodological and interpretational weaknesses. These three limitations follow a logical pattern as they are three layers of research. They form a cascading problem: weak theoretical grounding (GAP-Theo) leads to fragmented or weak data collection strategies (GAP-Meth), which, in turn, make it difficult to compare or interpret the results (GAP-Interp). This dissertation addresses the cascade in the same order. First, it anchors the neuromarketing package design research in established consumer behaviour models. This is done by combining attention, affect and choice. Second, it proposes a multimethod protocol that triangulates eye-tracking, facial expression measurement, and conjoint analysis within a single experimental design. The key here is that conjoint analysis is used for consumer choice analysis and as a framework for experiment design in eye-tracking and facial expression analysis. Finally, feeding attention and emotion metrics into the conjoint analysis model provides a systematic way to interpret these data and relate observed responses to specific package-design elements. Therefore, addressing the gaps sequentially on these three levels supports the development of an integrated, theoretically grounded and methodologically rigorous framework for package-design neuromarketing research.

An underlying theoretical limitation in neuromarketing package design research is the lack of integration of consumer behaviour models, referred to in this dissertation as **GAP-Theo**. While neuromarketing studies frequently focus on isolated emotional states or attention metrics, there is a significant opportunity to better integrate these findings with established behavioural models. Such models are essential for understanding the complex interaction of emotions, cognition, and attention in decision-making (Lerner et al., 2015). This disconnection between neuromarketing metrics and behavioural theory undermines the explanatory power of neuromarketing research. Consequently, current approaches fail to contextualise how attention and emotions shape a consumer's decision, missing the potential for a deeper, theory-informed understanding of consumer behaviour.

The broader theoretical models behind consumer behaviour must be considered to address the theoretical gap. Many well-known consumer behaviour models, such as the CAB (Cognitive, Affective, Behavioural) framework (Rosenberg & Hovland, 1960), the five-stage model (Engel, Kollat, & Blackwell, 1968), and AIDA (Attention, Interest, Desire, Action) (Lewis, 1898; Strong, 1925), share similar building blocks even as their specific scopes differ. While AIDA and the five-stage model outline the chronological sequence of a purchase, they are fundamentally underpinned by the structural components of attitude formation described by the CAB framework. These models can be placed side by side to demonstrate recurring stages and similarities in each step, illustrating how cognitive and affective processing ultimately drive behavioural choice (Figure 1).

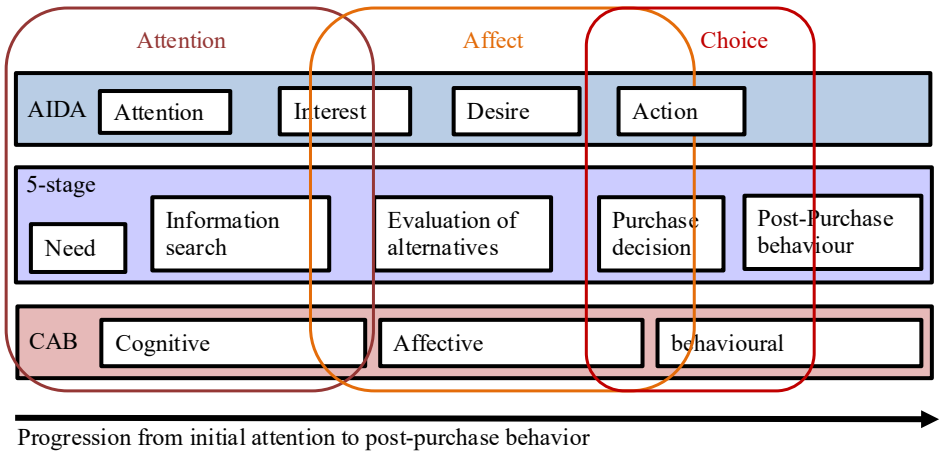

Figure 1: Three commonly used consumer behavioural models and their three common behaviour stages. Source: created by the author based on previous models (Rosenberg & Hovland, 1960; Engel, Kollat, & Blackwell, 1968; Lewis, 1898) compiled by the author.

When looking at the similarities of these three linear consumer behaviour and choice models, we can deduce three broad stages. Even as the stages overlap in time, each is defined by a dominant psychological process – attention, affect and evaluating alternatives for choice. Combining consumer behaviour models forms a reasonable basis for understanding which steps in a consumer's buying process a research method addresses.

The stages are depicted as overlapping to account for inevitable variance in real-life consumer behaviour. For instance, in most cases, a package design evokes emotions after it is noticed (i.e. fixated on). However, at other times, package design elements can elicit emotion even before the consumer fixates on a product, as emotional cues are a part of the system of how we choose fixation targets from our peripheral vision (Calvo & Lang, 2004; Nummenmaa, Hyönä, & Calvo, 2006; Orquin & Lagerkvist, 2015). Likewise, attention and emotional processes precede choices in most cases, but exceptions exist, such as habitual choices primarily driven by automatic associations (Miller et al., 2019). Therefore, this simplified linear model (based on well-known consumer behaviour linear models) is justified and sufficient for the conjoint-enriched neuromarketing methodology.

The methodological gap in neuromarketing package design research lies in single-method approaches that limit a deeper understanding of consumers' choices **(GAP-Meth)**. While package design has been researched in various ways, triangulation of methods is rare. Some studies focus on the influence of packaging without using neuromarketing tools (Orth & Malkewitz, 2008; Ampuero & Vila, 2006; Underwood, 2003) and do not consider the roles of attention and emotion. Others examine consumers' emotional responses (Liao et al., 2015) or aesthetics (Reimann et al., 2010) but do not measure visual attention. Eye-tracking studies

examine attention (Clement, 2007; Clement et al., 2013; Ellis & Smith, 1985; Wästlund et al., 2015; Chandon et al., 2009; Gidlöf et al., 2013) but do not examine emotions, thereby ignoring the affective phase of consumer decision-making. While eye-tracking (Vidal et al., 2013) and FaceReader (Drozdova, 2014) are useful on their own, combining them can yield deeper insights (Casado-Aranda et al., 2022; Stasi et al., 2018; Bell et al., 2018). The consumer behaviour model with three phases (attention, affect, and choice) highlights the benefits of an integrated approach. Triangulating eye-tracking, emotion analysis and conjoint analysis gives a deeper understanding of how packaging impacts decision-making (Alvino et al., 2019; Erzberger & Prein, 1997).

A further methodological weakness from this methodological gap in neuromarketing research is the tendency to isolate variables rather than examine their interplay. Though attention and emotional responses can be measured using eye-tracking or facial expression analysis tools, each method captures only a partial correlate of the consumer decision-making process (e.g., visual attention versus emotional expression). Consequently, reliance on a single metric risks underrepresenting the full complexity of consumer behaviour, highlighting the need for methodological triangulation to enhance interpretive validity (Alvino et al., 2019; Erzberger & Prein, 1997). Studies that examine a single correlate provide less explanatory depth into how these variables co-influence perception and behaviour (Kauffman et al., 2019), which hinders generalisability (Alsharif et al., 2023). Moreover, this is also related to neuromarketing, inheriting the weaknesses of the replication crisis in psychology (poor measurement reliability, inadequate statistical rigour and small sample sizes) (Kelly & Hoptman, 2022; Maxwell et al., 2015; Lilienfeld & Strother, 2020; Shrout & Rodgers, 2018). Eye-tracking studies, for instance, often lack transparent technical reporting, which leads to poor replicability (Holmqvist et al., 2012; Bell et al., 2018). These weaknesses reflect structural issues in neuromarketing research, closely related to psychology's ongoing struggles with methodological rigour and theoretical cohesion (Morawski, 2019; Feest, 2024; Wiggins & Christopherson, 2019).

As a final layer of weakness, neuromarketing research also suffers from the complexity of data interpretation, particularly with eye-tracking and emotion measurements (**GAP-Interp**). Emotion measurement data from facial expressions or physiological responses can be ambiguous and may yield inconsistent results across studies. Methodological reviews highlight substantial limitations in ecological validity, data interpretation and generalisability (Bell et al., 2018). Empirical findings further demonstrate that explicit self-report and implicit emotion measures often show only weak-to-moderate correlations, reducing confidence in drawing definitive conclusions about consumer behaviour from facial expressions alone (Mehta et al., 2021). This challenge is heightened when integrating eye-tracking data, as Kauffman et al. (2019) suggest that understanding consumer attention and perception involves nuanced interpretations that can vary significantly. Without a simple framework for data interpretation, these challenges reduce the reliability and validity of neuromarketing research insights, as variations in interpretation may skew findings and limit applicability.

Aim and Objectives of the Research

This dissertation aims to develop a conjoint-enriched neuromarketing research framework for package design research. The specific objectives are:

Objective 1: Enhancing Conjoint Analysis with Emotion Metrics
Evaluate how conjoint analysis can be used to analyse facial expression and emotion metrics to clarify the role of visual package elements in choice.

Objective 2: Examining Attention Measurement in Package Design Research
Assess how eye-tracking setup (mobile vs stationary) and context (in-store vs static) influence attention metrics and derive implications for package-design research.

Objective 3: Mapping Biases in Food Product Conjoint Studies
Map and synthesise food-product conjoint studies to reveal biases across attribute types, sampling strategies and evaluation framings, highlighting design implications.

Objective 4: Developing an Integrated Neuromarketing Framework
Develop an integrated neuromarketing framework that links attention, emotion and choice within a conjoint analysis, and propose reporting standards for replicable research.

Philosophical Foundations and Research Paradigm

A conjoint analysis approach can enrich neuromarketing research on package design. In this dissertation, the author demonstrates how to plan, design and conduct scientifically valid, replicable and informative neuromarketing research on package design using the conjoint analysis research method.

This is primarily an epistemological dissertation, focused on how knowledge is constructed, validated and applied in neuromarketing research. It addresses research methods, assumptions, validity, analysis and the reporting of results. While package design is the object of this research and different theoretical concepts related to it are introduced, the thesis is fundamentally about establishing a methodological framework. It is grounded in epistemology, focusing on how these phenomena can be systematically studied through robust methodologies. The dissertation emphasises the development and validation of research tools rather than questioning the essence of the phenomena being studied. This distinction aligns with the scientific and practical needs of neuromarketing research, where the objective is actionable insights into methodologies and methods rather than philosophical debates on the reality of the underlying concepts.

This dissertation provides actionable insights while advancing methodological approaches in neuromarketing by situating the research within the pragmatic and

post-positivist paradigms. The research adopts a pragmatic paradigm, which evaluates theories and methods based on their practical utility and problem-solving potential (Goldkuhl, 2012; Shrestha & Sharma, 2024). Pragmatism aligns well with this dissertation's focus on integrating multiple methods (eye-tracking, emotion measurement and conjoint analysis) into a triangulated framework (using conjoint analysis itself as the base methodology). This paradigm prioritises methodological flexibility, enabling the researcher to adapt tools and approaches to effectively address complex questions in neuromarketing and package design (Turyahikayo, 2021).

Additionally, this dissertation draws on a post-positivist perspective, recognising the limitations of objectivity in human behaviour research while maintaining a commitment to rigour and replicability (Henderson, 2011; Ryan & Sfar-Gandoura, 2018). Post-positivism acknowledges the role of context, values and subjectivity in shaping research findings while relying on empirical evidence to build and refine understanding (Turyahikayo, 2021). This perspective aligns with the dissertation's aim to establish valid and replicable methodologies for understanding consumer behaviour.

Research design and methodology

This dissertation demonstrates that combining conjoint analysis with eye-tracking and emotion measurement enhances the methodological soundness of package design neuromarketing research. The three-stage consumer behaviour model (Attention-Affect-Choice) serves as the basis, with each of the dissertations' three original studies addressing one specific part of the model (Figure 2).

The three-stage consumer behaviour model framework provides a clear research path, and most of it has been covered by the three original empirical studies. However, while the author has conducted multiple research projects implementing attention-correlated conjoint and supervised multiple theses using this approach, none of these research projects has been published in a peer-reviewed journal. Hence, this part of the framework is not researched and remains a future avenue of research.

The sequence of articles reflects the development of the research model, beginning with emotions integrated with conjoint analysis (2014), advancing to an attention measurement comparison of mobile and stationary eye-tracking (2020), and finally to a systematic review (2023). Each article contributes to one stage of the consumer behaviour model. Had the review (Article 3) preceded the experiments, the design of Article 2 would likely have more explicitly stratified stimuli by intrinsic versus extrinsic attributes and pre-registered evaluation framing (preference versus purchase intent), given the biases and framing sensitivities later documented in the review.

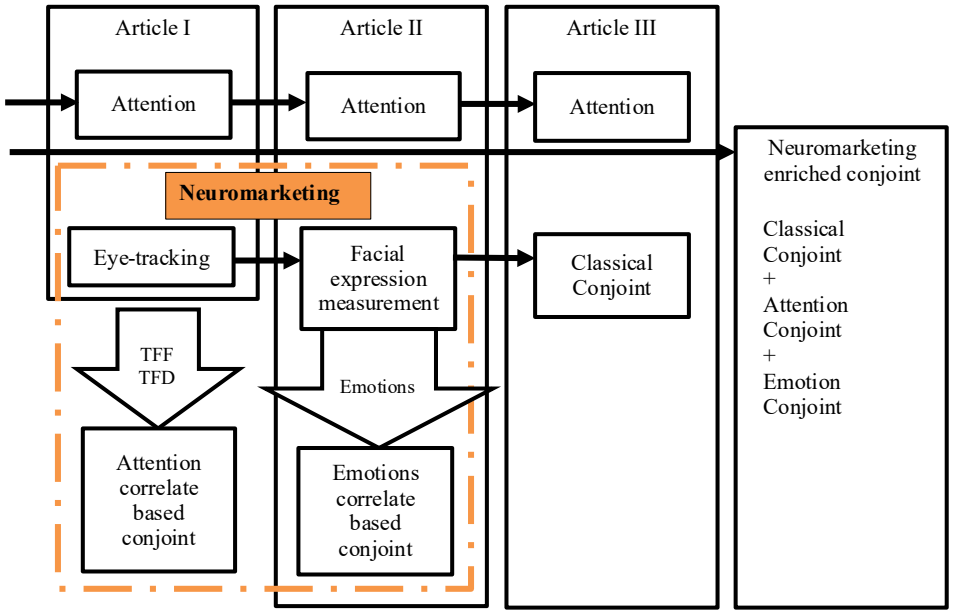

Figure 2: Alignment of consumer behaviour models with neuromarketing methods and the way the authors of three empirical studies researched these parts. TFF refers to time to first fixation, and TFD to total fixation duration; both serve as attention correlates within the conjoint-enriched neuromarketing framework compiled by the author.

Article 1: Pentus et al. (2020) investigate how different eye-tracking methods (mobile versus stationary) affect the accuracy of attention measurements in package design. This article highlights the role of methodological choices in obtaining reliable attention data for consumer analysis. RQ 1 examines the impact of mobile versus stationary eye-tracking on data accuracy, contributing to the research model's "Attention" and "Methodological Validity" dimensions. RQ 2 addresses the influence of centre-fixation bias on attention metrics in stationary eye-tracking studies, aiming to enhance data quality in stationary settings. These questions solidify the understanding of "Attention" measurement in dynamic and controlled settings while refining the methodological approach for future package-design studies.

> **RQ 1** How do eye-tracker type choices (mobile vs stationary eye-tracking) affect the validity of eye-tracking attention metrics in package-design research (biases such as centre-fixation bias)?
> **RQ 2** How do contextual settings (in-store shelves vs static displays) influence attention patterns, and what does this mean for optimising package design based on the results?

Article 2: Pentus, Kuusik, and Mehine (2014) examine the influence of emotions on consumer choices in food-package design, integrating conjoint analysis with psychophysiological measurements. This article aims to uncover the depth of emotional responses to visual elements in packaging and their impact on consumer decisions. RQ 3 explores how visual elements, such as colour and typography, shape consumer choices through emotional responses, positioning emotions as a critical aspect of the decision-making process. RQ 4 evaluates the effectiveness of combining conjoint analysis with facial expression measurements to capture emotional engagement with packaging, thereby emphasising the article's methodological contribution. Collectively, these questions contribute to the "Emotion and Choice" aspects of the dissertation's model, positioning emotional engagement as a core component in consumer decision-making.

> **RQ 3** How do emotional responses to specific visual package-design elements influence consumer choice for food products?
> **RQ 4** To what extent does a facial expression-based conjoint approach increase explanatory power over classical conjoint?

Article 3: Pentus (2023) systematically reviews food product conjoint analysis research, emphasising how intrinsic versus extrinsic attributes shape consumer preferences in package design. RQ 5 addresses how these attributes impact consumer choice, aligning with the research model's "Choice" and "Package Design" components. RQ 6 explores common subsampling methods in conjoint analysis for food products, enhancing the article's contribution to "Methodological Validity" by identifying ways to improve sampling rigour. These questions provide a critical lens on the model's "Choice" and "Consumer Behaviour" aspects, positioning the article as a foundation for understanding consumer preferences in package design.

> **RQ 5** What is the relative impact of intrinsic versus extrinsic attributes on consumer preference in food-package design?
> **RQ 6** How do study-design factors (subsampling strategy and framing evaluation questions) influence attribute-importance estimates in conjoint analysis, and how do these effects differ for utilitarian versus hedonic products?

This dissertation addresses three research gaps in neuromarketing package design research that arise from a lack of prior studies and the limitations inherent in previous work. These gaps have been identified throughout the introduction and are outlined here, linking them to the research questions in the associated articles. Table 1 aligns each research gap with the corresponding research questions, providing a clear roadmap of how this dissertation intends to contribute to the field.

Table 1: Research questions alignment with the three research gaps addressed by the empirical studies and this dissertation.

Gap	Focus	Aligned Research Questions
GAP-Theo	Anchoring neuromarketing in consumer behaviour theory	RQ 3
GAP-Meth	Designing reliable multimethod studies	RQ 1, RQ 4, RQ 6
GAP-Interp	Linking attention, emotion and choice at the element level and easing replicable interpretations	RQ 2, RQ 5

Source: compiled by the author

Coverage of Gaps Across the Dissertation

The empirical studies have covered the research gaps as shown in Table 2. However, as journals pose length limits and focus denies a broader approach, some aspects of the conjoint-enriched neuromarketing framework are not covered in the three articles on which this dissertation is based. These theoretical aspects are covered in the dissertation (see Table 2). In subchapter 1.1, the author extends the package design theories presented in the papers to explain product involvement by product type (utilitarian-hedonic scale and convenience, shopping and speciality) and to cover package design elements. In subchapter 1.2, the models underlying this dissertation's framework are discussed and integrated with neuromarketing measurement correlates – attention and emotions, which are also covered there. In subchapter 1.3, classical decision-making theories are explained and linked to emotions and attention. The second chapter addresses the methodology gap, explaining neuromarketing research and how eye-tracking, emotions, and choice-based conjoint analysis can be conducted. It also briefly covers the aspects of methodological rigour that are not explicitly mentioned in the articles.

Table 2: Dissertation components mapped to the research gaps this dissertation addresses

Dissertation components	GAP-Theo	GAP-Meth	GAP-Interp
1.1 Package design	✓		
1.2 The Role of Attention and Emotions in Consumer Decision-Making	✓		
1.3 Decision-making	✓		
2. Methods		✓	
Article I (Eye-tracking)		✓	✓
Article II (Emotion-based Conjoint)	✓	✓	
Article III (Attributes & Conjoint)		✓	✓

Source: compiled by the author

This dissertation adopts a consumer behaviour perspective on package design, showing how package elements guide attention, evoke affect and influence choice, rather than an organisation-centred view focused on production efficiency or branding consistency. From an industry standpoint, the proposed framework links behavioural outcomes with neuromarketing research data. Eye-tracking shows what was noticed, facial analysis shows how it was felt, and conjoint analysis connects both to choice, providing also a framework for empirical analysis. This integrated evidence-based approach turns conjoint-enriched neuromarketing analysis of package testing into a diagnostic tool for designing packaging that aligns with consumer cognition, emotion and choice. The author will demonstrate that integrating consumer behaviour models as a framework and combining them with conjoint analysis provides a strong foundation for a valid and replicable research design.

Contributions of Individual Authors

Article I. Mobile and stationary eye-tracking comparison: Package design and in-store results (Pentus, Ploom, Mehine, Koiv, Tempel, & Kuusik, 2020, Journal of Consumer Marketing).

This article was co-authored with Kerli Ploom, Tanel Mehine, Madli Koiv, Andres Kuusik and Age Tempel. Kristian Pentus was responsible for designing the research, conducting the data analysis, interpreting the results and writing the manuscript, with everyone else contributing. Kerli Ploom conducted the data analysis, formulated the empirical results and was responsible for the literature review and the final version of the manuscript. Age Tempel and Madli Kõiv helped compile the literature review and conducted the experiments. Andres Kuusik conducted the final part of the experiments and contributed to the methodological analysis framework. Tanel Mehine contributed to the manuscript writing, hypothesis development and manuscript revision. All co-authors contributed to the design of the research methodology, the interpretation of the empirical results and the review of the manuscript.

Article II. Considering emotions in product package design through combining conjoint analysis with psychophysiological measurements (Pentus, Mehine, & Kuusik, 2014, Procedia – Social and Behavioural Sciences).

This article was co-authored with Tanel Mehine and Andres Kuusik. Kristian Pentus designed the research, conducted the empirical analysis, developed an approach to incorporate emotions into conjoint analysis, developed a method to extract raw emotion data from the Realeyes online dataset and wrote the manuscript. Tanel Mehine contributed to the manuscript revision and conclusions, and Andres Kuusik provided theoretical guidance and manuscript revisions. All authors participated in discussing the results and refining the research framework.

Article III. A systematic review of food product conjoint analysis research (Pentus, 2023, ACCESS: Access to Science, Business, Innovation in Digital Economy).

This article was written solely by Kristian Pentus, who was responsible for developing the research framework, conducting the systematic review, analysing and interpreting the results and writing the manuscript.

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I want to express my sincere gratitude to the people without whom I would never have reached the point of defending this dissertation.

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I would never have pursued an academic career or undertaken a PhD without the inspiration of remarkable colleagues such as Tanel Mehine, Kerli Ploom, Urmas Varblane, Maaja Vadi, Kulno Türk, Krista Jaakson, Anne Reino, Kadri Ukrainski, and many others. Working alongside you has been a lasting source of motivation.

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To my family, I am forever grateful. Without your sacrifices, which made it possible for me to work on this dissertation, this would never have happened.

Finally, I never knew I could write something resembling a scientific text without the Writing Camps led by **Djuddah Leijen** and **Anni Jürine**. The confidence, skills, and understanding of writing that I gained there are something I will carry with me long after everything else is forgotten. I dedicate this dissertation to you, **Anni**.

Glossary of terms

The AIDA model describes a four-stage path by which marketing stimuli move a consumer from Attention to Interest, to Desire, and finally to Action (Strong, 1925). Widely used in advertising and package-design research, it frames eye-tracking and emotion variables as early-stage influencers of purchase behaviour. Originally used for print advertising, it has been adapted to packaging because a package design must first get attention on a shelf, then evoke interest and desire and finally prompt the consumer to buy. This linear, sequential logic provides a framework for aligning neuromarketing metrics with behavioural outcomes. Eye-tracking attention and facial-expression metrics can be mapped to these stages to understand where a design works best and where it does not align with consumers' buying process. This makes AIDA a practical bridge between neuromarketing research methods and consumer behaviour.

Attention is the directing of cognitive processing effort (that is, of limited capacity (Kahneman, 1973)) to one object or event (James, 1890) among either external (sensory information) or internal (memories, tasks, etc.) objects or events (Chun et al., 2011). Attention can be thought of as selecting a single focus object or event (Broadbent, 1958) while suppressing information about other objects and events in our attentional field (Treisman, 1969). Usually, the objects or events thereby selected for preferential processing have some value relative to (future) action (Allport, 1989). It can be further distinguished into external and internal attention (Chun et al., 2011) and is often treated as the gatekeeper of perception, memory and decision-making (James, 1890; Broadbent, 1958; Treisman, 1969; Kahneman, 1973; Allport, 1989; Wu, 2023).

Bottom-up vs top-down attention: As mentioned, there are two types of attention: stimulus-driven and goal-oriented (Carrasco, 2011; Corbetta & Shulman, 2002). Stimulus-driven attention occurs when a stimulus (e.g. package design) captures a person's attention (Schreij, Owens, & Theeuwes, 2008). Goal-oriented attention is the voluntary allocation of attention to a target (Pinto et al., 2013). Katsuki and Constantinidis (2014) describe attention as guided by two interacting but distinct mechanisms: bottom-up attention, which is guided by stimulus salience; and top-down attention, which is guided by prior knowledge and goals. Theeuwes (2010) notes that early visual selection (<150 milliseconds) is driven by salience, whereas later selection (>150 milliseconds) reflects volitional control and expectations. This means that TFF may be sensitive to bottom-up processes.

Bounded rationality: Herbert Simon's concept of bounded rationality (Simon, 1957) highlighted the limitations of human rationality, showing that while normative theories offer idealised models of behaviour, real-world decision-making often deviates from these models due to cognitive constraints and environmental factors. Normative decision-making theories focus on how individuals should make decisions to maximise outcomes based on rational criteria, assuming perfect information and logical thinking. In contrast, psychological decision-making theories describe how decisions are made in practice, acknowledging the influence of cognitive biases, emotions and social factors that often lead to irrational choices (Tversky & Kahneman, 1974).

Cannon-Bard theory (and the role of conscious recognition). This theory treats physiological responses and subjective feelings as parallel, simultaneous components of emotion (Cannon, 1927), distinguishing it from appraisal-based models that position evaluative processing as the central precursor to emotional experience (Lazarus, 1982). Within a neuromarketing framework, this parallel conceptualisation supports the inclusion of physiological metrics alongside subjective or choice data. Specifically, autonomic and facial-expression measures serve as valuable complementary tools; rather than acting as independently definitive indicators, they help capture affective responses that explicit self-reports might miss or cognitively distort (Bagozzi et al., 1999; Poels & Dewitte, 2006)

CNS/ANS/SNS neuromarketing techniques are commonly grouped into central nervous system (CNS), autonomic nervous system (ANS), and somatic nervous system (SNS) methods. In this classification, eye-movement analysis is typically placed among SNS measures, although some authors note that eye movements reflect both voluntary/somatic and involuntary/autonomic attentional activity (Wang et al., 2008; Stewart & Furse, 1982). More precisely, gaze is best understood as an index of overt visual attention shaped by both goal-directed and stimulus-driven processes, rather than as a complete measure of attention per se (Bell et al., 2018).

Conjoint analysis is a decompositional method that estimates the structure of consumer preferences such as the relative importance of different attribute levels based on their overall evaluations of multi-attribute product profiles (Green & Srinivasan, 1978). Core visual packaging elements, such as colour, shape, graphics, and textual cues, strongly influence consumer preferences and purchase intentions. Conjoint studies show that these attributes can carry substantial relative importance in package evaluation, although their weight varies by product category, and other cues, such as material or informational content, may sometimes dominate (Wang et al., 2022; El Oraiby & Kiygi-Calli, 2023). Enriched variants of conjoint integrate eye-tracking or emotion metrics, linking subconscious reactions to stated choice and producing a more complete view of package effectiveness.

Dual process theory proposes two interacting systems of thought: System 1, which is fast, intuitive and automatic; and System 2, which is slow, analytical and effortful (Evans, 2008). System 1 relies on effortless heuristics (colour, shape or a familiar logo), while System 2 weighs attribute trade-offs such as price versus sustainability claims. Packaging that simplifies decoding or deploys strong emotional cues can tip the balance toward System 1, accelerating choice; complex nutrient tables or comparative claims may invite the deliberative scrutiny of System 2, lengthening decision time. Recognising this difference in thinking justifies combining implicit measures, such as eye-tracking, with explicit preference reports in conjoint analysis (Meißner et al., 2017).

Emotion: Bagozzi, Gopinath, and Nyer (1999) define emotion as "a mental state of readiness that arises from cognitive appraisals of events or thoughts, is accompanied by physiological processes and is often expressed physically (e.g., in gestures, posture, facial features)". Russell and Barrett (1999) distinguish between prototypical emotion and core affect, the latter being similar to Ekkekakis's (2012) definition. A prototypical emotional episode refers to a complex set of interrelated subevents concerning a specific object (Russell & Feldman Barrett, 1999). Ekkekakis (2012) identifies co-occurring components of emotion, including core affect, facial expression, attention to the eliciting stimulus and cognitive appraisal.

Eye-tracking is a method for determining how people view things, what they notice, and what they do not. Eye-tracking determines gaze locations over time and, given the assumption that gaze mostly follows the focus of attention, can be used to measure where attention is drawn (Gofman et al., 2009; Graham et al.,

2012). Its primary measure is fixation, a brief period during which an image remains stable on the fovea and provides most of the information to people (Pentus et al., 2020). In package design research, eye-tracking measures how consumers locate a package on a shelf, which design elements get the fastest attention and hold it, and which remain unseen, guiding visibility and messaging decisions.

FACS (Facial Action Coding System): While basic-emotion research has identified six recurring facial expression patterns (Ekman & Friesen, 1971), facial expressions are better understood as probabilistic cues to affective states rather than perfect, one-to-one indicators, as contextual variability plays a significant role (Russell, 1994). The Facial Action Coding System (FACS) catalogues 46 action units (AUs) corresponding to specific facial muscle movements (Ekman & Friesen, 1978). Automated tools (e.g., FaceReader) implement FACS to score basic emotions and summarise valence and arousal, validated through correlations with facial EMG (den Uyl & van Kuilenburg, 2005; D'Arcey, 2013; Gunaratne et al., 2019; Bartkiene et al., 2019).

Facial expression or emotion measurement in this dissertation refers to the measurement of facial expressions. Facial expressions are informative indicators of one's emotional state (Russell, 1994). Some authors associate specific facial expressions with discrete emotions such as surprise, happiness, sadness, anger, fear, and disgust (Ekman & Friesen, 1971).

Fixation (definition) and modality-specific filters (I-VT vs I-VT Attention): A fixation is when a person's eyes stay relatively still on an object (which may also move) to keep that object on the fovea long enough (≥50 ms) for information processing (Duchowski, 2007). In screen-based work, fixations are measured in world-centred coordinates; in mobile setups, they are measured in head-centred coordinates and then mapped to 2D snapshots of the environment (Jovancević-Mišić & Hayhoe, 2009). For stationary data, a Tobii I-VT fixation filter can be used with standard parameters; for mobile data, an I-VT Attention filter (threshold 100°/s) helps maintain quality (Hessels et al., 2018; Niehorster et al., 2020a; Malladi et al., 2022; Niehorster et al., 2020b).

Hedonic vs utilitarian orientation: Bettiga et al. (2020) report that both hedonic and utilitarian products elicit emotional responses, but physiological and self-reported responses can diverge, especially for more functional products. This likely stems from how emotions are processed. For hedonic products, emotions are consciously experienced; for utilitarian products, emotions may not be consciously processed. Holbrook and Hirschman (1982) showed that consumer satisfaction derives not only from functional attributes but also from hedonic qualities such as fantasies, feelings and fun. Studies demonstrate that products can have both hedonic and utilitarian value dimensions (Batra & Ahtola, 1991; Babin, Darden & Griffin, 1994; Kempf, 1999; Voss et al., 2003; Chitturi, Raghunathan & Mahajan, 2008). Consumer behaviour toward hedonic products involves more emotion, whereas utilitarian products evoke more cognitive processing (Kim, 2016).

Heuristics and biases: Tversky and Kahneman (1974 suggest that individuals rely on cognitive shortcuts, which can lead to systematic errors. Eye-tracking can track which familiar features or heuristics attract immediate attention, while emotion measurement can detect affective responses triggered by such shortcuts. For example, a consumer may prefer a package with a familiar brand label over a cheaper alternative because brand value is evaluated relative to other brands. Such choices reflect trade-offs between attributes such as brand and price, consistent with comparison-based theories of decision-making in which preferences emerge from relative evaluations within the choice set rather than from stable internal values (Vlaev et al., 2011).

Internal validity / external validity / ecological validity: Internal validity involves the degree to which results can be attributed to manipulated variables rather than extraneous influences. High internal validity is achieved via rigorous design and control. External validity concerns the generalisability of findings to other populations, settings, or time periods. Ecological validity (a subset of external validity) refers to how well experimental setups replicate real-world conditions; realism often trades off against control. Three practical dimensions include environment, stimulus fidelity and task realism (Andrade, 2018; Heale & Twycross, 2015; Beechey, 2022; Kihlstrom, 2021; Chang et al., 2022; Jiménez-Buedo & Miller, 2010; Snow, 1974).

Microexpressions, discovered by Ekman in the 1960s during research on emotion concealment, are brief, involuntary facial expressions lasting fractions of a second (Ekman & Friesen, 1969). They are complex to detect visually and usually require automatic detection. Microexpressions can reveal subconscious emotional states since they are involuntary (Porter & Brinke, 2008). They show minimal facial activation (Zhao et al., 2022) and are universal across cultures (Matsumoto & Hwang, 2011). These microexpressions can work as emotion correlates.

Neuromarketing is the application of neuroscience research methods to the study of marketing stimuli and phenomena. Neuromarketing applies neuroscience-based methods to understand consumer responses to marketing stimuli. Some writers restrict it to brain-imaging techniques (Lee et al., 2007; Babiloni, 2012), while others include psychophysiological and behavioural tools such as eye-tracking and facial-expression analysis (Alvino et al., 2019). It therefore fuses experimental economics, psychology, and neuroscience (Page, 2012; Ohme & Matukin, 2012) and relies on neurological or biological metrics to study marketing effects (Hsu & Chen, 2019). In this dissertation, based on the broader view of Morin (2011) and Fortunato et al. (2014), it is treated as an interdisciplinary toolbox that relates attention, emotion and choice to neural and physiological signals generated by the marketing stimuli.

Overt and covert attention are different yet interconnected cognitive processes (Carrasco, 2011). Overt attention refers to explicit direction of gaze toward the object of focus (Posner, 1980), while covert attention allows mental focus without direct gaze (Wright & Ward, 2008). Overt attention is typically associated with detailed foveal processing, whereas covert attention involves

attending without moving the eyes and often operates on lower-acuity peripheral input (Carrasco & Barbot, 2014). Moreover, attention can alter the appearance of stimuli by increasing their apparent contrast (Carrasco et al., 2004). Most eye-tracking assumes attention moves with fixation (Deubel & Schneider, 1996; Rayner, 2009), even though peripheral information may also contribute (Orquin & Holmqvist, 2018).

Package design strategically combines protective, communicative and aesthetic functions to enhance product visibility, usability and desirability (Rundh, 2005; Hine, 1995; Prendergast & Pitt, 1996). It merges utilitarian requirements (size, material, durability) with brand-building visuals such as colour, typography and imagery (Kotler, 2000; Underwood, 2003). Rabinowitz (2002) notes that a well-designed package can significantly influence purchase decisions by evoking positive emotions. Sensory interactions, such as visual and tactile aspects, can significantly shape perceptions and preferences (Krishna, 2006; Raghubir & Greenleaf, 2006).

Product involvement is a consumer's enduring interest in or emotional connection to a product category, influenced by its personal relevance and symbolic value (O'Cass, 2000; Lockshin et al., 1997; Mittal & Lee, 1989). It encompasses the effort invested in selection, the time spent on decisions, and the perceived risks (Bell & Marshall, 2003). Zaichkowsky (1986) identifies situational, personal, and stimulus factors that affect involvement. Product involvement influences attention and emotions, with positive emotions having a stronger impact on satisfaction for low-involvement products (Calvo-Porral et al., 2018). Satisfaction patterns differ by involvement level (Richins & Bloch, 1991), and emotions affect satisfaction and loyalty differently across involvement levels (Juntongjin, 2022).

Purchase involvement pertains to the level of engagement and effort a consumer puts into the buying process, shaped by situational factors such as complexity, cost or risk (Mittal, 1989; Michaelidou & Dibb, 2008). It is transient and context-dependent, focusing on the decision-making process rather than long-term product interest.

Reference dependence and loss aversion: Prospect theory states that individuals make decisions by weighing potential gains and losses rather than focusing solely on outcomes (Kahneman & Tversky, 1979). A central concept in this theory is reference dependence, which means that individuals evaluate outcomes relative to a reference point (often the current state or expectations), perceiving them as gains or losses depending on their deviation from that point (Kahneman & Tversky, 1979). Framing options as gains or losses can significantly affect decision-making. Fox and Poldrack (2009) emphasise that framing effects, loss aversion, and probability distortions have neural correlates, aligning with the manipulation of prospect theory's value and probability functions.

Sustained attention, often referred to as vigilance, describes the ability to maintain attentional focus on a task or stimulus over prolonged periods of time (Sarter et al., 2001; Warm et al., 2008). It is needed for tasks requiring continuous focus (Fortenbaugh et al., 2017). Divided attention refers to the ability to process

multiple tasks or stimuli simultaneously (Kahneman, 1973; Spelke et al., 1976). When multiple tasks compete for limited cognitive resources, performance often deteriorates due to resource competition and increased mental workload (Pashler, 1994; Wickens, 2008). Both depend on task complexity, cognitive load and environmental conditions.

Triangulation types (convergence, complementarity, dissonance). Triangulation increases confidence and completeness by combining methods and data. Triangulation refers to the use of multiple research methods, data sources or theoretical perspectives to strengthen the validity, credibility and interpretive richness of findings (Dźwigoł, 2020; Farquhar, Michels, & Robson, 2020; Heale & Forbes, 2013). In this dissertation, complementary triangulation is employed, following the conceptualisation by Erzberger and Prein (1997), in which each method (eye-tracking, facial-expression analysis and conjoint analysis) captures a different yet complementary facet of consumer behaviour. Instead of merging results into a composite measure, these methods are interpreted side by side to identify convergence, divergence and contextual nuances across the Attention–Affect–Choice sequence. This approach is particularly suited to neuromarketing research, as it connects conscious and subconscious processes and reveals methodological interactions that would be invisible in single-method studies (Eroglu & Kucun, 2020).

Within the pragmatic and post-positivist framework of this dissertation, triangulation functions as both a methodological and epistemological strategy: it acknowledges that each method provides a partial but valid perspective on consumer behaviour, and that coherence and validity emerge through systematic alignment and interpretive complementarity.

Valence/arousal; active–passive (Wundt): Facial-expression analysis supports two-dimensional emotion summaries: valence (positivity/negativity) and arousal (activation). Emotions may also be described along an active–passive dimension. Applied tools often map stimuli onto valence–arousal scales to compare subtle differences. This dimensional approach is historically rooted in Wundt's early dimensional theories of affect (Wundt, 1948), which were later formalised into the modern circumplex model of valence and arousal used by contemporary tools (Russell, 1980).

1. THEORETICAL BACKGROUND

1.1 Package Design: Influencing Consumer Behaviour through Product Categories, Involvement and Design Elements

Product categories

This subchapter explains how product categories, packages and their elements influence consumer behaviour. The way they do it depends on the purchase context and many other factors that are interconnected with the package and product. While these phenomena influence each stage of consumer behaviour, they have the most profound effect on one particular stage. Category and involvement have the strongest impact on the attention strategy (what gets noticed and when), and the hedonic–utilitarian orientation calibrates the extent to which emotions influence consumer behaviour. Concrete design attributes (visual, verbal, structural, and informative) will most strongly influence choice trade-offs, as later quantified in the conjoint analysis.

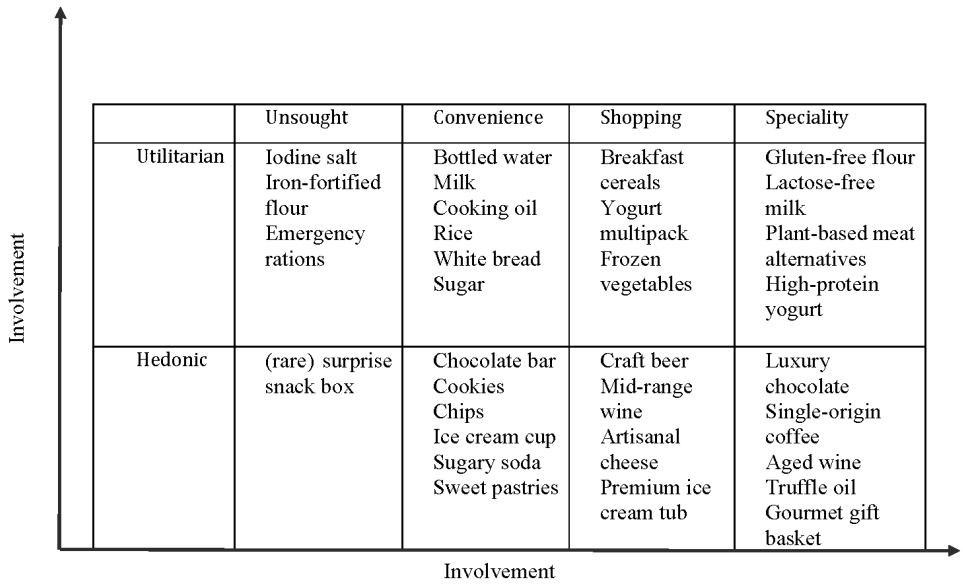
An understanding of product categories is needed to analyse consumer behaviour and to choose appropriate neuromarketing methods. Copeland's products division into convenience, shopping and speciality remains the most used even today (Copeland, 1923; Mason, 2005). Holton stressed that this category is relative: "Since items which are shopping goods for some consumers may be convenience goods for others, convenience goods and shopping goods can be defined accurately only from the standpoint of the individual consumer" (Holton, 1958, p. 53). Convenience products are frequent, low-effort purchases with minimal search effort because the gains from comparison are small relative to the costs of searching (Copeland, 1923; Holton, 1958; Murphy, 1986). Shopping products involve fewer, higher-effort comparisons; speciality products entail the highest effort and reward, often with one preferred brand (Holton, 1958; Murphy, 1986). These distinctions imply different attention and emotion dynamics at the shelf.

These variations in product category emotions and attention are influenced by product and purchase involvement. Product involvement reflects enduring, personal relevance and symbolic value to a product, shaping long-term attention and meaning (O'Cass, 2000; Lockshin et al., 1997; Mittal & Lee, 1989). Purchase involvement is situational, tied to decision complexity, cost and risk (Mittal, 1989; Michaelidou & Dibb, 2008). Involvement varies with effort, time and risk (Bell & Marshall, 2003) and is influenced by situational, personal and stimulus factors (Zaichkowsky, 1986). The more involved a person is in a product and in the purchase situation, the more effort and time she is willing to spend on it.

Product involvement influences attention and information search behaviour, with higher involvement generally leading to increased fixation likelihood and deeper attribute evaluation, while lower involvement tends to reduce the extent

of information search (Zaichkowsky, 1985; Bell & Marshall, 2003). Eye-tracking research further demonstrates that visual attention to product attributes and branding cues varies across retail contexts and product presentations (Huddleston et al., 2015; Mundel et al., 2018). High involvement increases search and attribute examination, while low involvement decreases it. It also conditions emotional effects on satisfaction as positive emotions more strongly raise satisfaction for low-involvement goods, while situational factors play a larger role for high-involvement goods (Calvo-Porral et al., 2018; Richins & Bloch, 1991; Juntongjin, 2022). Early attention is influenced by bottom-up salience in the first 150 milliseconds. It is measured by time to first fixation (TFF), the latency from stimulus onset to the first fixation on a predetermined area of interest (AOI). As tasks and goals take control, later metrics (fixation count, total fixation time) demonstrate heightened top-down guidance. Thus, both attention and affect depend on how much consumers invest in the purchase process (purchase involvement) or the category or purchase (product involvement). Attention itself has stimulus-driven (bottom-up) and goal-oriented (top-down) components (Carrasco, 2011; Corbetta & Shulman, 2002) (see glossary: bottom-up vs top-down attention). Stimulus factors channel bottom-up capture, whereas personal and goal factors align top-down selection (Schreij, Owens, & Theeuwes, 2008; Pinto et al, 2013). This link connects product involvement to the mix of salience-driven versus goal-guided viewing.

Hedonic vs utilitarian orientation of products explains why products in similar categories can elicit different emotions and attract different levels of attention. Hedonic products are fun, exciting and experiential; utilitarian products are functional and necessary (Dhar & Wertenbroch, 2000; Voss et al., 2003; Lu, Liu, & Fang, 2016). Research by Bettiga et al. (2020) indicates that although both product types evoke emotions, consumers' physiological reactions and conscious self-reports often diverge, especially for utilitarian products. This division is convenient, but in reality, it is never purely one or the other. Hedonic and utilitarian values co-exist within products (Batra & Ahtola, 1991; Babin, Darden, & Griffin, 1994; Kempf, 1999; Voss et al., 2003; Chitturi, Raghunathan, & Mahajan, 2008). For hedonic items, purchasing decisions often involve more emotion, while for utilitarian items, they are typically more rational. (Kim, 2016; Voss et al., 2003). This division interacts with involvement to shape what consumers notice and which emotions are elicited. Examples of utilitarian and hedonic products in the unsought, convenience, shopping, and speciality categories are shown in Figure 3.



	Unsought	Convenience	Shopping	Speciality
Utilitarian	Iodine salt Iron-fortified flour Emergency rations	Bottled water Milk Cooking oil Rice White bread Sugar	Breakfast cereals Yogurt multipack Frozen vegetables	Gluten-free flour Lactose-free milk Plant-based meat alternatives High-protein yogurt
Hedonic	(rare) surprise snack box	Chocolate bar Cookies Chips Ice cream cup Sugary soda Sweet pastries	Craft beer Mid-range wine Artisanal cheese Premium ice cream tub	Luxury chocolate Single-origin coffee Aged wine Truffle oil Gourmet gift basket

Figure 3: Involvement levels of products categorised by the two dimensions of product type (unsought to speciality) and categorisation (hedonic-utilitarian) compiled by the author

Convenience goods typically entail lower involvement (Bell & Marshall, 2003; Michaelidou & Dibb, 2008; Bauer et al., 2006). Product knowledge shows a varied relationship with different orientations: for utilitarian products, it aligns more with objective knowledge, whereas for hedonic products, it aligns more with subjective knowledge (Park & Moon, 2003). Affective involvement drives purchase intentions for hedonic goods, while cognitive involvement does not significantly affect intentions for utilitarian goods; hedonic brands may also better withstand negative shocks (Magno, Cassia, & Ugolini, 2017). Eye-tracking studies demonstrate that hedonic visual cues elicit more visual attention, particularly during product evaluation and comparison phases (Mundel et al., 2018; Guerreiro et al., 2015). Empirically, many package-design neuromarketing studies focus on convenience and hedonic products, so generalisations to utilitarian or higher-effort categories require caution (Chaudhuri, Aboulnasr, & Ligas, 2010). Furthermore, almost all package design neuromarketing research is conducted with convenience products as its subjects. Also, most package design conjoint analysis is conducted on hedonic products (Pentus, 2023), and most neuromarketing research, specifically eye-tracking papers, focuses on hedonic products. Design tests and interpretations should therefore account for differences in category and orientation.

Product categorisation and purchase involvement are subject to subjective interpretation, which must be taken into account when analysing attention and emotion data. Although empirically resolving this is beyond the present scope, a brief control questionnaire could address this variability. In essence, product

category and involvement shape how consumers visually search and evaluate packages: convenience goods elicit faster, less detailed scanning, whereas speciality goods require more deliberate processing. Emotional responses align with the product's hedonic or utilitarian orientation. Hedonic goods evoke a stronger affective influence on choice-making, category involvement and hedonic orientation, essential filters that link consumer reactions, elaboration and choice.

Package design elements

Package elements are fundamental to a conjoint enriched neuromarketing approach. These elements are categorised into four groups: visual, verbal, structural and informative. These categories are consumer subjective and are based on how they attract attention, convey meaning and aid decision-making. This classification builds upon previous distinctions such as visual vs informative and functional vs visual (Silayoi & Speece, 2004; Bloch, 1995; Rundh, 2009).

Colour, typeface, graphics, shape, layout and other visual components produce emotion and visual salience, meaning the ability to stand out from the background and surroundings. They influence brand associations and shelf visibility. As demonstrated, somewhat unusual designs can increase purchase intent, making it beneficial to stand out from the crowd of other packages (Creusen & Schoormans, 2005; Rundh, 2009; Garber et al., 2009; Kovač et al., 2019; Celhay & Trinquecoste, 2015). Brand names, slogans and product text are examples of verbal features that can reinforce identification while promoting analytical processing, clarity and trust (Silayoi & Speece, 2004; Kuvykaitė et al., 2009; Ahmed et al., 2014; Tassawa & Khumhome, 2023). In terms of usability, sustainability perceptions and quality cues, the structural elements include shape, size, material, finish and closing system (Orth & Malkewitz, 2008; Chrysochou & Festila, 2019; Ampuero & Vila, 2006; Creusen & Schoormans, 2005). Labels, certificates and technological characteristics are examples of informative elements used for high-involvement product evaluation and trust (Silayoi & Speece, 2004; Ahmed et al., 2014; Kuvykaitė et al., 2015). A combination of these constituent kinds is necessary for good packaging. Structural features guarantee functionality, product safety and differentiation; informational elements foster confidence; visual elements draw attention and arouse emotions; and linguistic elements clarify and reinforce brand messaging. For instance, a package featuring bold colours and typography (visual), a clear slogan (verbal), durable materials (structural) and detailed product information (informative) offers a comprehensive consumer experience, effectively bridging emotional and analytical processing (Creusen & Schoormans, 2005; Kotler & Keller, 2014).

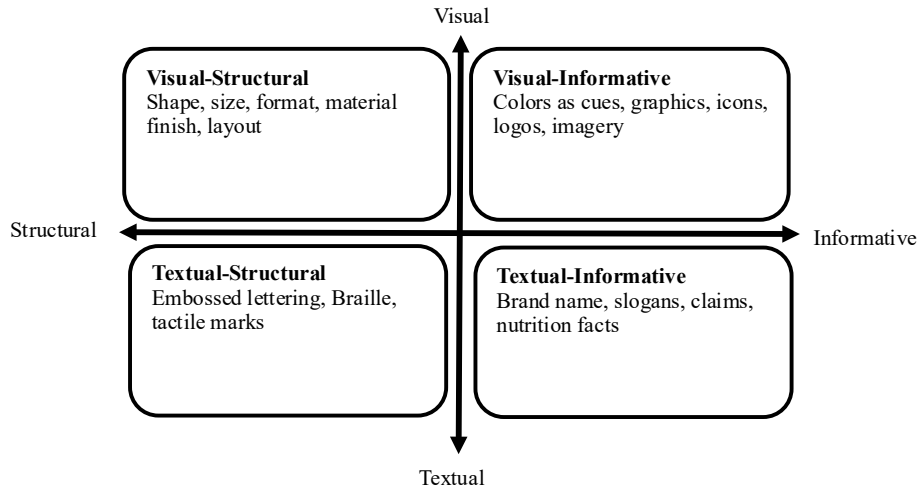


Figure 4: Package design elements matrix
Visual–Structural (Garber et al., 2009; Orth & Malkewitz, 2008); Visual–Informative (Spence & Van Doorn, 2022); Textual–Structural (Rettie & Brewer, 2000); Textual–Informative (Silayoi & Speece, 2004; Kuvykaitė et al., 2009; Ahmed et al., 2014). Source: compiled by the author.

Package design elements are typically divided into categories, and while some overlap, this oversimplifies categorisation. Every element can technically be visual; otherwise, how can we see them? All textual elements are informative, and colours can convey information about taste, brand or other aspects. This matrix in Figure 4 takes a step toward blurring these lines, as every element always falls on a scale between being informative and structural and between being more visual or textual. It holds that most elements are predominantly at one end of these scales, but there is an element of fuzzy definition, and this matrix conveys that.

This classification of the package's elements demonstrates how each contributes to the packaging's overall effectiveness. According to Silayoi and Speece (2004) and Rundh (2009), visual components such as colour and graphics are essential for attracting customers and eliciting strong feelings. For example, although visuals can establish associations and improve brand awareness, colours can indicate product kinds or communicate brand identity (Creusen & Schoormans, 2005). According to Garber et al. (2009) and Orth and Malkewitz (2008), structural components such as size, form and material also contribute to functionality and tactile appeal. These features highlight the importance of striking a balance between innovation and pragmatism by increasing the product's shelf visibility and shaping perceptions of its quality and usability (Ampuero & Vila, 2006). Brand names, product information and slogans are both verbal and informative components that are equally important in influencing consumer choices. According to Ahmed et al. (2014) and Silayoi and Speece (2004),

comprehensive product information is essential for high-involvement products to foster consumer trust and enable well-informed decision-making. By effectively communicating the product's advantages and values, slogans and textual information can enhance brand communication. These components produce a unified package design that guarantees clarity, usability and conformity with customer expectations, while also drawing attention. By combining verbal and visual cues, packaging serves as a "silent salesman" (Kotler & Keller, 2014), influencing consumer behaviour by bridging the gap between emotional and logical processing.

This element categorisation is consumer-subjective, just like the product hedonic-utilitarian scale, and the division of products into convenience, shopping and speciality products is primarily defined by how consumers feel about the product and the level of involvement they invest in it. Visual elements, such as colour, can serve as informative cues when a consumer seeks orange juice and detects its location based on its orange colour. In conclusion, categorising package design elements into visual, verbal, structural and informative offers a framework for understanding how packaging influences consumer behaviours and which sub-elements can be researched.

1.2 The Role of Attention and Emotions in Consumer Decision-Making

Models to describe the consumers' buying process

This subchapter bridges consumer behaviour models and the measured metrics used in the research framework. Attention mechanisms, categorised by bottom-up salience versus top-down goals and by overt versus covert processes, determine which eye-tracking metrics are relevant at specific times and across different research contexts. Emotion constructs, such as basic emotions, the valence–arousal scale and microexpressions, define the meaning of facial expression signals in the formation of subsequent preferences.

Consumer behaviour models form the basis for this dissertation, linking package design to the decision processes investigated in the research framework. Consumer behaviour studies explain the motivations, timing and processes behind consumer purchases (Kumar et al., 2014). The author focuses on three prominent consumer behaviour models: AIDA, CAB and the 5-stage model (Figure 5). The AIDA model (Attention, Interest, Desire and Action), established by St. Elmo Lewis in 1898, and elaborated by Strong (1925), outlines a sequential cognitive path leading to purchase, from first noticing a product to deciding to purchase it (Barry & Howard, 1990; Strong, 1925; Lavidge & Steiner, 1961) (see glossary). It provides a framework for understanding how marketing stimuli capture attention, build interest, foster desire and drive consumers to action.

The CAB model identifies the Cognitive, Affective, and Behavioural components of attitude (Rosenberg & Hovland, 1960). In a consumer context, these

components are often viewed as a hierarchy of effects, where cognition (knowledge and beliefs) leads to affect (emotional evaluation), which subsequently drives behaviour (purchase action) (Ray, 1973). This progression is underpinned by expectancy-value logic, in which the integration of cognitive beliefs forms the basis of an affective attitude (Fishbein, 1963; Fishbein & Ajzen, 1975). This framework illustrates how consumers assess package information, emotionally evaluate the design, and engage in purchase-related behaviours (Vakratsas & Ambler, 1999).

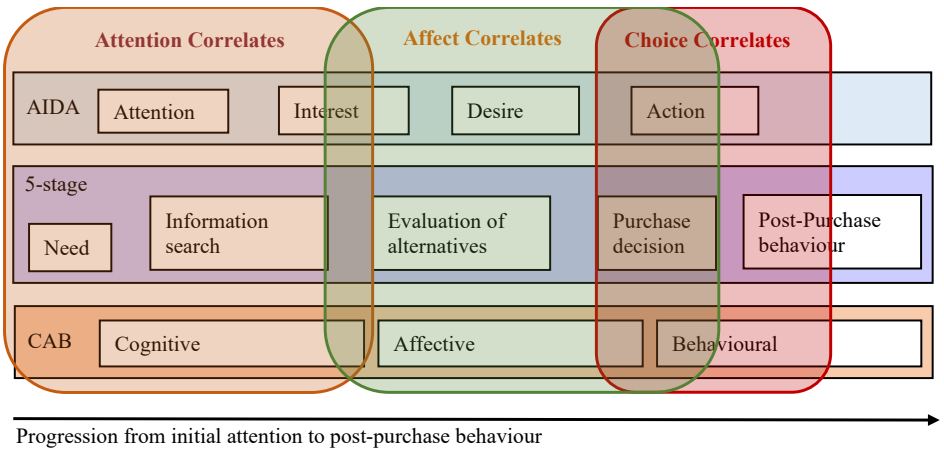


Figure 5: The three research methods overlap with the three consumer behaviour models AIDA, CAB and 5-stage (Barry & Howard, 1990; Dewey, 1910; Engel, Kollat, & Blackwell, 1968; Howard & Sheth, 1969; Lavidge & Steiner, 1961; Lewis, 1898; Rosenberg & Hovland, 1960; Strong, 1925; Vakratsas & Ambler, 1999). Compiled by the author

The 5-stage model, or Buyer Decision Process, provides another very similar (to AIDA and CAB model) understanding of consumer decision-making and was based on Dewey's (1910) phases of reflective thought before being improved first by Engel, Kollat and Blackwell (1968) and then by Engel, Blackwell and Miniard (1986). Kotler and Keller (2014) popularised this concept in marketing, emphasising that consumer decisions extend beyond the purchase itself, encompassing post-purchase evaluation, potential cognitive dissonance and repurchase intentions.

Attention and saliency

This dissertation adopts a pragmatic definition of attention while acknowledging ongoing debates in the literature. In recent years, several well-cited articles have raised doubts about how attention has traditionally been defined. Hommel et al. (2019) argue that attention is used inconsistently across neuroscience and psychology, describing different brain functions without empirical precision. Similarly,

Wu (2023) points out that the theory of attention has become logically inconsistent, with too many processes tied to the concept, leading to contradiction and confusion. Despite these challenges, attention can still be defined universally as a selective cognitive process, even if competing models show different mechanisms.

Attention is the first element in the consumer behaviour model because it acts as the gatekeeper to what is perceived at all, and therefore what is even considered in decision-making. Only the elements that capture or hold attention can influence evaluation, memory and choice (Carrasco, 2011; Chun et al., 2011). In this context, attention can be described as the allocation of limited cognitive resources to certain aspects of the environment while ignoring others. This selective process underpins why packaging design matters: unless a feature gains attention, it cannot shape consumer response. A longer conceptual definition is provided in the glossary.

Visual attention has been described as a spotlight that illuminates parts of the visual field for enhanced processing (Posner, 1980). This metaphor demonstrates how consumers can effectively navigate complicated situations by prioritising certain package cues over others (Chun & Marois, 2002) by using attention to both enhance useful details and block irrelevant stimuli (Carrasco, 2011). The procedure is similar to traditional filter theory in that only specific inputs are thoroughly processed. Although it is a competitive process, attention is not static. According to Desimone and Duncan's (1995) biased-competition paradigm, different inputs compete for representation in the brain. This rivalry is then skewed by top-down factors, including customer objectives or incentives, which give preference to features that are more pertinent to desired behaviours. Because it highlights the interaction between customer intentions and the stimulus-driven qualities of packages, this viewpoint is especially pertinent to marketing (Corbetta & Shulman, 2002).

Within this competitive framework, the salience of stimuli in the surrounding visual space is important. Salience refers to how distinctive a stimulus is compared to its environment and how strongly it draws initial gaze (Itti et al., 1998; Borji & Itti, 2013). Stimuli with high visual distinctiveness (bright colours, strong contrasts or unusual shapes) are more likely to capture attention than less distinctive features. Salience is therefore frequently mentioned while discussing bottom-up visual cues. This idea is formalised in salience models, including Desimone and Duncan's (1995) competitive framework, Wolfe's (1994) Guided Search model and Koch and Ullman's (1985) saliency map. In addition to predicting where consumers look, visual salience also influences the sequence and duration of visual search during consumer decision making (Navalpakkam et al., 2012; Peschel & Orquin, 2013). A feature's impact on package design depends on its attributes and context. For instance, a colour prominent in one product category might be overlooked in another due to lower salience or uniqueness. This salience can bias eye-tracking results and affect the impact of design elements.

Package choices involve both rapid, almost automatic capture and sustained, deliberate focus. Quick scanning of products aligns with fast, intuitive System 1

processing, while prolonged attention supports more deliberate System 2 evaluation (see glossary, Evans, 2008). Although Kahneman's fast and slow thinking models are related to decision-making, not attention, they are useful here as an analogy for fast versus controlled attention processes. The way sustained attention, or divided attention, is used depends on salience and our goals. Stimulus-driven, or bottom-up, attention occurs when a stimulus (e.g., a package design) captures a person's attention (Schreij, Owens, & Theeuwes, 2008). Goal-oriented or top-down attention is the voluntary (self-driven) allocation of attention to something. (Pinto et al, 2013). The allocation of attention unfolds over time, and the early measures, such as time-to-first-fixation in eye-tracking (TFF), are largely influenced by bottom-up salience. In contrast, dwell time reflects goal-driven, top-down examination (see glossary) (Theeuwes, 2010).

Finally, attention involves both overt and covert components. Overt attention occurs when gaze location (fixation) and focus align, whereas covert attention allows individuals to process peripheral information without direct fixation (Posner, 1980; Rayner, 2009). Most neuromarketing studies assume fixation as a proxy for attention, but covert processes can complicate interpretation, as consumers may notice features without looking directly at them (see glossary). Recognising this interplay is essential for valid conclusions about how package design influences consumer behaviour.

Emotions

Attention and emotions are central correlates of consumer behaviour in neuromarketing research, especially in advertising (Amiri et al., 2022), and the same applies to package design. While strong reactions such as delight at a playful package can occasionally drive a purchase directly, emotions usually act as modulators rather than sole determinants of choice. Their influence intensifies under information load, time pressure or when hedonic value is salient. A package that elicits more positive emotion is more likely to be chosen. In the consumer behaviour model, emotions serve as an intermediary stage. They convert initial attention into signals of approach or avoidance, which subsequently influence the trade-offs evaluated by conjoint analysis.

Bagozzi (1999) defines emotion as "a mental state of readiness that arises from cognitive appraisals of events or thoughts, is accompanied by physiological processes and is often expressed physically (e.g., in gestures, posture, facial features)." Emotions have been described as conscious states that include appraisal and response to stimuli (Baumeister et al., 2007). Russell and Barrett (1999) distinguished prototypical emotions from core affect. Core affect is a simple, conscious feeling with a specific valence and intensity, reflecting underlying physiological conditions (Ekkekakis, 2012). In contrast, prototypical emotions are short-lived episodes directed toward a specific object (Russell & Feldman Barrett, 1999). These emotional episodes involve core affect alongside additional components, such as appraisal of meaning, physiological changes, expressive behaviour and the subjective feeling of the state (Bagozzi, Gopinath, & Nyer,

1999; Ortony, Clore, & Collins, 1988). Feeling thus becomes the conscious, introspectively accessible part of emotions (Frijda, 1986).

From definition to distinctive prototypical types of emotion. Prototypical emotions have been divided into discrete categories. Although lists vary, several basic-emotion models remain influential. Izard (1977) identified ten "fundamental emotions"; Plutchik (1980) proposed eight primary emotions; and Ekman (1992) distinguished six basic emotions most suited for facial expression research. The latter is used as a basis for facial expression analysis. Detailed taxonomies and their methodological implications are presented in the Glossary (see glossary).

The terminology surrounding affective phenomena has been debated extensively in psychology, where authors disagree on whether constructs such as affect, emotion and feeling are distinct or overlapping (Russell & Barrett, 1999; Ekkekakis, 2012). In this thesis, the author will use emotion as an umbrella term that encompasses both emotions in a narrow sense and other states that include affective feelings.

Affective states are shaped by both explicit (conscious) and implicit (automatic) processes. Implicit processes operate below awareness and may give rise to very fast like/dislike responses to stimuli (Baumeister et al., 2007; Baumeister & Bushman, 2020). Explicit processes involve conscious and deliberate thought and therefore require more time and cognitive resources. These can co-exist, converge or diverge, and one may dominate decision-making in specific consumer contexts (Greenwald & Banaji, 1995; Wilson, Lindsey, & Schooler, 2000).

Translating these theoretical concepts into measurement, facial expressions are among the most recognisable indicators of emotion (Ekkekakis, 2012; Bagozzi, Gopinath, & Nyer, 1999). They reflect both voluntary and involuntary muscle movements, with the latter revealing underlying states even when individuals attempt to suppress them (Ekman, 1992; Wojdel & Rothkrantz, 2005; Lewinski et al., 2014). Automated tools such as FaceReader, based on Ekman and Friesen's (1978) Facial Action Coding System (FACS), enable systematic and replicable analysis of expressions (den Uyl & van Kuilenburg, 2005). Technical details on coding systems and action units are provided in the Glossary (see glossary).

Methods for measuring emotions are often divided into self-report and autonomic approaches (Poels & Dewitte, 2006). While self-assessments are common, they can be biased if consumers misunderstand tasks (Jaeger et al., 2013). Autonomic methods include skin conductance, heart rate, respiration, brain activity and facial expression analysis (Micu & Plummer, 2010). In packaging studies, automated facial coding is particularly valuable because it complements explicit reports and reduces self-report bias. A systematic overview of emotion measurement approaches is summarised in the glossary.

In this dissertation, emotions are not viewed as discrete triggers. Still, rather than being a component of a three-stage process of consumer behaviour, they arise concurrently with, or after, attention, are recorded by correlates (emotions and facial expressions) and affect how attention influences consumer choice.

Emotions often serve as modulators, but in some decision-making situations, such as when faced with overwhelming information, impulsive behaviour or intense emotional cues, their effect can also become dominating. Choice-making theories, such as dual-process models, heuristics and biases and bounded rationality (see glossary), provide the greatest understanding of these impacts, which vary in weight depending on the type of purchase choice. Emotions are reconnected to the broader decision-making framework in Section 1.3, which elaborates on these connections.

1.3 Decision-making

Consumer decision-making is a complex process shaped by rational evaluation, bounded cognitive capacity, emotions and social context. In neuromarketing, it is essential to link decision-making theories with the methodological tools used in this dissertation (conjoint analysis, eye-tracking and emotion measurement). Each of these methods corresponds to a different stage of the consumer behaviour model: conjoint analysis captures choice trade-offs, eye-tracking reveals attention allocation, and emotion measurement uncovers affective reactions that modulate or bias decisions. Together, these theories and methods allow for a more complete picture of how consumers make decisions in package design contexts.

Decision-making models can broadly be divided into normative models, which assume rational evaluation of alternatives, and descriptive models, which capture how people actually make decisions under real-world conditions of limited time, information and attention. While both traditions are important, descriptive models tend to align more closely with consumer behaviour in food and package design contexts, where decisions are fast, habitual and emotionally charged.

This dissertation explores key decision-making theories, including expected utility, prospect theory, dual-process theory and affective heuristics. These frameworks will be used to demonstrate the interplay between attention, emotion and choice. A longer list of decision-making theories, including both those emphasised here and others less directly applied, is summarised in a table (see appendix).

Expected Utility and Prospect Theory

Expected Utility Theory (Von Neumann & Morgenstern, 1944) represents the normative ideal of rational choice. It assumes that consumers systematically evaluate alternatives, assign probabilities to outcomes and select the option that maximises expected utility. In packaging research, this logic is embedded in conjoint analysis, which quantifies trade-offs among attributes (e.g. price, brand, sustainability) as utilities. From this perspective, choice is a matter of rational calculation, and eye-tracking or emotional reactions play little role.

However, this model is often insufficient in real-world consumer behaviour. Grocery shopping, for instance, rarely involves such deliberate computation. Here, prospect theory (Kahneman & Tversky, 1979) provides a more descriptive alternative. It argues that individuals evaluate outcomes relative to a reference point, are highly sensitive to framing and show loss aversion. In packaging contexts, reference-dependent evaluations are common: a package may feel "expensive" compared to another on the shelf, even if its objective quality is higher. Eye-tracking research shows that consumers disproportionately attend to cues such as "discount," "low-fat", or "eco-friendly." At the same time, emotion measures capture the subtle affective responses that frame these trade-offs.

Prospect theory also explains why emotions heighten under certain decision contexts. Consumers often encounter situations in which the volume of information presented overwhelms their cognitive processing capacity, a phenomenon known as information overload (Eppler & Mengis, 2004). This overload commonly arises in scenarios involving extensive product options, numerous features or detailed attribute comparisons (Scheibehenne et al., 2010; Iyengar & Lepper, 2000). Under such conditions, cognitive overload significantly hampers individuals' capacity to evaluate and synthesise information effectively, leading to impaired judgment and suboptimal decision-making (Sweller, 2011; Malhotra, 1982). People often turn to decision heuristics (rules to simplify decision-making) in these situations. Emotional responses become especially salient in information overload, as cognitive shortcuts that simplify processes by leveraging affective reactions (Slovic et al., 2007). Similarly, framing effects in packaging ("now with 20% less sugar") create affective anchors that bias evaluations. Thus, while expected utility provides the rational scaffold for modelling trade-offs, prospect theory and emotion research capture the distortions and biases that emerge in realistic shopping environments.

Dual Process Theory

Dual process theory (Evans, 2008; Kahneman, 2011) distinguishes between two cognitive systems: System 1, which is fast, intuitive and affect-driven, and operates under minimal deliberation; and System 2, which is slow, effortful, rational and capable of weighing options systematically (See glossary). This framework is directly relevant to neuromarketing. Eye-tracking can provide process indicators relevant to faster and slower decision-making, but fixation duration alone does not identify whether System 1 or System 2 is operating. Emotion measures may indicate affective responses associated with faster, less deliberative processing, rather than directly reveal which system is active. For example, facial expression analysis detects brief affective shifts that indicate System 1 dominance, while heightened physiological arousal may signal that rational deliberation has been overridden by emotion.

In packaging contexts, impulse decisions exemplify System 1 dominance. Impulse decisions are spontaneous and unplanned choices made without extensive deliberation or evaluation of alternatives. These decisions are often driven

by emotional impulses in which individuals act on immediate desires or gratification rather than rational considerations (Verplanken & Sato, 2011). Emotions can lead consumers to impulsively buy, as Weinberg and Gotwald (1982) demonstrated. More research on the affective antecedents of impulse buying was done by Rook and Gardner (1993), who emphasised the significance of mood in these kinds of decisions.

Furthermore, Donovan et al. (1994) investigated the impact of store atmosphere on consumer behaviour, which may lead to impulsive purchases. Rapid, automatic affective responses often guide impulse decisions, while cognition shapes behaviour indirectly through anticipated emotional outcomes and post hoc reflection rather than direct emotional causation (Baumeister et al., 2007). Emotions can act as triggers that intensify the desire for immediate gratification and impede rational decision-making (Loewenstein, 2000). Positive emotions, for example, can enhance the perceived benefits or rewards associated with impulsive choices (Mellers, Schwartz, & Ritov, 1999), while negative emotions may lead individuals to seek instant relief or distraction, driving impulsive behaviours (Tice, Bratslavsky, & Baumeister, 2001).

Conversely, System 2 comes into play when consumers weigh long-term goals (e.g. healthiness, sustainability) or conduct deliberate comparisons, which are best captured by conjoint utilities. Context plays a decisive role in determining which system governs behaviour. Context helps determine whether behaviour is guided by heuristic System 1 or reflective System 2 processing. Situational cues can promote more automatic responses, whereas greater time and cognitive resources support more reflective evaluation (Donovan et al., 1994; Evans, 2008; Kahneman, 2011). Under time pressure, affective reactions may take precedence, leading to increased reliance on intuitive processing (Kahneman, 2011; Loewenstein, 2000). With more time, consumers may engage System 2, but early affective impressions often linger and bias evaluations. This layered interaction underscores the need for methodological triangulation: eye-tracking to capture attention strategies, emotion measures to reveal unconscious affect and conjoint analysis to quantify deliberate trade-offs both for choice, attention and emotions.

Heuristics and Affective Decision-Making

Heuristics and biases (Tversky & Kahneman, 1974) provide another descriptive account of consumer choice. Under cognitive load, consumers rely on shortcuts such as brand familiarity, visual salience, or simple rules ("choose the cheapest" or "stick with what I always buy"). While these heuristics reduce effort, they can lead to systematic errors and context-dependent preferences.

In packaging design, heuristics are visible in attention allocation: eye-tracking often shows disproportionate fixations on logos, price tags or health claims. At the same time, less effort is devoted to scrutinising nutritional details. People use heuristics frequently when grocery shopping, since decisions are often made quickly and without giving them much thought. In some situations, heuristics can

simplify decision-making, as discussed in the seminal article by Tversky and Kahneman (1974). Customers choose products in grocery shops based on packaging designs that are most appealing, informative or high-quality (Wells, Farley, & Armstrong, 2007; Marsh & Bugusu, 2007). Furthermore, Holbrook and Batra (1987) and Spanjaard and Freeman (2012) show how emotions and simplified logic are used when making shopping decisions.

Positive emotions can increase the salience of an option, allowing heuristic choice processes to dominate and making a package feel "good enough" to be chosen without further consideration. Vlaev et al. (2011) demonstrate that such heuristics are not fixed rules but are dynamically shaped by situational context and relative comparisons, supporting the view that package choices depend on framing and attentional salience rather than stable preferences. Affective decision-making (Lerner et al., 2015) complements this by framing emotions not as noise but as integral inputs to decision-making. Our perception of risk, the value we assign to different attributes, and our ability to make trade-offs over time are all influenced by our emotions. For example, negative emotional salience in labels (e.g. warnings or stark contrasts) can draw attention and alter preferences (Orquin & Lagerkvist, 2015). Positive affect, meanwhile, enhances product appeal and can accelerate choice.

Emotional stimuli will capture attention (Calvo & Lang, 2004), as do negative emotion-evoking stimuli (Nummenmaa, Hyönä, & Calvo, 2006). People are more likely to fixate on a food label when the label has a negative emotional connotation (Orquin & Lagerkvist, 2015). Emotionally charged visuals can impact decisions when people assess their options. Butkeviciene et al. (2008) claim that nonverbal (colour, form, graphics, etc.) and verbal (brand name, information, producer, etc.) elements of product packaging all influence consumers' emotions and, consequently, their purchasing decisions (Loewenstein & Lerner, 2003).

These mechanisms are particularly visible under strong emotional cues, such as vivid imagery, nostalgic references or sensory triggers. Strong emotional cues can activate the limbic system, particularly the amygdala and the hippocampus, which are involved in emotion regulation and memory encoding (Tyng et al., 2017). Packaging that tells a story, uses personalised design or incorporates rich colours and textures often evokes such cues, creating memorable impressions that bias choice. This is consistent with research showing that storytelling, sensory elements and nostalgic design cues strengthen emotional engagement (Poels & Dewitte, 2019; Krishna, 2012; Wood, 2012; Talmi, 2013). Facial expression analysis identifies affective shifts, eye-tracking shows how emotional stimuli capture gaze, and conjoint analysis quantifies how these impressions translate into attribute trade-offs.

Finally, heuristics also include social shortcuts. Cialdini and Goldstein (2004) emphasise that social proof, authority and conformity guide consumer behaviour. Packaging claims like "#1 recommended" or celebrity endorsements reduce decision effort while signalling affective value. While social influence theory is not treated as a primary framework here, its mechanisms function within heuristic–affective processes observable through neuromarketing.

Integrating the Frameworks

While these theories are often presented and used on their own, they are best seen as complementary lenses rather than mutually exclusive explanations. Expected Utility Theory provides the normative framework for modelling rational trade-offs, prospect theory captures distortions introduced by framing and loss aversion, dual process theory explains how both rapid affective responses and deliberate reasoning can govern choice, and heuristic–affective accounts show how short-cuts and emotions simplify decisions under cognitive strain, overload or strong affective cues.

In practice, consumer behaviour rarely follows a single model. At times, one framework may provide the dominant explanation, such as loss aversion in price framing or system 1 dominance in impulse buys. More often, however, these perspectives overlap, each illuminating a different layer of the same decision event. These remain simplified abstractions of complex real-world behaviour. By combining them with neuromarketing methods, such as eye-tracking, emotion measurement and conjoint analysis, a more integrated and empirically grounded understanding can be developed. These methods not only help explain how consumers navigate package choices but also frame observed results in relation to underlying decision mechanisms, deepening the link between theory and empirical measurement.

Across all these theories, attention and emotion act as modulators: attention directs what enters the decision process, emotions shape how options are evaluated, and conjoint utilities provide a rational framework for understanding choices. By integrating these frameworks, the dissertation situates neuromarketing methods within the broader landscape of decision science, showing how they jointly capture the complex interplay of rationality, bounded cognition and affect in consumer behaviour.

2. METHODS FOR STUDYING CONSUMER BEHAVIOUR IN THE CONTEXT OF PACKAGE DESIGN

2.1 Neuromarketing research

This subchapter frames how neuromarketing operationalises the three stages of the consumer behaviour model: eye-tracking provides correlates of attention (what is seen and for how long); facial-expression analysis captures emotion (valence/arousal patterns elicited by design); and conjoint analysis quantifies choice (utilities/part-worths for design attributes). Together, these methods form a triangulated evidence base in which method-level agreement (or an explained divergence) comes before recommendations.

Neuromarketing research aligns with the consumer behaviour model – eye-tracking for attention (first stage), facial-expression analysis for affective responses (second), and conjoint analysis for choice-making (third), forming a triangulation that spans package-influenced behaviour. Eye-tracking clarifies shelf visibility and attention retention, emotion measures inform choice and memory effects, and conjoint analysis evaluates how multiple design factors simultaneously impact decisions.

Neuromarketing methods have been summarised in reviews that outline benefits, assumptions and application strategies (Bercea, 2012; Stasi et al., 2018), and broader field overviews detail strengths, weaknesses, primary methods and the field's evolution (Fortunato et al., 2014; Lim, 2018). Guidance includes early research models (Butler, 2008), multi-criteria decision frameworks (Nilashi et al., 2020) and comparisons with traditional approaches (Stasi et al., 2018). While none provides a definitive roadmap, together they offer useful scaffolding for study design and method choice.

Neuromarketing techniques are often grouped into central nervous system (CNS; e.g. brain waves, hemisphere lateralisation, fMRI/EEG), autonomic nervous system (ANS; e.g. heart rate, voice pitch, electrodermal analysis/EDA) and somatic nervous system (SNS; e.g. eye-movement analysis, facial muscle activity) (Wang et al., 2008; Bell et al., 2018). Eye-movement analysis must be acknowledged as automatic and somatic (Stewart et al., 1982). This dissertation focuses on eye-tracking and facial-expression analysis, then links these to conjoint analysis in an enriched framework (see glossary).

Among popular tools for package design, eye-tracking is the third most widely used neuromarketing method (Alsharif et al., 2023) because attention is central to package success but difficult to measure otherwise. Alternatives such as questionnaires, observation or cursor tracking are typically ex-post. They cannot locate the exact point of gaze, which is why eye-tracking is uniquely suited to measure where people look.

In packaging research, eye-tracking assesses whether and how products are noticed and processed, affective measures link emotional responses to preference formation and memory, and conjoint analysis explains how combinations of

package elements influence choice. Used together, these methods provide complementary evidence on attention, affect and preference. Accordingly, this dissertation examines the correlates of three consumer behaviour stages: eye-tracking captures fixation speed, location and duration as attention correlates; FaceReader measures facial action units as correlates of emotional responses; and product choice (typically observed in laboratory or store-like settings serves as a strong correlate of actual buying decisions (Figure 5). Within this neuromarketing framework, these correlates are referred to as "attention," "emotions", and "choice" for brevity.

2.2 Studying package design with eye-tracking

In this chapter, the author will explain how attention correlates are measured in the context of package design. People go about their everyday lives and get most of their information from what they see. It is often said that humans get 80% or 90% of their information from eyesight, but this is purely a simplification and not a scientific fact. Sivak (1996) argued in his paper on driving a car that there is no precise measure of how much of the information is visual, nor is there even a measurement system to do so. While, depending on the task, most of our information is perceived through eyesight, we lack a way to establish how much. This means that understanding how people look and see the world is beneficial for understanding how they perceive it.

Eye-tracking gives researchers a glance into a person's cognition and otherwise hidden gaze behaviour (MacInnes et al., 2018). In theory, any task or situation in which people look at things for information can be studied using eye-tracking.

Eye-tracking is used to determine which visual stimuli capture consumers' attention and how it is distributed across design elements. In marketing, this allows the optimisation of communication materials and retail environments. As eye-tracking equipment has become more affordable and user-friendly, it is increasingly used by companies, universities and research labs to improve design effectiveness (Wedel & Pieters, 2006; Feit et al., 2017). Optimising package designs to be attention-grabbing, readable and comprehensible makes shopping more efficient and can stimulate product sales (Pieters & Wedel, 2004; Genco et al., 2013; van der Lans et al., 2008b; Meißner et al., 2017). These aspects of package design (attention, clarity and comprehension) can be effectively examined using eye-tracking methodology.

Consistency and repeatability of data gathered during experiments are referred to as reliability. Reliable instruments produce consistent results under the same conditions, ensuring the credibility and reproducibility of research findings (Andrade, 2018; Heale & Twycross, 2015). In eye-tracking, reliability means that repeated exposure to the same stimulus under similar conditions yields similar patterns of eye movements. The sample size significantly influences statistical power and reduces sampling error, ensuring results are more representative of the

population. For instance, the average sample size for conjoint analysis is 355 participants (Pentus, 2023), while eye-tracking research on package design and nutrition labels varies widely, from 10 to 392 participants, with 69% of studies using 100 or fewer participants (Ma & Zhuang, 2021). Hardware also plays a key role. For example, mobile Tobii glasses have an average accuracy of 1.42 degrees and a precision of 0.34 degrees. However, these indicators worsen as the viewing angle and distance to the visual target increase (MacInnes et al., 2018).

There are three types of eye trackers: stationary (screen-based), mobile (head-mounted) and virtual reality headsets. Of these, only two, stationary and mobile eye-tracking, are commonplace in neuromarketing research (VR being a niche method in neuromarketing); hence, the thesis focuses on these two. When viewing two-dimensional stimuli on a computer screen, a stationary eye tracker measures the user's gaze position (Takahashi et al., 2018). Mobile eye-trackers are head-mounted devices that track a person's gaze on a video of the observed visual field (Takahashi et al., 2018). While mobile eye trackers measure gaze in head-centred coordinates, stationary eye trackers measure gaze in world-centred coordinates. Since head movement does not move the coordinate system, world-centred coordinates are inherently simpler to analyse.

Internal validity refers to the degree to which experimental results can be linked to the studied variables rather than outside influences. High internal validity is achieved through rigorous methodological practices to ensure the study accurately addresses the research questions without bias (Andrade, 2018; Trafimow, 2022).

In neuromarketing, this means considering the three systems that shape visual attention: bottom-up processes (stimulus-related), top-down processes (observer-related) and spatial viewing tendencies (Kollmorgen et al., 2010). Eye movements often follow a statistically dependent stochastic pattern, meaning the previous fixation influences each fixation (Ellis & Smith, 1985). This was tested by Pieters et al. (1999), who found that a stationary, reversible first-order Markov process can adequately explain the scan trajectories of print advertising. This was expanded upon by Coutrot and colleagues (2018), who demonstrated how Hidden Markov Models may be used to explain the scan routes for various stimuli. Within these scan routes, it is important to note that first fixations are a component that affects the outcomes (Atalay et al., 2012).

The stationary eye-tracking method is best suited for testing stimuli displayed on a computer screen – pictures, videos, and websites – and is usually conducted in a lab with controlled interfering factors (Clement et al., 2013; Reimann et al., 2010). Stationary eye-tracking would also be the preferred method for tests requiring high accuracy. On the other hand, in many cases in the neuromarketing research field, such as when testing shopping behaviour or advertising viewing, the ecological validity of showing visuals on a screen is questionable. Viewing stimuli on a screen is not always representative of how they are perceived in real life (Takahashi et al., 2018; Graham et al., 2012).

Mobile eye-tracking is frequently used when walking around an environment, such as a store (Imotions, 2015; Huddleston et al., 2015). People can be tested

using mobile eye-tracking in standard settings (Takahashi et al., 2018), such as seeing a package in a store or on a shelf in front of them. During these tests, people typically wear eye-trackers that resemble glasses, which measure eye movements, such as stationary eye-tracking. Mobile eye-tracking may seem more natural, but there is some debate about whether it is better for marketing research.

External validity examines the extent to which study findings can be generalised beyond the specific conditions of the research, including applicability to other populations, settings or times (Beechey, 2022; Vidyadharan & Harish, 2018). A subset of external validity is ecological validity, which focuses specifically on how well experimental setups replicate real-world conditions to ensure findings are meaningful in natural settings (Kihlstrom, 2021; Chang et al., 2022). Studies with high ecological validity often prioritise realism over strict control, balancing the trade-offs between internal and external validity (Jiménez-Buedo & Miller, 2010; Snow, 1974). People will probably look at package designs differently when sitting in a chair, looking at packages on a screen, compared to when walking freely through a supermarket while shopping (Foulsham et al., 2011). Since in-store shopping decisions are made quickly, research should be conducted at the point of purchase (Wästlund et al., 2015).

Eye-tracker precision varies widely across devices and setups, and these differences directly affect data quality (MacInnes et al., 2018). Stationary, screen-based systems typically report manufacturer accuracies ranging from approximately 0.25° to 0.5° and very high precision (often ~0.01°), although lower-cost or older systems may exhibit substantially poorer performance (e.g., up to ~1.0° accuracy and higher variability) (Dowiasch et al., 2020; Niehorster et al., 2018). Importantly, these baseline values are typically obtained under optimal, head-restrained conditions and significantly degrade when participants adopt unrestrained poses (Niehorster et al., 2018). In contrast, mobile eye-tracking glasses provide greater ecological validity but exhibit higher real-world error, with reported accuracies ranging from 0.84° to 1.42° and precisions from 0.16° to 0.34° (MacInnes et al., 2018). This performance further deteriorates at larger viewing distances, such as 3 meters (MacInnes et al., 2018). Moreover, wearable systems record gaze in egocentric coordinates, requiring frame-by-frame transformations to map gaze onto fixed environmental references, which introduces substantial analytical complexity compared to stationary systems (MacInnes et al., 2018). Choosing hardware thus involves a direct compromise: balancing the tight control and simpler analysis of stationary rigs against the naturalism and heavier analytical burden of mobile systems.

When watching scenes on a screen, people frequently begin watching them from the centre (Tatler, 2007). Tatler (2007) demonstrated that viewers' initial fixations usually occur at the scene's centre, where the most initial information can be gathered. This effect has been shown in research on package design, where visual components in the middle of the package are noticed first (Sørensen et al., 2012; Vidal et al., 2013). This tendency may be because the speed and length of saccades made in the direction of the centre are greater (Frost & Pöppel, 1976; Collewijn et al., 1988). The screen can act as a frame, as eyes naturally migrate

towards its centre because the saccade target's position is evaluated in a global screen reference framework (Vitu et al., 2004). Further studies from Bindemann (2010) and Borji and colleagues (2013) established the reality of the centred fixation bias. Shelf placement interacts with these effects: products in upper-left positions enjoy a viewing advantage in screen-based studies (Sørensen et al., 2012; Graham & Jeffery, 2011) but less so when aisles extend beyond a framed display (Gofman et al., 2009; Chandon et al., 2009; Tonkin et al., 2011). When dozens of alternatives compete, nutritional labels often go unseen (Visschers, Hess, & Siegrist, 2010), and larger-sized stimuli capture more fixations (Peschel & Orquin, 2013).

Both mobile and stationary eye-tracking have been used in respective package design studies. Multiple articles in packaging design research use stationary eye-tracking (Sørensen et al., 2012; Vidal et al., 2013; Gofman et al., 2009; etc.). Similarly, some articles use mobile eye-tracking (Chandon et al., 2009; Gidlöf et al., 2013; Burke & Leykin, 2014; Hendrickson & Ailawadi, 2014; Wästlund et al., 2015; Mokatren et al., 2018). Very few articles use both in the same study for comparison or validation. Very few articles use both in the same study for comparison or validation, and it is even rarer for the same hypothesis to be tested with both eye-trackers. In stationary eye-tracking, participants are asked to focus intently on anything displayed on the computer screen, which does not occur in real life (Clement, 2007). Using eye-tracking glasses (or mobile eye-trackers) also means that eye-tracking can be conducted in controlled or uncontrolled, naturalistic environments.

A distinct and underreported issue in neuromarketing research is the inconsistent definition of fixation, which directly impacts validity. Hessels et al. (2018) highlight how eye-tracking researchers often employ varying definitions, leading to discrepancies in how data is interpreted and analysed. The difference between the definitions is greatest between on-screen eye-tracking (Duchowski, 2007) and mobile eye-tracking (Jovancevic-Misic & Hayhoe, 2009). The four-parameter definitions suggested by Hessels et al. (2018) should be used, requiring researchers to report their methodological approach transparently. A key adaptation for mobile setups is adjusting the algorithm to maintain data quality when head movement can introduce instability in gaze estimates (Niehorster et al., 2020a). The utility of specific algorithms, such as I-VT, for classifying eye movements across various scenarios has been demonstrated in other studies (Malladi et al., 2022), and specialised software further underscores the importance of appropriate data processing tools for mobile environments (Niehorster et al., 2020b).

A fixation is:

1. When a person's eyes remain relatively still on an object, which may also be moving;
2. made with a focus to keep that object on the fovea long enough (50ms) for information processing (Duchowski, 2007;
3. measured using world-centred coordinates for on-screen eye-tracking and head-centred coordinates for mobile eye-tracking, with gaze points manually mapped to 2D snapshots of the environment;

4. determined using Tobii I-VT fixation filter;
5. using a gap fill-in interpolation is 75ms, average of 2 eyes is used, the velocity threshold is 30 degrees/second, the velocity calculator window length is 20ms, adjacent fixation merging is done with a maximum time difference between fixations of 75ms and a maximum angle between fixations being 0,5 degrees; fixations below 60ms are discarded).

This definition has proven effective for both stationary and mobile eye-trackers. A notable adjustment when working with Tobii eye-trackers is using the I-VT Attention filter for mobile eye-tracking data, which is more susceptible to motion artefacts. The I-VT Attention filter addresses this by setting a velocity threshold of 100 degrees/second, rather than the 30 degrees/second typically used in stationary setups. This adjustment helps maintain data quality in mobile conditions, where head movement can introduce instability in gaze estimates (Niehorster et al., 2020a). Studies such as Malladi et al. (2022) further demonstrate the utility of the I-VT algorithm for classifying eye movements across diverse scenarios, validating its flexibility across eye-tracking applications. Additionally, the GlassesViewer software developed for analysing Tobii Pro Glasses 2 data underscores the importance of appropriate data processing tools and methodologies to accommodate mobile eye-tracking environments (Niehorster et al., 2020b). This research found the I-VT Attention filter to be effective, producing relatively high-quality data despite the challenges inherent in mobile eye-tracking.

Eye-tracking validity also depends on the fixation definition, the wording used and its relation to the research setup. In static, screen-based setups, researchers often rely on temporal–spatial thresholds (e.g., 50 ms dwell time, defined AOIs) consistent with classic descriptions of fixation (Duchowski, 2007). However, mobile and head-mounted systems require additional considerations, such as distinguishing smooth pursuit from proper fixation and compensating for head motion (Jovancević-Mišić & Hayhoe, 2009). The four-component definition we introduced (Hessels et al., 2018) must therefore be instantiated with modality-appropriate filters: stationary I-VT parameters per Niehorster et al. (2020a) and elevated-velocity I-VT Attention filters with GlassesViewer processing in mobile contexts (Niehorster et al., 2020b). Transparent reporting of these adaptations helps keep ‘fixations’ comparable across lab and field studies (Hessels et al., 2018; Holmqvist et al., 2012).

2.3 Studying package design with facial-expression measurement

When noticed, package design usually triggers emotion(s) to varying degrees. In consumer behaviour frameworks such as the AIDA model (see glossary), this emotional activation marks the transition from “Attention” to “Interest” and “Desire,” where visual cues elicit affective responses that influence purchase intent. Emotional visual cues can be noticed faster than neutral ones, so that some

emotion can arise before attention. The model assumes that package design must first be noticed in most cases, while positive emotions will support faster noticing.

Emotional processing can begin before we fixate on a stimulus, as evidenced by growing research showing that emotional content captures attention at early, pre-fixation stages (Fan et al., 2022). Such prioritisation is not limited to healthy individuals; people with affective disorders, including anxiety and depression, also exhibit rapid, automatic attentional biases toward emotional stimuli, affecting initial attention allocation (Armstrong & Olatunji, 2012). Moreover, eye-movement studies reveal that emotional stimuli can alter gaze patterns (fixation duration and saccade direction) even before fixation occurs, highlighting the role of emotions in guiding visual exploration (Huang et al., 2023; Jang et al., 2016). In line with this, emotional distractors have been shown to interfere with ongoing tasks, suggesting that emotional processing can occur swiftly and involuntarily, well before direct visual focus (Pedale et al., 2019).

From a neural perspective, these early emotional processes involve regions such as the amygdala that activate in response to emotionally salient information, regardless of foveal fixation (Hadjikhani et al., 2017; Stephenson et al., 2019). The resulting enhanced detection and prioritisation of emotional targets underscore the influence of pre-fixation emotional processing on subsequent attention and behaviour (Pedale et al., 2019). Collectively, these findings illustrate how emotional stimuli can shape both neural and behavioural responses (even before we consciously direct our gaze), underscoring the deep-seated connection between emotion and attention across various populations. This sequence supports integrating eye-tracking and facial-expression analysis within a single behavioural model, as both capture distinct temporal phases of stimulus evaluation.

Emotional stimuli are generally processed faster than neutral stimuli, a phenomenon supported by extensive research showing a preferential, rapid allocation of cognitive resources to emotionally charged content (Pool et al., 2016; Bekhtereva et al., 2015; Bannerman et al., 2009). This prioritisation emerges early in attentional and perceptual processing, as evidenced by quicker, more involuntary shifts of attention towards emotional stimuli (Pool et al., 2016; Bekhtereva et al., 2015). Concurrently, the enhanced perceptual encoding of emotional material leads to heightened salience and more accurate recognition (Zeelenberg et al., 2006; Kissler & Koessler, 2011). Research on saccadic eye movements consistently shows that emotional images, even when displayed for short durations, provoke quicker responses. This highlights a strong bias toward emotionally charged content (Bannerman et al., 2009). Neurophysiological studies further show that emotional stimuli trigger stronger and faster event-related potentials (ERPs), underscoring the brain's innate tendency to prioritise emotional information (Simola et al., 2013; Bekhtereva et al., 2015). For package design, this means that emotion may not only follow perception but actively guide which visual elements receive attention first.

Beyond immediate detection, emotional stimuli also enhance memory retention and recognition, with low-spatial-frequency images proving particularly effective at enhancing emotional memory (Rohr et al., 2017). These combined

observations reflect the brain's adaptive mechanism to rapidly and efficiently process emotionally significant information, likely shaped by evolution to respond swiftly to potential threats or opportunities (Pool et al., 2016; Bannerman et al., 2009). These results show how emotional stimuli gain preferential access to cognitive and neural resources, facilitating quicker attentional capture, improved perceptual accuracy and strengthened memory encoding.

Depending on the decision-making theory we choose to describe consumers' purchase behaviour, emotions may play a pivotal role (affective or system 1 thinking; see glossary: dual-process theory). After we have noticed a product, the decision to buy it might be based on thorough calculation or a mere feeling: "I like this so I will buy it." Given that emotions strongly influence consumers' buying behaviour and are important in decision-making (Bagozzi, Gopinath, & Nyer, 1999; Lerner et al., 2015), this chapter explains how to measure them most effectively. This approach also reflects the principle of bounded rationality (Simon, 1957), in which limited cognitive capacity leads to greater reliance on affective cues in design choices.

Before any preference mapping can begin, every participant must see and feel each orthogonally generated package design. To that end, all stimulus cards are presented individually, allowing the researcher to record a complete emotional profile for each design. This sequential display is the only way to guarantee that every consumer evaluates every level of every factor in the conjoint matrix and that the resulting emotion scores truly reflect reactions to individual package attributes. Although it might seem efficient to show all designs at once on a "virtual shelf" and infer emotions by pairing gaze data with affective measures, in practice, this approach struggles with split-second viewing patterns, variable emotion-onset delays and unintended context effects (e.g., a disliked design reduces feeling toward its neighbours). Moreover, the near-identical nature of 12–16 ceteris-paribus orthogonal stimuli can induce fatigue, leading to weaker responses to later items. Counterbalancing display order or introducing sufficiently large factor-level contrasts can help, but when subtle design changes alone will not sustain engagement, alternative experimental formats should be considered.

In methodological terms, this structure ensures internal validity (see glossary) by isolating emotion elicited by each design and controlling carryover between stimuli. Theories and debates about whether emotion should also be recognised by the person experiencing it must be acknowledged. For some theories, emotion is only when consciously known or labelled (Lazarus, 1982). When package designs are measured, the emotions these stimuli evoke are small and often not consciously labelled. One suitable theory to rely on is the Cannon-Bard theory (see glossary), which holds that physiological and emotional processes occur simultaneously and do not directly influence one another. This suggests that physiological responses and subjective feeling may unfold in parallel; however, that theoretical position does not by itself establish that FaceReader outputs are equivalent to emotions. In this dissertation, facial-expression measures are therefore treated as affective correlates rather than direct readouts of emotion. This is an important underlying assumption, as otherwise the emotions evoked by

package designs, measured by FaceReader, cannot be considered emotions. This assumption underscores the value of facial expression measurement in package design research, where consumers' responses may be subtle and often occur unconsciously. It thus validates the use of non-verbal measures in contexts where verbal self-report would underestimate true affective intensity.

There are various ways to measure emotions. One suggestion for this dissertation is to measure facial expressions. There are numerous reasons for this choice, stemming from the possibility of two-dimensional measurements with expression (arousal and valence) and the active-passive dimension. This dimensional framing draws on broader historical traditions in affect research, originating with Wundt's early dimensional proposals (Wundt, 1948) and operationalized by modern valence-arousal models (Russell, 1980). This framework (see glossary: Valence/Arousal) enables interpretation of subtle consumer reactions by mapping each facial response onto a two-dimensional emotion space, balancing sensitivity and interpretability. This approach aligns with the goals of package design research, where ecological validity (see glossary) is essential, and minimal intrusiveness is preferred. Measuring emotions through facial expressions using a webcam is less intrusive than EEG or fMRI and highly practical for package design research. Furthermore, as highlighted by Poels and Dewitte (2006), autonomic emotion measurement provides a distinct advantage over self-report methods by capturing immediate affective responses before they can be filtered, altered, or biased by higher cognitive processes.

EEG can accurately identify emotions, but it is most effective in clinical settings because it requires a lengthy setup process and is sensitive to noise. It allows for two-dimensional measurements of emotions, specifically valence and arousal. Speech and voice recognition are also capable of estimating both arousal and valence within dimensional frameworks; however, their application is often restricted to contexts where participants provide verbal output. Additionally, while automated facial coding and speech recognition each offer high precision in their respective modalities, their relative accuracy remains task-dependent. Other measures, such as heart rate, electrodermal activity and galvanic skin response, can all be used to some extent but primarily index arousal, often falling short of capturing the valence dimension. Facial-expression measurement therefore provides a favorable trade-off between ecological realism, interpretability and efficiency in neuromarketing contexts.

In this dissertation, the author focuses explicitly on FaceReader software for expression measurement. FaceReader is an automated emotion-measurement tool developed by Noldus Information Technology in Wageningen, Netherlands, that measures emotions from facial expressions. It uses the Facial Action Coding System (FACS). Paul Ekman's FACS is a foundational tool in analysing facial expressions, allowing systematic categorisation of facial movements that correspond with specific emotions (Ekman & Friesen, 1978). FACS operates by identifying facial muscle activity associated with basic emotions such as happiness, sadness, anger, fear, surprise and disgust (Ekman & Friesen, 1971; Russell, 1994). In an early validation using posed-expression images, FaceReader achieved about

89% overall accuracy; class precision was 0.97 for happy and 0.80 for angry expressions (den Uyl & van Kuilenburg, 2005). Furthermore, FaceReader classifications have shown convergent validity with facial electromyography (EMG), which measures the activity of facial muscles (specifically the zygomaticus and corrugator muscles) (D'Arcey & Trevor, 2013). In practice, FaceReader assigns scores for neutral, happy, sad, angry, surprised, scared, disgusted, and contempt (0–1), and summarises responses via valence and arousal (Gunaratne et al., 2019; Bartkiene et al., 2019). Automated implementations of FACS, such as FaceReader, thus enable consistent, scalable quantification of facial movements across large and diverse participant samples.

Participants differ in baseline expressiveness and "neutral" faces: classic and recent work show both universal patterns and meaningful individual/cultural (Bagozzi, Gopinath, & Nyer, 1999; Barrett, 2006; Cowen & Keltner, 2021; Eid & Diener, 2001; Ekman, 1972; Ekman & Friesen, 1978; Fischer et al., 2004; Frijda, 1986; Izard, 1971; Manokara, 2021). Two practical calibration options address this: a neutral-stimulus baseline (e.g. 10 s; automated in AFEA) or continuous calibration between each participant's least/most expressive responses (Höfling et al., 2020; Crist et al., 2018; Danner et al., 2014; Kessler et al., 2020). When measuring emotions in response to package designs, the designs must be shown individually to allow for clear differentiation in emotional responses associated with each design, with counterbalanced orders and neutral "reset" slides to reduce carryover (Pentus et al., 2014; Orth & Malkewitz, 2008; Clement et al., 2013; Kessler et al., 2020). Because packaging often elicits low-intensity signals, appropriate thresholds and baseline corrections help filter noise and detect meaningful responses (Crist et al., 2018). Together, these steps yield reliable, interpretable emotion profiles for each orthogonal design. These methodological calibrations strengthen both reliability and validity by accounting for individual variability and emotional drift across repeated stimuli.

While universality of expression supports standardisation, the literature also emphasises the cultural relativity of emotion interpretation (see glossary: facial expressions of emotion). Recognising this duality enables researchers to generalise results while acknowledging possible cross-cultural nuances in emotional decoding.

Package designs are usually less emotionally engaging than stimuli like TV or banner advertisements, which are more commonly tested in neuromarketing. As a result, facial-expression analysis often captures low-level emotional responses when evaluating packaging. This limited engagement poses two main challenges for researchers. First, a threshold must be set to exclude responses below a certain level from being considered genuine emotional reactions. Low-intensity signals can blend with neutral expressions, making it challenging to distinguish meaningful responses. Setting an appropriate threshold improves data accuracy by filtering out noise and focusing only on significant emotional responses (Crist et al., 2018). Second, the subtlety of these emotional responses requires highly sensitive measurement tools. Traditional facial-recognition software may struggle to capture low-intensity responses, necessitating adjustments in analysis, such as

baseline corrections, to improve the sensitivity and reliability of the data (Crist et al., 2018).

When measuring emotions in response to package designs, it is important to present designs one at a time (Pentus et al., 2014). This approach allows each package to elicit its emotional responses, minimising overlapping emotional reactions and isolating the unique emotional impact of each design. Facial-expression data can be summarised at the stimulus level (Crist et al., 2018; Danner et al., 2014); using those summaries to inform rankings for conjoint analysis allows researchers to explore how different design factors contribute to specific emotional responses. The order in which stimuli are presented is also important for obtaining accurate emotion data. When package designs are shown sequentially, participants' focus and emotional reactivity can diminish due to mental fatigue or boredom, especially when designs appear visually similar. This factor is particularly relevant in conjoint-analysis-based package-design testing, where orthogonal designs often result in similar-looking packages.

Emotions can also transfer from one stimulus to another within the same experimental design. When two stimuli are presented consecutively, emotions triggered by the first stimulus may "spill over" into the second, a phenomenon known as emotional carryover. For example, intense positive emotions from a brightly coloured package could carry over to a package design shown next, unintentionally raising positive emotion levels across multiple stimuli. Counterbalancing presentation orders can help reduce this effect. Additionally, following each package with a blank or neutral slide helps "reset" participants' emotional baseline, minimising carryover and isolating each package's unique emotional impact (Kessler et al., 2020). These reset phases effectively serve as emotional washout periods, enhancing the interpretive clarity of each trial.

In summary, measuring emotions in the context of package design involves several considerations. From managing individual differences in baseline calibration to controlling emotional carryover and accounting for response fatigue, each factor plays a vital role in collecting reliable consumer-engagement data. Addressing these variables carefully ensures that insights into emotional engagement with packaging are accurate and actionable for better design decisions. Facial-expression measurement examines the affective stage of the consumer-behaviour model, bridging emotional responses with observable design preferences. When integrated with attention metrics and conjoint-derived choice data, it enables a triangulated understanding of how package elements influence perception, feeling and purchase intent.

2.4 Studying package preferences with classical conjoint

Conjoint analysis, a method for measuring consumer preferences, was first introduced in 1964 by mathematical psychologist R. Duncan Luce and statistician John W. Tukey (Tukey & Luce, 1964), who introduced its foundational theoretical framework (see glossary) (Carroll & Green, 1995; Gustafsson et al., 2000).

Early psychometric advancements by researchers such as Kruskal in 1964, Carroll in 1969 and 1973 and Young in 1972 expanded its scope by developing nonmetric conjoint analysis (Carroll & Green, 1995). The method gained prominence in marketing with contributions from Green and Rao (1971) and Johnson (1974), who showcased its practical applications for understanding consumer preferences (Gustafsson et al., 2000). Subsequent refinements by Green and Srinivasan (1978, 1990) and further documentation by Wittink and Cattin (1989) solidified its role as a crucial tool in market research, while its applications extended to sectors like health care (Carroll & Green, 1995; Gustafsson et al., 2000). Today, conjoint analysis is a vital methodology for analysing preferences and decision-making across various domains.

Most package design research analyses the effects of specific elements, such as colour, illustrations and typography, on consumer perceptions. Regardless of how a product package is designed, it combines informative and visual elements contributing to consumer decision-making. Among statistical approaches, conjoint analysis is a powerful method for systematically analysing combinations of attributes, offering insights into how a design influences consumers, which details matter most, and to what extent each attribute affects consumer preferences.

The important product characteristics to be studied are identified in the first stage of conjoint analysis. In this context, a preliminary analysis or qualitative research can help determine which package attributes are most likely to influence consumer responses. Louviere et al. (2010) note that, although a range of approaches can be used to identify attributes, there is no accepted standardised method, and practice varies widely. After selecting the product and its attributes, the researcher must then establish the levels of these attributes. This process generates an orthogonal design, a set of "cards" or product profiles, each with a unique combination of attribute levels. Respondents are then shown these cards and asked to evaluate each according to their preference.

Depending on the study objectives, respondents may rank each card or choose between paired profiles, providing valuable consumer preference data. This information enables the calculation of sample preferences for each attribute and its levels, supporting predictions about which traits are more significant and which attribute levels the larger market may favour. North and Vos (2002) describe the crucial steps in conjoint analysis as follows: first, selecting the relevant product attributes; second, defining the specific levels or variations for each chosen attribute; third, combining these attribute levels to create distinct product profiles; fourth, deciding how to present these profiles to respondents and what type of judgments to collect; and finally, choosing the appropriate analytical technique for the gathered data.

There are different ways to structure classical conjoint analysis based on the type of question presented to the participant. Primarily, conjoint analysis can be based on choice, ranking or ordering tasks. For instance, the base question may ask participants to select a preferred product, rank a series of products, or choose which product they would be willing to purchase. As Table 3 illustrates, various task options align with these approaches.

Table 3: Overview of different conjoint tasks and their potential bases, as identified in a systematic review of food product conjoint research.

Task format	**Based on:**				
Choose	Choice	Purchase intent	Likability	Willingness to pay	Preference
Order	Which would you choose?	Which would you rather purchase?	Which do you like?	Which would you pay more for?	Which do you prefer?
Rank	Which would you choose?	Which would you rather purchase?	Which do you like more?	Which would you pay more for?	Which would you prefer?

Source: compiled by the author

The research methodology must clearly articulate the specific question guiding the conjoint analysis. Different package design elements are suited to different objectives, as some influence purchase decisions more strongly than others. For instance, price typically affects purchase intent more than likability, and utilitarian and hedonic product types evoke distinct consumer responses. Aligning the conjoint analysis task with the product's nature ensures methodological consistency and reliable insight into package perception and choice.

Classical conjoint analysis decomposes package designs into defined attributes and levels, revealing how each contributes to consumer preference. By capturing trade-offs through ranking or selection tasks, it quantifies both attribute importance (e.g., colour, label, or price) and level effects (e.g., colour = blue vs purple), providing a robust basis for package optimisation. Integrating conjoint analysis with neuromarketing methods, such as eye-tracking metrics (time to first fixation, total fixation duration) and emotion-measurement scores, enables a systematic linkage among attention, emotion and preference. In practice, this requires high-quality, orthogonally designed visuals shown in controlled, randomised settings to minimise position bias and visual fatigue. This combined approach strengthens the predictive power of package-design research by connecting conscious and subconscious determinants of consumer choice.

2.5 Triangulation of research methods

Triangulation is often used to increase confidence in research findings by confirming results across multiple methods or data sources. This approach can provide a more comprehensive understanding of the research problem (Dźwigoł, 2020; Farquhar et al., 2020; Heale & Forbes, 2013). Integrating neuromarketing techniques with traditional methods like conjoint analysis can provide a more comprehensive understanding of consumer behaviour by capturing both subconscious and conscious decision-making processes and can also often lead to better data quality (Anuar & Isa, 2022). Triangulation also allows researchers to

explore consumer psychology, motivation and behaviour more deeply, offering insights that are not possible with a single method (Eroglu & Kucun, 2020). Triangulating results using different research methods in neuromarketing provides a more holistic view of consumer behaviour, enhances data quality and can address the limitations of individual methods.

There are three types of triangulations: convergence, complementarity and dissonance. Without unnecessarily delving into the vast literature and nuances of triangulation or its application to neuromarketing methods (which would be a dissertation in itself), the author suggests using complementary triangulation. In this approach, the researcher will establish multiple constructs of an object and then combine these strategies to form a more complete picture of reality (Erzberger & Prein, 1997). This approach perfectly aligns with the consumer behaviour model and stages shown in Figure 1 (AIDA, Cab and 5-Stage). Neuromarketing package design research deals with understanding how a design might influence consumer behaviour. It does so by examining how package design influences consumers at different stages (in the consumer behaviour model). This aligns with complementary triangulation, where the aim is not to combine the different approaches into a new holistic whole as a picture of reality; rather, it is to put the different methods' results side by side, like a jigsaw puzzle (Erzberger & Prein, 1997).

This means that eye-tracking results, for instance, should not be interpreted separately from emotion measurement results, but rather examined side by side. For example, when red is favourable for noticing a package design in eye-tracking research, it elicits lower levels of positive emotion than alternatives in an orthogonal design. It should not be stated that red colour is good for the package. Additionally, if conjoint analysis results for choice indicate that red is a positive influence, it could be concluded that red is a good colour to go with, but this should be examined alongside emotion measurement results. Since consumer behaviour is a complex and multifaceted phenomenon, triangulating the various neuromarketing methods that fit within consumer behaviour models is a good approach.

3. EMPIRICAL STUDIES

4. DISCUSSION AND CONCLUSIONS

4.1 Discussion

The main findings from this dissertation will be discussed in this section. This dissertation is based on three original articles, as each one addresses distinctly different aspects of this dissertation's conjoint-enriched neuromarketing analysis. The framework builds upon consumer behaviour models, integrating eye-tracking and facial expression measurement with conjoint analysis. Answers to RQs at a glance (one-sentence summaries):

RQ1 (eye-tracker choice influences validity): Stationary eye-tracking results in more central fixations; mobile eye-tracking results in more ecologically valid scanning patterns for in-store tasks.

RQ2 (context influences attention patterns): Shelf and aisle contexts with mobile eye-tracking disperse first fixation locations versus static screens with stationary eye-tracking; context selection must match research aims.

RQ3 (affect influences choice): Textual cues (e.g. sugar disclaimers, slogans) generate positive emotion that aligns with choice, indicating affective utility.

RQ4 (incremental power): Integrating facial-expression valence introduces a distinct affective dimension to the conjoint framework, capturing subconscious variance in consumer preference that explicit choice models traditionally omit.

RQ5 (attribute coverage): The literature overly emphasises extrinsic attributes; intrinsic cues are understudied.

RQ6 (conjoint research design choices matter): Evaluation framing and ex-post clustering shift attribute-importance estimates.

Article 1: Mobile vs Stationary Eye-Tracking

This article (Pentus et al., 2020) compares two eye-tracking methods (mobile versus stationary) and examines their impact on measuring attention to package designs. It examines how methodological choices can accurately capture consumer attention, underscoring the importance of data validity in neuromarketing research. The findings provide a clear answer to RQ1 (How do eye-tracker type choices affect the validity of attention metrics?). The article found significant differences between the two methods, most notably the prevalence of centre-fixation bias in stationary, screen-based experiments. With abstract package designs, 60.4% of first fixations in the stationary condition were in the centre, compared to only 26.3% in the mobile condition. This demonstrates that stationary setups can artificially inflate attention on centrally located package elements, potentially skewing results and leading to flawed design recommendations.

Stationary eye-tracking can suffer from centre fixation bias, where participants disproportionately look at the centre of the screen, potentially skewing attention metrics by disadvantaging package elements presented in the screen periphery. Mobile eye-tracking, used in more naturalistic settings (e.g. walking down a store aisle), yielded different, likely more ecologically valid, scanning

patterns that better reflect real-world visual search behaviour. This result highlights the importance of methodological choices for capturing accurate attention data when measuring attention to package design.

These differences proved large and consistent across stimuli: for abstract package designs, 60.4% of first fixations under stationary conditions were in the centre, compared to only 26.3% under mobile conditions; for real packages, 48.2% versus 21.9%; and for store shelves, 29.5% versus 9.4%. These empirical results underscore the need to choose eye-tracking methods aligned with one's research aims and caution practitioners against over-reliance on screen-based results when the objective is to capture realistic in-store behaviours.

This directly informs RQ2 (How do contextual settings influence attention patterns?). The article showed that the more naturalistic context of mobile eye-tracking, used while navigating a store aisle, yields more dispersed and ecologically valid scanning patterns that better reflect real-world visual search behaviour. These empirical results show the importance of choosing an eye-tracking method that aligns with the research objective; if the goal is to understand in-store behaviour, mobile eye-tracking is less affected by methodological artefacts arising from setup and other factors. This finding directly addresses GAP-Meth by highlighting how unexamined methodological choices can undermine data reliability in a multi-method study. When the research question concerns in-store discovery or shelf search, mobile eye-tracking should be preferred in the research design, or debias stationary studies via randomised stimulus positions and an enforced initial fixation point.

In linking these findings to the dissertation's conceptual model, Article 1 relates to the "Attention" or "Cognitive" stage of consumer behaviour models. It emphasises that measuring attention must be rigorous, or interpretations of emotional triggers and choice behaviours may be skewed. This article, therefore, addresses methodological research gaps by demonstrating that "real" consumer scanning patterns can differ substantially from lab-based, screen-bound data. It also expands on earlier work (Tatler, 2007; Atalay et al., 2012) by systematically comparing on-screen and mobile conditions, reinforcing that centre fixation bias can confound studies of package design or shelf layouts. Consequently, the validity of any conjoint-enriched neuromarketing approach depends on minimising such biases in measuring attention.

While Article 1 is, by its nature, a comparison of methodologies, it also demonstrates how eye-tracking is such a valuable tool in consumer decision research. Both methods yielded actionable results for potentially optimising products. Both methods showed that people have distinct visual search patterns when choosing products and that their attention is influenced by the environment (screen vs shelf). While understanding where each method's results (emotion correlates, attention correlates or choice correlates) sit in the consumer choice model, Article 1 demonstrates that a layer of methodological rigour is just as important for obtaining valid, actionable results. Answer to **RQ1**: Eye-tracker choice affects attention metrics; stationary set-ups inflate central fixations relative to mobile, potentially biasing design (GAP-Meth; Objective 2). Answer to

RQ2: Naturalistic shelf contexts disperse attention and better reflect in-store search; method–context alignment is required for valid attention data (GAP-Meth; Objective 2).

These findings demonstrate that visual attention patterns in package design are not only descriptive but also shape the information basis on which the choice is formed. Compared to prior eye-tracking studies, which typically examine fixation metrics in isolation, this study links attention to choice within a conjoint analysis framework, extending earlier work that treated visual salience and preference formation as parallel rather than integrated processes. The results suggest that design elements positioned to attract early and sustained attention can disproportionately influence choice outcomes even when multiple attributes are available. However, these effects are bounded by the experimental context, as attention may differ in more naturalistic retail environments with higher cognitive load, competing stimuli or time pressure.

Article 2: Emotional Responses and Conjoint Analysis

The second article (Pentus, Mehine, & Kuusik, 2014) examines how emotions influence consumer choices in food package design by integrating conjoint analysis with neuromarketing measurements (facial expressions). Specifically, it evaluated apple juice packages to address RQ3 (How do emotional responses to visual package design elements influence consumer choice?). The article found that specific textual elements, such as slogans and sugar disclaimers, evoked positive emotional reactions (i.e., "happiness" as coded from facial expressions) that aligned with product choice. This supports the premise that package design elements are processed not only cognitively but also elicit affective responses relevant to decision-making.

By systematically combining facial expression analysis with a conjoint-like methodology, the study provides a deeper understanding of consumer reactions at both cognitive and affective levels. The second article suggests that positive facial-expression responses varied across package designs and aligned with some preference patterns. It demonstrates that facial-expression data can be incorporated into a conjoint-like framework as an additional affective signal. In addressing RQ4 (concerning the incremental contribution of a facial-expression-based conjoint approach), the article demonstrated that integrating facial-expression valence introduces a distinct affective dimension to the framework. It captures variance in consumer preference that explicit choice models traditionally omit, providing valuable insights beyond those offered by classical conjoint models. This directly addresses GAP-Theo by integrating a core consumer behaviour (affect) component into a quantitative framework and GAP-Meth by proving the viability of a novel multi-method combination.

107 participants evaluated nineteen juice package "cards" that systematically varied elements (such as slogans, sugar disclaimers and portion sizes). Results revealed distinct differences in measured "happiness". When these aggregated emotion scores were used as inputs in a "conjoint-like" framework, sugar/carbohydrate disclaimers and slogans emerged as particularly relevant to positive

emotional responses. This extends prior arguments (Bagozzi, Gopinath, & Nyer, 1999) by demonstrating a methodology for integrating and quantifying affective responses within a choice-modelling framework, aligning with the "Affective" stage of consumer behaviour models.

While prior work acknowledged the role of emotions (e.g. Liao et al., 2015), this article extends traditional conjoint analysis by incorporating a direct measure of affect, unlike studies that rely solely on self-reported emotions or preference ratings. Answer to **RQ3**: Emotionally positive facial-expression responses to specific textual elements align with higher choice utility, indicating that affect acts as an important correlate of preference (GAP-Theo; Objective 1). Answer to **RQ4**: Incorporating facial-expression valence adds a distinct affective signal to the framework, broadening process-level interpretability at the element level (GAP-Meth & GAP-Interp; Objective 1).

Ultimately, Article 2 advances previous work by connecting emotional responses to attribute-level decision processes. While previous conjoint-based research has largely examined preferences inferred from observed choices, this study demonstrates that affective reactions (particularly positive emotions elicited by package designs) help contextualize why certain attributes dominate choice even when visual attention is controlled.

Article 3: Systematic Review of Food Product Conjoint Analysis

The third article (Pentus, 2023) systematically reviews 72 articles on the application of conjoint analysis to food product packaging published between 2000 and 2020. It examines how different product evaluation questions (preference, purchase intent and likability), varying product categories (hedonic vs utilitarian) and subsampling methods (ex-ante vs ex-post clustering) shape the outcomes of conjoint-based studies. The findings address RQ5 (What is the relative impact of intrinsic versus extrinsic attributes?) by showing a strong bias in the literature toward extrinsic attributes such as brand and price, often at the expense of intrinsic attributes such as taste or texture. This suggests that classical conjoint studies may overlook key product features that an enriched framework, capable of measuring attention and emotion related to intrinsic cues, could capture.

From a methodological standpoint, the review shows that sample heterogeneity is often addressed through ex post subsampling methods, such as cluster analysis. However, these techniques often produce subsamples that are not straightforward for managerial use, as they are difficult to apply without a demographic denominator. Similarly, selecting an evaluative framing (purchase intent, likability or preference) can shift the importance of attributes such as price, health claims or brand.

Article 3 revealed a strong bias in the existing literature towards extrinsic attributes (brand, price, origin) over intrinsic ones (taste, texture). Hedonic products were studied more often than utilitarian ones. It found that the choice of evaluation question (e.g. preference vs purchase intent) significantly impacts attribute importance, particularly for price and health claims. Ex-post clustering

was common for addressing sample heterogeneity, but often lacked clear demographic links useful for managers. The review highlighted gaps, including the need for further research on utilitarian products and intrinsic attributes.

The review also answers RQ6 (How do study-design factors influence attribute-importance estimates?). It found that methodological choices, such as the framing of the evaluation question (e.g., purchase intent vs preference) and the subsampling strategy (e.g., ex post clustering), significantly influence results. This finding reinforces the arguments from Article 1 about methodological rigour. It directly addresses GAP-Interp by showing that interpreting conjoint results requires a keen awareness of the study's design. The review revealed that many studies lack clear, managerially meaningful segmentation, a weakness that the proposed framework aims to mitigate by providing richer data for profiling. Answer to **RQ5**: The literature disproportionately focuses on extrinsic cues while intrinsic attributes remain under-represented, motivating integrated designs that capture both (GAP-Interp; Objective 3). Answer to **RQ6**: Attribute-importance estimates change with evaluation framing and segmentation approach; transparent reporting and validation are necessary for comparability (GAP-Meth & GAP-Interp; Objectives 3–4).

This article provides a structured overview of how conjoint analysis has been applied in food product research and examines recurring methodological patterns that shape reported results. While earlier reviews have primarily focused on summarising findings, this study shows that food-related conjoint research is dominated by extrinsic attributes and hedonic product categories, which may systematically influence both preference estimates and managerial interpretations. By analysing attribute selection, evaluation approaches and segmentation practices across studies, the article highlights how design choices constrain the comparability and cumulative value of conjoint-based evidence.

Mapping Attention, Emotion and Choice

These three articles validate the proposed framework by addressing its core components. Article 1 establishes the importance of methodological rigour for the attention input. Article 2 successfully integrates affect as a quantifiable signal that informs choice patterns. Article 3 contextualises the choice output, highlighting the theoretical gaps of classical conjoint analysis research that the enriched framework is designed to address. Taken together, the evidence demonstrates consistent structural associations among packaging elements, visual attention, affect, and choice. Within the proposed framework, these components function as integrated correlates, illustrating that both attentional allocation and affective engagement jointly inform consumer preference and choice utility.

This integrated approach addresses the three cascading research gaps:

- GAP-Theo is grounded in the Attention-Affect-Choice sequence, ensuring that the research is not a collection of metrics but a cohesive model of consumer behaviour.

- GAP-Meth is addressed by demonstrating a viable, triangulated protocol that combines eye-tracking, emotion analysis and conjoint analysis, moving beyond the limitations of single-method studies.
- GAP-Interp is addressed using the conjoint model as a robust framework for systematically analysing complex attention and emotion data. It relates them to choice patterns at the design-element level, thereby making interpretation more methodical and grounded.

Consumer buying decisions are not made purely computationally or rationally. Attention is an important prerequisite for any product to be considered. Purchase decisions are influenced by package design elements, which the person must also attend to for any meaningful influence on the choice. Depending on the product's positioning on the hedonic-utilitarian scale, emotions influence our choices. Acknowledging exceptions such as habitual purchases helps to clarify when the complete attention-affect-choice sequence is applicable, and when simplified, attention-sparse heuristics might prevail.

Across the three studies, attention, emotion and choice are interrelated but non-redundant components of consumer decision-making. Eye-tracking identifies which elements enter the decision process, emotional measures clarify how these elements are evaluated affectively, and conjoint-based choices indicate the final behavioural outcome. Importantly, the triangulation reveals that close attention does not always translate into positive emotional evaluation or choice, underscoring the added interpretative value of integrating these methods. At the same time, some uncertainty remains regarding the order of these components and the causal direction between attention and emotion, highlighting the need for future research designs that more explicitly disentangle these dynamics.

4.2 Conclusions

This dissertation aimed to develop and validate a conjoint-enriched neuromarketing analysis framework for package design research. The research is grounded in consumer behaviour theory (CAB, AIDA and the 5-stage model). It adopts a pragmatic, post-positivist paradigm to enhance the validity, replicability and depth of insights derived from studying consumer responses to packaging. It does so via three specific contributions: (1) **Theory:** a decision-stage mapping that ties neuromarketing measures to attention, affect and choice stages of consumer behaviour; (2) **Method:** a triangulated protocol that integrates eye-tracking and facial-expression valence into conjoint analysis; (3) **Interpretation/Practice:** element-level results and method-selection rules for more realistic retail contexts.

Theoretical grounding in consumer behaviour models aids the choice and interpretation of neuromarketing methods and their results: A foundational conclusion of this work is the advantage gained by grounding the integrated neuromarketing methodology within established linear models of consumer behaviour, such as the cognitive, affective and behavioural sequence, AIDA, and

the 5-stage purchase process. It is important to choose the decision stage (and corresponding research aim) first, and then select methods accordingly. The three stages of consumer behaviour (Attention, Affect, Choice) dictate which neuromarketing methods could be used, and how they form a systematic picture of consumer behaviour. It also helps interpret the multi-source data streams generated by eye-tracking, emotion measurement and conjoint tasks. The framework is a more systematic and coherent analysis linking specific empirical measures to distinct conceptual stages (Attention/Cognition, Emotion/Affect, Choice/Behaviour). This directly addresses GAP-Theo, overcoming the common weakness of applying neuromarketing tools in a theoretical vacuum. In practice, this mapping tells researchers which measures to prioritise at a given decision stage and how to interpret cross-signal conflicts.

Building upon this theoretical consumer behaviour model integration, the dissertation's primary contribution is the successful development and validation of the conjoint-enriched neuromarketing analysis framework. The research demonstrates that systematically integrating correlates of attention, emotion, and choice yields a more multidimensional view of consumer buying behaviour than does employing these techniques in isolation. By incorporating explicit attentional and affective data, this framework provides a broader behavioural profile than classical conjoint analysis alone.

The dissertation demonstrates that emotions can be successfully integrated as systematic inputs into conjoint analysis to broaden the interpretation of consumer choice behaviour. This work shows that incorporating facial-expression measurement into package design research expands the dimensionality of traditional choice modelling techniques. The research illustrates how affective responses can function as quantifiable correlates within a choice-modelling framework, thereby capturing affective signals often missed by self-reports. This approach provides a more multidimensional profile of consumer decision-making, addressing GAP-Meth and GAP-Interp. Furthermore, this integrated method clarifies the conditions under which specific text-based cues, such as health-related statements, are most relevant, specifically in contexts of high category involvement or perceived risk.

The choice of eye-tracking methodology can influence results and their practical implications. One conclusion drawn from this dissertation is the importance of methodological rigour in neuromarketing research, particularly in eye-tracking. The article comparing mobile and stationary eye-tracking systems provided clear empirical evidence regarding the influence of methodology on results. It highlighted how stationary eye-tracking can introduce significant biases, such as the centre fixation bias, potentially skewing results away from what occurs in naturalistic settings. Accordingly, method–context alignment (e.g. mobile ET for aisle discovery) should be an a priori design decision rather than a convenience choice.

This thesis concludes that the proposed enriched conjoint model addresses several limitations and biases identified in the traditional application of conjoint analysis in the food packaging domain (Article 3).

The review highlighted common tendencies to focus excessively on extrinsic attributes rather than intrinsic ones, and to focus on hedonic products while neglecting utilitarian categories. Methodological inconsistencies in evaluation framing and sample segmentation were also identified. By integrating objective measures of attention and emotion, the proposed framework provides a more balanced and robust toolset, allowing researchers to investigate a fuller range of factors that influence consumer choice and thereby addressing GAP-Interp.

In summary, the dissertation demonstrated that conjoint analysis can be applied to neuromarketing research by using a conjoint orthogonal design as the basis for experimental designs, using emotion and attention correlates as inputs to rank corresponding designs, and finally easing the interpretation of element-level effects on emotion, attention and choice. This approach provides a clear structure for the research and for interpreting results. The resulting framework is not merely additive, as it broadens process-level interpretation relative to single-method designs; however, claims of superior replicability or causal inference would require further comparative testing. Since the model's empirical parts are moulded to fit a consumer behaviour model, it is also firmly grounded in previous theory. Hence, it was demonstrated that the conjoint analysis enriches the design research on neuromarketing packages.

4.3 Limitations of the conjoint-enriched neuromarketing analysis model

While this dissertation establishes a robust framework, specific research scope and methodology limitations must be acknowledged. The validation primarily relied on specific neuromarketing tools (eye-tracking and facial expression analysis), representing only a subset of possible psychophysiological techniques (such as EEG or GSR) that could capture different cognitive or affective dimensions. Consequently, the framework's current operationalisation is bound by the capabilities and constraints of these chosen methods. Similarly, the research focused predominantly on the visual elements of package design, deliberately excluding other sensory inputs, such as tactile properties, olfactory cues and auditory feedback. While vision (and hence visual elements) is often the key to initial attention and evaluation, other sensory aspects can significantly influence the overall consumer experience and purchase decision, particularly in specific product categories, which represent a boundary to the current framework's scope.

Further limitations relate to the execution of the research and its generalisability. Empirical articles often utilise convenience samples (e.g. students), which may not fully represent the broader consumer population, potentially limiting the direct applicability of specific quantitative findings across different demographic or cultural contexts. Methodological trade-offs were also present; for instance, while mobile eye-tracking was favoured for ecological validity in specific contexts, it inherently possesses lower spatial precision than stationary systems, which could affect analyses focused on minimal design features.

While conjoint-enriched neuromarketing simplifies the analysis of eye-tracking and emotional data, it can make the experiment cumbersome. Presenting conjoint cards from an orthogonal design will mean the designs presented to test participants will be similar. This can bring down the validity of the research and tire the participants.

4.4 Future work

As conjoint-enriched neuromarketing combines multiple fields, it also offers many avenues for future research and development. There is significant potential to expand the framework to incorporate a wider array of psychophysiological and neurological measures, such as EEG to assess attention, cognitive load or engagement; GSR to measure physiological arousal; or even fNIRS, which could capture additional dimensions of consumer cognitive and emotional responses. While these tools have been very data-intensive and challenging to interpret, introducing artificial intelligence may make the method more easily applicable to neuromarketing research.

Another important direction is testing the model's applicability and robustness across diverse contexts to strengthen its generalisability. This includes applying it to a broader range of product categories, particularly comparing high- versus low-involvement goods or utilitarian versus speciality items, and examining its effectiveness across different cultural settings and consumer segments. Methodologically, developing hybrid research designs that synergise quantitative data from neuromarketing tools with rich contextual insights derived from qualitative methods (such as in-depth interviews or ethnographic observation) could yield a deeper, more nuanced understanding of consumer motivations and experiences. Furthermore, longitudinal studies tracking how consumer responses (attentional patterns, emotional associations, preferences) to specific package elements evolve with repeated exposures or influence brand perceptions and loyalty over time represent another valuable yet currently underexplored direction. Such extensions would reinforce the framework's flexibility and test and refine the assumed linkages between specific measurement techniques and the sequential stages of consumer behaviour models.

4.5 Managerial implications

While primarily epistemological in its focus on a methodological framework, the research provides clear ontological takeaways relevant to consumer decision-making and effective package design. Managers and package designers can leverage these insights by incorporating eye-tracking technologies early in the development process to empirically determine which visual elements most effectively capture consumer attention in cluttered retail environments. Doing so will help optimise how products are found and which elements are noticed. Emotion

measurement, such as facial expression analysis, helps brands to understand affective responses (positive or negative) generated by package designs. Traditional self-report surveys often miss these insights, but they are important for shaping consumers' preferences.

The evaluation of the relative significance of different visual, textual, and even emotional aspects in influencing overall consumer decision-making is made possible by integrating these neuromarketing physiological data streams into a conjoint analysis framework. To ensure that packaging for high-involvement or primarily hedonistic products receives designs that are adequately detailed or emotionally resonant, this data-driven method enables targeted design revisions tailored to specific customer segments and product types. The product category, typical purchase context and hedonic/utilitarian profile should all be considered by managers when choosing a research methodology.

In conclusion, this dissertation introduced an integrated, multi-dimensional approach to studying consumer psychology in the context of package design, combining classical conjoint analysis with eye-tracking and emotion measurement. This blended methodology provides a more robust understanding of how packages influence consumer decisions by systematically bridging attention, emotion and choice. The findings offer a theoretical foundation and practical tools for managers seeking to optimise package design to increase sales and consumer satisfaction. At the same time, it is important to recognise the limitations and areas for further development. By continually refining and innovating these research methodologies, future studies can further deepen our understanding of consumer behaviour and enhance the strategic value of package design.

Beyond these recommendations, the findings of this dissertation support a set of context-specific heuristics for managerial use. When the managerial question concerns in-store visibility (e.g. shelf noticeability and what is seen first), mobile eye tracking should be preferred, as screen-based testing can systematically inflate centre-position effects and may therefore mislead design decisions. When the objective is design screening (quickly eliminating weak alternatives), attention-based measures based on stationary eye-tracking are particularly useful for verifying that critical elements (brand, product name, key claim) reliably enter the consumer's information set. When the objective is design optimisation among strong alternatives, combining choice data with emotion measurement can add interpretative value by clarifying whether attention-grabbing elements are evaluated positively or negatively, rather than assuming that visibility translates into preference. Practically, this implies a staged workflow in which stationary testing can be used for early iterations. Still, shelf-relevant conclusions are validated in a mobile or in-store setting before implementation.

SUMMARY IN ESTONIAN

Eeliskombinatsiooni analüüsiga rikastatud neuroturunduse uurimisraamistik pakendidisaini uurimiseks

Probleemipüstitus

Tänapäeva küllastunud tarbekaupade turul on pakendikujundus oluline vahend konkurentide seas eristumiseks ja poekeskkonnas otsuste mõjutamiseks. Castellion ja Markham (2013) ning Salnikova (2020) on oma uuringutes näidanud, et 40% uutest toodetest ebaõnnestub. Nielsen (2014) omistab selle ebaõnnestumise tarbijate ebapiisavale teadlikkusele toodetest, mida toetab ka Dijksterhuis (2016) uuring. Kirjutel ja tooteid täis riiulitel tähelepanu köitmiseks on Steinmetz et al. (2014) uuring näidanud, et ebatüüpilised kujundid ja julged värvid pakenditel paistavad silma, samas kui Vermeir ja Roose (2020) näitavad, et inspiratsioonivaesed pakendid võivad kahe silma vahele jääda. Pakendi visuaalsed elemendid mõjutavad otseselt tarbijate tähelepanu ja usaldust (Steinmetz et al., 2014; Verma, 2024; Yadav, 2024). Samas jäävad traditsioonilised tarbijauuringute meetodid, nagu küsitlused ja intervjuud, sageli piiratuks, kuna need ei pruugi tabada tarbijate vahetuid, madalama kognitiivse kontrolliga reaktsioone ning on mõjutatud sotsiaalse soovitavuse kallutatusest. Neuroturundus võib aidata traditsiooniliste uuringute piirangutest üle saada.

Pakendidisaini uuringud keskenduvad sageli sellele, millised kujundused tarbija valib ja millised seetõttu turul paremini toimivad. See seob uuringu tarbijakäitumise protsessiga, mis koosneb kolmest etapist – kognitiivne (tähelepanu), afektiivne (emotsioonid) ja käitumuslik (valik). Pakendi kujundamine võib nendes etappides äratada tähelepanu, kutsuda esile afektiivseid reaktsioone ja mõjutada inimesi toodet valima.

Eesmärk

Antud doktoritöö eesmärgiks on välja töötada eeliskombinatsiooni analüüsiga rikastatud neuroturunduse uuringuraamistik pakendi disaini uurimiseks. Antud raamistik kombineerib eeliskombinatsiooni analüüsi (conjoint analysis) neuroturunduse mõõtmismeetoditega (pilgujälgimine ja näoväljenduste analüüs). Raamistiku aluseks on tarbijakäitumise teooriad, mis jaotavad otsustusprotsessi kolmeks etapiks: tähelepanu (kognitiivne), afekt (emotsioonid) ja valik (käitumuslik). Eeliskombinatsiooni analüüs võimaldab süstemaatiliselt hinnata erinevate pakendi disainielementide mõju tarbija valikutele, pilgujälgimine aitab kindlaks teha, milliseid elemente tarbijad tähele panevad, ning näoväljenduste analüüs pakub täiendavat teavet pakenditega seonduvate afektiivsete korrelaatide kohta.

Pilgujälgimine annab protsessitasandi indikatsioone visuaalse info töötlemise kohta, näoilmete analüüs võimaldab hinnata emotsionaalset valentsi ning eeliskombinatsiooni analüüs hindab atribuutide osatähtsust lõplikus valikus.

Selline lähenemisviis aitab lahendada probleemi, kuna pakendidisain koosneb alati mitmete elementide kombinatsioonist ning on keeruline kvantifitseerida, millised visuaalsed elemendid seostuvad positiivsete afektiivsete reaktsioonide või tõhusamale märkamisele poeriiulil. Kui uuringu ülesehitus põhineb eeliskombinatsiooni analüüsi ortogonaalsetel disainkaartidel ning integreerib pilgujälgimise ja emotsioonide mõõtmise, siis saadud andmeid on võimalik kasutada eeliskombinatsiooni analüüsi mudeli sisenditena.

Kuigi neuroturundus aitab ületada traditsiooniliste meetodite piiranguid, esineb valdkonnas selgeid vähem uuritud teaduslikke aspekte. Käesolevas doktoritöös on identifitseeritud ja adresseeritud kolm konkreetset uurimislünka, mis takistavad sügavamat ja täpsemat arusaama pakendidisaini mõjust tarbija otsustusprotsessidele.

Uurimislüngad ja panus

Esiteks, neuroturunduse uuringute aluseks olev teoreetiline raamistik on sageli nõrk (edaspidi viidatud kui GAP-Theo). Neuroturunduslikud uuringud mõõdavad küll tähelepanu ja/või emotsioone, kuid jätavad sageli tähelepanuta väljakujunenud tarbijakäitumise mudelid. Need mudelid, nagu CAB (Rosenberg & Hovland, 1960), AIDA (Lewis, 1898; Strong, 1925) ja Engel, Kollati ja Blackwelli (1968) viieastmeline ostuprotsess, võimaldavad mõista, kuidas tähelepanu, emotsioonid ja valikud omavahel seotud on. Antud töös on seega selge panus neuroturunduslike uuringute tulemuste teoreetilisele sidumisele tarbijakäitumise mudelitega.

Teiseks, senised pakendi uuringud pigem kasutavad ühte mõõtmismeetodit (näiteks ainult pilgujälgimist või ainult emotsioonide mõõtmist), mis piirab tarbijakäitumise mõistmist terviklikuna (edaspidi viidatud kui GAP-Meth). Kuigi iga meetod eraldi annab väärtuslikku infot, jääb ükshaaval rakendatavate meetodite kasutamine piiratuks, kuna need ei arvesta tarbijakäitumise mitmekihilist olemust. Käesoleva doktoritöö metoodiline panus seisneb selles, et traditsiooniliste neuroturunduse ja pakendi uuringute piiranguid laiendatakse meetodite triangulatsiooni abil, kus pilgujälgimine, näoilmete analüüs ja eeliskombinatsiooni analüüs on ühendatud üheks terviklikuks uurimismetoodikaks.

Kolmandaks, neuroturunduse uuringute tulemuste tõlgendamine on sageli mitmetähenduslik ja keeruline, eriti kui mõõdetakse tähelepanu ja emotsioone (edaspidi viidatud kui GAP-Interp). Nende andmete eraldi käsitlemine raskendab selgete järelduste tegemist pakendi elementide seoste kohta tarbija käitumisele. Antud doktoritöös on see probleem lahendatud, kasutades eeliskombinatsiooni analüüsi raamistikku süstemaatilise vahendina, mis ühendab pilgujälgimise ja emotsioonide mõõtmise tulemused pakendi elementide tasandil selgete ja korratavate järelduste tegemiseks.

Seega moodustavad need kolm uurimise lünka omavahel seotud probleemide kolmekihilise kaskaadi: teoreetilise aluse puudulikkus (GAP-Theo) viib nõrkade metodoloogiliste valikuteni (GAP-Meth), mille tõttu tulemusi on keeruline üheselt tõlgendada ja rakendada (GAP-Interp). Käesolevas doktoritöös on neid probleeme adresseeritud just selles järjestuses, luues tervikliku, sidusa ja praktiliselt rakendatava uuringuraamistiku pakendidisaini mõistmiseks neuroturunduse perspektiivist.

Empiirilised uuringud ja tulemused

Doktoritöö raames viidi läbi kolm omavahel seotud empiirilist uuringut, millest igaüks käsitleb ühte ülaltoodud uurimislünka.

Uuring 1 (Pentus et al. (2020)) keskendus tähelepanu mõõtmise metoodikale. Uuringu eesmärgiks oli hinnata, kuidas pilgujälgimise meetodi valik (mobiilne vs. statsionaarne) mõjutab tulemuste täpsust. Uuringust selgus, et statsionaarses keskkonnas tekib stiimuli/ekraani keskpunkti fikseerimise kallutatus, mis tähendab, et tarbijad vaatavad ebaproportsionaalselt palju ekraani keskosa. See tulemus rõhutab vajadust metoodilise täpsuse järele neuroturunduse uuringutes, kuna vale metoodika võib kaasa tuua ebatäpseid järeldusi ja praktiliselt sobimatuid disainisoovitusi.

Uuring 2 (Pentus, Kuusik ja Mehine, 2014) keskendus emotsioonide mõõtmisele pakendielementide tasandil. Kasutati näoväljenduste analüüsi, et hinnata, kuidas erinevad pakendi visuaalsed elemendid seostuvad tarbijate afektiivsete reaktsioonide ja eelistustega. Tulemused näitasid, et emotsioonid ei ole valikute tegemisel pelgalt kõrvalised, vaid mängivad olulist rolli. Näiteks seostusid tekstielemendid, nagu loosungid ja suhkrusisalduse märgised, positiivsete näoväljenduslike reaktsioonidega. Oluline järeldus oli ka see, et näoväljenduste andmete integreerimine eeliskombinatsiooni analüüsi mudelisse toimib täiendava afektiivse signaalina, mis avardab uuringu protsessitasandi tõlgendamisvõimalusi.

Uuring 3 (Pentus, 2023) oli süstemaatiline kirjandusülevaade eeliskombinatsiooni analüüsi kasutamisest toiduainete pakendiuuringutes. Leiti, et olemasolevates uuringutes on tugev kallutatus väliste pakendiomaduste (nagu bränd ja hind) uurimise suhtes sisemiste omaduste (nt maitse või tekstuur) arvelt. Ühtlasi selgus, et senistes uuringutes on alahinnatud utilitaarsete tootekategooriate uurimist. Lisaks tuvastati, et tulemuste tõlgendamist raskendab sageli valimi klastrite loomine tagantjärele, mis muudab praktiliste soovituste andmise keeruliseks. Need järeldused toetasid vajadust eeliskombinatsiooni analüüsi raamistikku täiendada objektiivsete mõõdikute, nagu pilgujälgimise ja emotsioonide analüüsi andmetega, et saavutada põhjalikum ja praktilisem arusaam tarbijakäitumisest.

Kokkuvõttes toetasid need kolm empiirilist uuringut selgelt käesoleva doktoritöö keskset argumenti: tarbijakäitumise terviklik mõistmine pakendidisaini kontekstis eeldab metoodiliselt ranget ja mitmemõõtmelist lähenemist, mis integreerib tähelepanu, emotsioonide ja valikute mõõtmise tulemused selgelt määratletud teoreetilise raamistiku alusel.

Järeldused ja praktilised soovitused

Doktoritöö peamiseks tulemuseks oli eeliskombinatsiooni analüüsiga rikastatud neuroturunduse uuringuraamistiku väljatöötamine pakendidisaini uurimiseks. Raamistiku rakendamine võimaldab mitmemõõtmelisemalt mõista tarbijakäitumist kui üksikute meetodite kasutamine eraldi.

Esiteks võimaldas tarbijakäitumise mudelite (CAB, AIDA, viieastmeline mudel) integreerimine täpsemalt määratleda, kuidas tähelepanu, emotsioonid ja valikud omavahel seostuvad. Tulemused rõhutasid, et eelnevalt välja töötatud teoreetiliste mudelite kasutamine võimaldab süstemaatiliselt valida sobivad neuroturunduse mõõdikud ning hõlbustab tulemuste interpreteerimist.

Teiseks näidati, et neuroturunduse meetodite triangulatsioon pakub laiemat ja terviklikumat käitumisprofiili. Üksikutele mõõdikutele tuginedes (nt ainult pilgujälgimine või ainult emotsioonide mõõtmine) jääb uuringute seletusjõud piiratuks. Kolme mõõdiku (tähelepanu, emotsioonid ja valikud) samaaegne trianguleeritud rakendamine võimaldab jõuda sügavama arusaamiseni sellest, miks tarbijad teevad teatud valikuid.

Kolmandaks ilmnes selgelt, et emotsioonide mõõtmise integreerimine eeliskombinatsiooni analüüsi mudelitesse annab märkimisväärset lisaväärtust. Näoväljenduste analüüsi kaudu saadud andmed võimaldasid tuvastada afektiivseid reaktsioone, mida traditsioonilised meetodid (nagu küsitlused või intervjuud) ei pruugi vahetult jäädvustada, kuna need on vähem mõjutatud kognitiivsest kontrollist.

Neljas oluline järeldus puudutas pilgujälgimise metoodika mõju uuringutulemustele. Leiti, et pilgujälgimise tulemuste usaldusväärsus sõltub märkimisväärselt kasutatud meetodist: statsionaarne pilgujälgimine võib tekitada keskpunkti fikseerimise kallutatuse, samas kui mobiilne pilgujälgimine annab realistlikuma ja usaldusväärsema ülevaate tarbija tegelikust visuaalsest käitumisest poes.

Lõpuks näitas doktoritöö, et eeliskombinatsiooni analüüsiga rikastatud neuroturunduslik raamistik aitab täiendada klassikalise eeliskombinatsiooni analüüsi. Selline kombineeritud lähenemine võimaldab lisaks üksikute disainielementide mõju mõõtmisele ka struktureeritult interpreteerida saadud tulemusi ning anda konkreetseid, praktilisi disainisoovitusi.

Praktiliste soovitustena võiksid ettevõtted ja pakendite disainerid kasutada välja töötatud raamistikku pakendite optimeerimiseks juba disainiprotsessi varases staadiumis. Pilgujälgimise ja emotsioonide analüüsi abil saadud andmed võimaldavad ettevõtetel täpsemalt hinnata, millised visuaalsed elemendid köidavad tarbija tähelepanu, millised tekitavad positiivseid emotsioone ning millised elemendid seostuvad kõige tugevamalt lõpliku ostuotsuse kujunemisega. Selline teaduspõhine lähenemine vähendab turundusotsuste määramatust ja suurendab pakendite efektiivsust konkurentsitihedatel turgudel.

Piirangud ja edasiarenduse võimalused

Vaatamata sellele, et väljatöötatud raamistik pakub olulisi metoodilisi ja praktilisi eeliseid, esineb doktoritööl teatud piiranguid, mida tuleb arvestada tulemuste tõlgendamisel ja edasises rakendamises.

Esiteks tugineb väljatöötatud metoodika peamiselt kahele neuroturunduse mõõdikule: pilgujälgimisele ja näoilmete analüüsile. Kuigi mõlemad meetodid võimaldavad põhjalikult uurida tähelepanu ja emotsioonide rolli pakendidisainis, ei pruugi need täielikult hõlmata kõiki olulisi füsioloogilisi reaktsioone, mida saaks mõõta teiste meetoditega, näiteks ajutegevuse mõõtmise (EEG) või naha elektrijuhtivuse mõõtmise (GSR) abil.

Teiseks kasutati uuringutes valdavalt mugavusvalimeid, mis koosnesid peamiselt üliõpilastest ja olid seeläbi demograafiliselt ühetaollised grupid. Selline valimivalik võib piirata tulemuste üldistatavust laiematele tarbijagruppidele, eriti juhul, kui tarbijate vanus, haridustase või sotsiaalmajanduslik taust mõjutavad nende tähelepanu ja emotsionaalseid reaktsioone pakenditele.

Kolmandaks keskendusid kõik doktoritöös läbi viidud uuringud peamiselt visuaalsetele pakendielementidele. Kuigi visuaalsed omadused on pakendite puhul sageli määrava tähtsusega, ei käsitlenud töö teisi sensoorseid omadusi, näiteks puutetundlikke või lõhnaga seotud elemente, mis võivad samuti märkimisväärselt mõjutada tarbija eelistusi ja käitumist.

Tulevaste uuringute jaoks on olemas mitmeid edasiarenduse võimalusi. Esiteks võiks tulevane uurimistöö integreerida raamistikku täiendavaid neuroturunduse mõõdikuid, nagu EEG või GSR, et paremini haarata tarbijate emotsioonide ja tähelepanu sügavamaid ja komplekssemaid aspekte.

Teiseks tuleks laiendada valimite mitmekesisust, et tulemused oleksid paremini üldistatavad eri tarbijasegmentidele ja kultuurikontekstidele. Sellised laiendatud uuringud võiksid tuua välja olulised erinevused tarbijakäitumises, mida kitsamalt määratletud valimitega tehtud uuringud ei pruugi tuvastada.

Kolmandaks oleks oluline rakendada metoodikat erinevatele tootekategooriatele, eriti neile, mis asuvad utilitaarse-hedonistliku skaala erinevates otstes. See võimaldaks testida metoodika sobivust ja efektiivsust erinevates ostukontekstides ja pakkuda veelgi täpsemaid soovitusi tootekategooriapõhiselt.

Neljandaks võiks edaspidine uurimistöö kombineerida kvantitatiivseid neuroturunduse andmeid kvalitatiivsete uurimismeetoditega, nagu intervjuud või etnograafilised vaatlused. Selline hübriidne lähenemine võimaldaks täpsemalt mõista tarbijate motivatsioone ja otsuste tegemise protsesse ning pakkuda sügavamaid ja nüansirikkamaid teadmisi.

Lõpuks võiks pikaajalised uuringud, mis vaatlevad tarbijakäitumise muutusi ajas, aidata selgitada, kuidas korduv kokkupuude konkreetsete pakendikujundustega mõjutab tarbijate tähelepanu, emotsioone ja eelistusi. Sellised uuringud annaksid väärtuslikke teadmisi pakendite disainielementide pikaajalisest mõjust bränditaju ja lojaalsuse kujunemisele.

REFERENCES

Ahmed, R. R., Parmar, V., & Amin, M. A. (2014). Impact of product packaging on consumer buying behavior. European Journal of Scientific Research, 122(2), 125–134. https://doi.org/10.13140/2.1.2343.4885

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Allport, A. (1989). Visual attention. In M. I. Posner (Ed.), Foundations of cognitive science (pp. 631–682). MIT Press.

Alsharif, A. H., Md Salleh, N. Z., & Baharun, R. (2021). Neuromarketing: Marketing research in the new millennium. Neuroscience Research Notes, 4(3), 27–35. https://doi.org/10.31117/neuroscirn.v4i3.79

Alsharif, A. H., Salleh, N. Z. M., Abdullah, M., Khraiwish, A., & Ashaari, A. (2023). Neuromarketing tools used in the marketing mix: A systematic literature and future research agenda. SAGE Open, 13(1). https://doi.org/10.1177/21582440231156563

Alvino, L., van der Lubbe, R., Joosten, R. A. M., & Constantinides, E. (2019). Which wine do you prefer? An analysis on consumer behaviour and brain activity during a wine tasting experience. Asia Pacific Journal of Marketing and Logistics, 32(5), 1149–1170. https://doi.org/10.1108/APJML-08-2018-0324

Amiri, H., Ghorbani, A., Hosseini, M., & Jowkar, A. (2022). Identifying the effective psychologically motivational factors in neuromarketing: A systematic review. Practice in Clinical Psychology, 10(2), 824-1. https://doi.org/10.32598/jpcp.10.2.824.1

Ampuero, O., & Vila, N. (2006). Consumer perceptions of product packaging. Journal of Consumer Marketing, 23(2), 100–112.

Andrade, C. (2018). Internal, external, and ecological validity in research design, conduct, and evaluation. Indian Journal of Psychological Medicine, 40, 498–499. https://doi.org/10.4103/IJPSYM.IJPSYM_334_18

Anuar, N., & Isa, S. (2022). Reflections on the use of conjoint analysis as a dual method in neuromarketing research. Journal of Information System and Technology Management. https://doi.org/10.35631/jistm.727012

Armstrong, T., & Olatunji, B. (2012). Eye tracking of attention in the affective disorders: a meta-analytic review and synthesis. Clinical Psychology Review, 32(8), 704–723. https://doi.org/10.1016/j.cpr.2012.09.004

Atalay, A. S., Bodur, H. O., & Rasolofoarison, D. (2012). Shining in the center: Central gaze cascade effect on product choice. Journal of Consumer Research, 39(4), 848–866. https://doi.org/10.1086/665984

Babiloni, F. (2012). Consumer neuroscience: a new area of study for biomedical engineers. IEEE Pulse, 3(3), 21–23. https://doi.org/10.1109/MPUL.2012.2189166

Babin, B. J., Darden, W. R., & Griffin, M. (1994). Work and/or fun: Measuring hedonic and utilitarian shopping value. Journal of Consumer Research, 20(4), 644–656. https://doi.org/10.1086/209376

Babin, B. J., Griffin, M., & Boles, J. S. (2004). Buyer reactions to ethical beliefs in the retail environment. Journal of Business Research, 57(10), 1155–1163. https://doi.org/10.1016/S0148-2963(02)00319-3

Bagozzi, R. P., Gopinath, M., & Nyer, P. U. (1999). The role of emotions in marketing. Journal of the Academy of Marketing Science, 27(2), 184–206. https://doi.org/10.1177/0092070399272005

Bannerman, R., Milders, M., & Sahraie, A. (2009). Processing emotional stimuli: Comparison of saccadic and manual choice-reaction times. Cognition and Emotion, 23, 930–954. https://doi.org/10.1080/02699930802243303
Barrett, L. F. (2006). Valence is a basic building block of emotional life. Journal of Research in Personality, 40(1), 35–55. https://doi.org/10.1016/j.jrp.2005.08.002
Barry, T. E., & Howard, D. J. (1990). A review and critique of the hierarchy of effects in advertising. International Journal of Advertising, 9(2), 121-135. https://doi.org/10.1080/02650487.1990.11107138
Bartkienė, E., Steiblienė, V., Adomaitienė, V., Juodeikienė, G., Černauskas, D., Lele, V., & Guiné, R. P. F. (2019). Factors affecting consumer food preferences: food taste and depression-based evoked emotional expressions with the use of face reading technology. BioMed Research International, 2019, Article 2097415. https://doi.org/10.1155/2019/2097415
Batra, R., & Ahtola, O. T. (1991). Measuring the hedonic and utilitarian sources of consumer attitudes. Marketing Letters, 2, 159–170.
Bauer, H. H., Stokburger-Sauer, N. E., & Becker, C. (2006). Investigating the relationship between product involvement and consumer decision making styles. Journal of Consumer Behaviour, 5(4), 342–354. https://doi.org/10.1002/cb.185
Baumeister, R. F., & Bushman, B. J. (2020). Social psychology and human nature. Cengage Learning.
Baumeister, R. F., Vohs, K. D., Nathan DeWall, C., & Zhang, L. (2007). How emotion shapes behavior: Feedback, anticipation, and reflection, rather than direct causation. Personality and social psychology review, 11(2), 167-203. https://doi.org/10.1177/1088868307301033
Becker, G. S. (1976). The economic approach to human behavior. University of Chicago Press.
Beechey, T. (2022). Ecological validity, external validity, and mundane realism in hearing science. Ear and Hearing, 43, 1395–1401. https://doi.org/10.1097/AUD.0000000000001202
Bekhtereva, V., Craddock, M., & Müller, M. (2015). Attentional bias to affective faces and complex IAPS images in early visual cortex follows emotional cue extraction. NeuroImage, 112, 254–266. https://doi.org/10.1016/j.neuroimage.2015.03.052
Bell, L., Vogt, J., Willemse, C., Routledge, T., Butler, L. T., & Sakaki, M. (2018). Beyond self-report: A review of physiological and neuroscientific methods to investigate consumer behavior. Frontiers in Psychology, 9, 1655. https://doi.org/10.3389/fpsyg.2018.01655
Bell, R., & Marshall, D. W. (2003). The construct of food involvement in behavioral research: scale development and validation. Appetite, 40(3), 235–244.
Belliza, A., & Kusumawati, N. (2024). The influence of visual attributes in packaging design on generation z's dessert snack purchasing decision. Journal of Consumer Studies and Applied Marketing. https://doi.org/10.58229/jcsam.v2i1.175
Bercea, M. D. (2012, August). Anatomy of methodologies for measuring consumer behavior in neuromarketing research. In Proceedings of the LCBR European Marketing Conference (pp. 1–14).
Bettiga, D., Bianchi, A. M., Lamberti, L., & Noci, G. (2020). Consumers emotional responses to functional and hedonic products: A neuroscience research. Frontiers in Psychology, 11, 559779. https://doi.org/10.3389/fpsyg.2020.559779
Bindemann, M. (2010). Scene and screen center bias early eye movements in scene viewing. Vision Research, 50(23), 2577–2587.

https://doi.org/10.1016/j.visres.2010.08.016
Bloch, P. H. (1995). Seeking the ideal form: Product design and consumer response. Journal of Marketing, 59(3), 16–29. https://doi.org/10.2307/1252116
Borji, A., & Itti, L. (2013). State-of-the-art in visual attention modeling. IEEE Transactions on Pattern Analysis and Machine Intelligence, 35(1), 185–207.
Broadbent, D. E. (1958). Perception and communication. Pergamon Press.
Burke, R. R., & Leykin, A. (2014). Identifying the drivers of shopper attention, engagement, and purchase. Review of Marketing Research, 11, 147–187.
Butkevičienė, V., Stravinskienė, J., & Rūtelionė, A. (2008). Impact of consumer package communication on consumer decision-making process. Engineering Economics, 56(1), 57–65.
Butler, M. J. R. (2008). Neuromarketing and the perception of knowledge. Journal of Consumer Behaviour, 7(4–5), 415–419. https://doi.org/10.1002/cb.260
Calvo, M. G., & Lang, P. J. (2004). Gaze patterns when looking at emotional pictures: Motivationally biased attention. Motivation and Emotion, 28(3), 221–243. https://doi.org/10.1023/B:MOEM.0000040153.26156.ed
Calvo-Porral, C., Ruiz-Vega, A. V., & Lévy-Mangin, J.-P. (2018). Does product involvement influence how emotions drive satisfaction? An approach through the Theory of Hedonic Asymmetry. European Research on Management and Business Economics, 24(3), 130–136. https://doi.org/10.1016/j.iedeen.2018.06.001
Carrasco, M. (2011). Visual attention: The past 25 years. Vision Research, 51(13), 1484–1525. https://doi.org/10.1016/j.visres.2011.04.012
Carrasco, M., & Barbot, A. (2014). How attention affects spatial resolution. Cold Spring Harbor Symposia on Quantitative Biology, 79, 149–160. https://doi.org/10.1101/sqb.2014.79.024687
Carrasco, M., Ling, S., & Read, S. (2004). Attention alters appearance. Nature Neuroscience, 7(3), 308-313. https://doi.org/10.1038/nn1194
Carroll, D., & Green, P. (1995). Psychometric methods in marketing research: Part I, conjoint analysis. Journal of Marketing Research, 32, 385–391. https://doi.org/10.1177/002224379503200401
Casado-Aranda, L.-A., Sánchez-Fernández, J., & García, F. (2022). Advances in neuroscience and marketing: Analyzing tool possibilities and research opportunities. Spanish Journal of Marketing – ESIC, 26(1), 3–25. https://doi.org/10.1108/sjme-10-2021-0196
Castellion, G., & Markham, S. K. (2013). Perspective: New product failure rates: influence of argumentum ad populum and self-interest. Journal of Product Innovation Management, 30(5), 976–979.
Celhay, F., & Trinquecoste, J. (2015). Package graphic design: Investigating the variables that moderate consumer response to atypical designs. Journal of Product Innovation Management, 32(6), 1014–1032. https://doi.org/10.1111/jpim.12212
Chandon, P., Hutchinson, J. W., Bradlow, E. T., & Young, S. H. (2009). Does in-store marketing work? Effects of the number and position of shelf facings on brand attention and evaluation at the point of purchase. Journal of Marketing, 73(6), 1–17. https://doi.org/10.1509/jmkg.73.6.1
Chang, M., Büchel, D., Reinecke, K., Lehmann, T., & Baumeister, J. (2022). Ecological validity in exercise neuroscience research: A systematic investigation. European Journal of Neuroscience, 55, 487–509. https://doi.org/10.1111/ejn.15595

Chaudhuri, A., Aboulnasr, K., & Ligas, M. (2010). Emotional responses on initial exposure to a hedonic or utilitarian description of a radical innovation. Journal of Marketing Theory and Practice, 18(4), 339–359.
Chitturi, R., Raghunathan, R., & Mahajan, V. (2008). Delight by design: The role of hedonic versus utilitarian benefits. Journal of Marketing, 72(3), 48–63.
Chrysochou, P., & Festila, A. (2019). A content analysis of organic product package designs. Journal of Consumer Marketing, 36(2), 252–261. https://doi.org/10.1108/jcm-06-2018-2720
Chun, M. M., & Marois, R. (2002). The dark side of visual attention. Current Opinion in Neurobiology, 12(2), 184–189. https://doi.org/10.1016/S0959-4388(02)00309-4
Chun, M. M., Golomb, J. D., & Turk-Browne, N. B. (2011). A taxonomy of external and internal attention. Annual Review of Psychology, 62, 73–101.
Cialdini, R. B., & Goldstein, N. J. (2004). Social influence: Compliance and conformity. Annual Review of Psychology, 55, 591–621. https://doi.org/10.1146/annurev.psych.55.090902.142015
Clement, J. (2007). Visual influence on in-store buying decisions: An eye-track experiment on the visual influence of packaging design. Journal of Marketing Management, 23(9–10), 917–928. https://doi.org/10.1362/026725707X250395
Clement, J., Kristensen, T., & Grønhaug, K. (2013). Understanding consumers' in-store visual perception: The influence of package design features on visual attention. Journal of Retailing and Consumer Services, 20(2), 234–239.
Collewijn, H., Erkelens, C. J., & Steinman, R. M. (1988). Binocular co-ordination of human horizontal saccadic eye movements. The Journal of Physiology, 404(1), 157–182. https://doi.org/10.1113/jphysiol.1988.sp017284
Copeland, M. T. (1923). Relation of consumers' buying habits to marketing methods. Harvard Business Review, 1(April), 282–289.
Corbetta, M., & Shulman, G. L. (2002). Control of goal-directed and stimulus-driven attention in the brain. Nature Reviews Neuroscience, 3(3), 201–215. https://doi.org/10.1038/nrn755
Cowen, A. S., & Keltner, D. (2021). Semantic space theory: A computational approach to emotion. Trends in Cognitive Sciences, 25(2), 124–136. https://doi.org/10.1016/j.tics.2020.11.004
Creusen, M. E. H., & Schoormans, J. P. L. (2005). The different roles of product appearance in consumer choice. Journal of Product Innovation Management, 22(1), 63–81.
Crist, C. A., Duncan, S. E., Arnade, E. A., Leitch, K. A., O'Keefe, S. F., & Gallagher, D. L. (2018). Automated facial expression analysis for emotional responsivity using an aqueous bitter model. Food Quality and Preference, 68, 349–359. https://doi.org/10.1016/j.foodqual.2018.04.004
D'Arcey, J. T., & Trevor, J. (2013). Assessing the validity of FaceReader using facial EMG Master thesis, California State University, Chico.
Danner, L., Sidorkina, L., Joechl, M., & Duerrschmid, K. (2014). Make a face! Implicit and explicit measurement of facial expressions elicited by orange juices using face reading technology. Food Quality and Preference, 32, 167–172. https://doi.org/10.1016/j.foodqual.2013.02.010
den Uyl, M. J. D., & van Kuilenburg, H. (2005). The FaceReader: Online facial expression recognition. In Proceedings of the 5th international conference on Methods and techniques in behavioral research (pp. 589–590).

Desimone, R., & Duncan, J. (1995). Neural mechanisms of selective visual attention. Annual Review of Neuroscience, 18, 193–222. https://doi.org/10.1146/annurev.ne.18.030195.001205
Deubel, H., & Schneider, W. X. (1996). Saccade target selection and object recognition: Evidence for a common attentional mechanism. Vision Research, 36(12), 1827–1837. https://doi.org/10.1016/0042-6989(95)00294-4
Dewey, J. (1910). How we think. D.C. Heath & Company.
Dhar, R., & Wertenbroch, K. (2000). Consumer choice between hedonic and utilitarian goods. Journal of Marketing Research, 37(1), 60–71.
Dijksterhuis, G. (2016). New product failure: Five potential sources discussed. Trends in Food Science & Technology, 50, 243–248.
Donovan, R. J., Rossiter, J. R., Marcoolyn, G., & Nesdale, A. (1994). Store atmosphere and purchasing behavior. Journal of Retailing, 70(3), 283–294. https://doi.org/10.1016/0022-4359(94)90037-X
Dowiasch, S., Wolf, P., & Bremmer, F. (2020). Quantitative comparison of a mobile and a stationary video-based eye-tracker. Behavior Research Methods, 52(2), 667–680. https://doi.org/10.3758/s13428-019-01267-5
Drozdova, N. (2014). Measuring emotions in marketing and consumer behavior: Is Face Reader an applicable tool? [Master's thesis].
Duchowski, A. (2007). Eye tracking methodology: Theory and practice (2nd ed.). Springer.
Durán, J. I., & Fernández-Dols, J.-M. (2021). Do emotions result in their predicted facial expressions? A meta-analysis of studies on the co-occurrence of expression and emotion. Emotion. Advance online publication. https://doi.org/10.1037/emo0001015
Dźwigoł, H. (2020). Innovation in marketing research: Quantitative and qualitative analysis. Marketing and Management of Innovations, (1), 128–135. https://doi.org/10.21272/mmi.2020.1-10
Eid, M., & Diener, E. (2001). Norms for experiencing emotions in different cultures: Inter- and intranational differences. Journal of Personality and Social Psychology, 81(5), 869–885. https://doi.org/10.1037/0022-3514.81.5.869
Ekkekakis, P. (2012). Affect, mood, and emotion. Measurement in Sport and Exercise Psychology, 321.
Ekman, P. (1972). Universal and cultural differences in facial expressions of emotion. In J. Cole (Ed.), Nebraska Symposium on Motivation (pp. 207–283). University of Nebraska Press.
Ekman, P. (1992). Are there basic emotions? Psychological Review, 99(3), 550–553.
Ekman, P., & Friesen, W. V. (1969). Nonverbal leakage and clues to deception. Psychiatry, 32(1), 88–106.
Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. Journal of Personality and Social Psychology, 17(2), 124–129. https://doi.org/10.1037/h0030377
Ekman, P., & Friesen, W. V. (1978). Facial Action Coding System: A technique for the measurement of facial movement. Consulting Psychologists Press.
El Oraiby, M., & Kiygi-Calli, M. (2023). The influence of packaging design visual elements on consumers' purchase intention: A comparison study on organic food and non-food products. Organic Agriculture. https://doi.org/10.1007/s13165-023-00446-1
Ellis, S. R., & Smith, J. D. (1985). Patterns of statistical dependency in visual scanning. In R. Groner (Ed.), Eye movements and human information processing (pp. 221–238). Elsevier Science Publishers BV.

Engel, J. F., Blackwell, R. D., & Miniard, P. W. (1986). Consumer behavior (5th ed.). Dryden Press.
Engel, J. F., Kollat, D. T., & Blackwell, R. D. (1968). Consumer behavior. Holt, Rinehart, and Winston.
Eppler, M. J., & Mengis, J. (2004). The concept of information overload: A review of literature from organization science, accounting, marketing, MIS, and related disciplines. The Information Society, 20(5), 325–344. https://doi.org/10.1080/01972240490507974
Eroglu, S., & Kucun, N. (2020). Traditional market research and neuromarketing research. In Applying neuromarketing approaches for governmental and non-profit organizations (pp. 146–167). IGI Global. https://doi.org/10.4018/978-1-7998-3126-6.ch008
Erzberger, C., & Prein, G. (1997). Triangulation: Validity and empirically-based hypothesis construction. Quality and Quantity, 31(2), 141–154. https://doi.org/10.1023/A:1004249313062
Evans, J. S. B. (2008). Dual-processing accounts of reasoning, judgment, and social cognition. Annual Review of Psychology, 59, 255–278.
Fan, S., Shen, Z., Jiang, M., Koenig, B., Kankanhalli, M., & Zhao, Q. (2022). Emotional attention: From eye tracking to computational modeling. IEEE Transactions on Pattern Analysis and Machine Intelligence, 45, 1682–1699. https://doi.org/10.1109/TPAMI.2022.3169234
Farquhar, J., Michels, N., & Robson, J. (2020). Triangulation in industrial qualitative case study research: Widening the scope. Industrial Marketing Management. https://doi.org/10.1016/j.indmarman.2020.02.001
Feest, U. (2024). What is the replication crisis a crisis of? Philosophy of Science. https://doi.org/10.1017/psa.2024.2
Feit, A. M., Williams, S., Toledo, A., Paradiso, A., Kulkarni, H., Kane, S., & Morris, M. R. (2017). Toward everyday gaze input: Accuracy and precision of eye tracking and implications for design. In CHI '17: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (pp. 1118–1130).
Fischer, A. H., Mosquera, P. M. R., Vianen, A. E. M. V., & Manstead, A. S. R. (2004). Gender and culture differences in emotion. Emotion, 4(1), 87–94. https://doi.org/10.1037/1528-3542.4.1.87
Fishbein, M. (1963). An investigation of the relationships between beliefs about an object and the attitude toward that object. Human Relations, 16(3), 233-239.
Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research. Addison Wesley.
Fortenbaugh, F. C., DeGutis, J., & Esterman, M. (2017). Recent theoretical, neural, and clinical advances in sustained attention research. Annals of the New York Academy of Sciences, 1396(1), 70–91. https://doi.org/10.1111/nyas.13318
Fortunato, V. C. R., Giraldi, J. D. M. E., & de Oliveira, J. H. C. (2014). A review of studies on neuromarketing: Practical results, techniques, contributions and limitations. Journal of Management Research, 6(2), 201.
Foulsham, T., Walker, E., & Kingstone, A. (2011). The where, what and when of gaze allocation in the lab and the natural environment. Vision Research, 51(17), 1920–1931.
Fox, C. R., & Poldrack, R. A. (2009). Prospect theory and the brain. In P. W. Glimcher & E. Fehr (Eds.), Neuroeconomics: Decision making and the brain (pp. 145–173). Academic Press.
Frijda, N. H. (1986). The emotions. Cambridge University Press.

Frost, D., & Pöppel, E. (1976). Different programming modes of human saccadic eye movements as a function of stimulus eccentricity. Biological Cybernetics, 23(1), 39–48. https://doi.org/10.1007/BF00344150

Garber, L. L., Burke, R. R., & Jones, J. M. (2000). The role of package color in consumer purchase consideration and choice. Marketing Science Institute Working Paper Series, Report No. 00-104.

Garber, L. L., Hyatt, E. M., & Starr, R. G. (2009). The effects of food color on perceived flavor. Journal of Marketing Theory and Practice, 7(1), 59–72.

Genco, S. J., Pohlmann, A. P., & Steidl, P. (2013). Neuromarketing for dummies. Hoboken, NJ: John Wiley & Sons.

Gidlöf, K., Wallin, A., Dewhurst, R., & Holmqvist, K. (2013). Using eye tracking to trace a cognitive process: Gaze behaviour during decision making in a natural environment. Journal of Eye Movement Research, 6(1), 1–14. https://doi.org/10.16910/jemr.6.1.2

Gofman, A., Moskowitz, H. R., Fyrbjork, J., Moskowitz, D., & Mets, T. (2009). Extending rule developing experimentation to perception of food packages with eye tracking. The Open Food Science Journal, 3(1), 66–78.

Goldkuhl, G. (2012). Pragmatism vs. interpretivism in qualitative IS research. European Journal of Information Systems, 21(2), 135–146. https://doi.org/10.1057/ejis.2011.54

Graham, D. J., & Jeffery, R. W. (2011). Location, location, location: eye-tracking evidence that consumers preferentially view prominently positioned nutrition information. Journal of the American Dietetic Association, 111(11), 1704–1711. https://doi.org/10.1016/j.jada.2011.08.005

Graham, D. J., Orquin, J. L., & Visschers, V. H. M. (2012). Eye tracking and nutrition label use: A review of the literature and recommendations for label enhancement. Food Policy, 37(4), 378–382.

Green, P. E., & Rao, V. R. (1971). Conjoint measurement for quantifying judgmental data. Journal of Marketing Research, 8(3), 355–363. https://doi.org/10.2307/3149575

Green, P. E., & Srinivasan, V. (1978). Conjoint analysis in consumer research: Issues and outlook. Journal of Consumer Research, 5(September), 103–123. https://doi.org/10.1086/208721

Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. Psychological Review, 102(1), 4–27. https://doi.org/10.1037/0033-295X.102.1.4

Guerreiro, J., Rita, P., & Trigueiros, D. (2015). Attention, emotions and cause-related marketing effectiveness. European Journal of Marketing, 49(11/12), 1728–1750. https://doi.org/10.1108/EJM-09-2014-0543

Gunaratne, N. M., Viejo, C. G., Gunaratne, T. M., Torrico, D. D., Ashman, H., Dunshea, F. R., & Fuentes, S. (2019). Effects of imagery as visual stimuli on the physiological and emotional responses. J, 2(2), 206–225. https://doi.org/10.3390/j2020015

Gustafsson, A., Herrmann, A., & Huber, F. (2000). Conjoint analysis as an instrument of market research practice. In Conjoint measurement: Methods and applications (pp. 5–46). Springer. https://doi.org/10.1007/978-3-540-71404-0_1

Hadjikhani, N., Zurcher, N., Lassalle, A., Hippolyte, L., Ward, N., & Johnels, J. (2017). The effect of constraining eye-contact during dynamic emotional face perception-an fMRI study. Social Cognitive and Affective Neuroscience, 12, 1197–1207. https://doi.org/10.1093/scan/nsx046

Heale, R., & Forbes, D. (2013). Understanding triangulation in research. Evidence-Based Nursing, 16, 98. https://doi.org/10.1136/eb-2013-101494

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. Evidence-Based Nursing, 18, 66–67. https://doi.org/10.1136/eb-2015-102129
Henderson, K. A. (2011). Post positivism and the pragmatics of leisure research. Leisure Sciences, 33(4), 341–346. https://doi.org/10.1080/01490400.2011.583166
Hendrickson, K., & Ailawadi, K. L. (2014). Six lessons for in-store marketing from six years of mobile eye tracking research. Review of Marketing Research, 11, 57–74.
Hessels, R. S., Niehorster, D. C., Nyström, M., Andersson, R., & Hooge, I. T. C. (2018). Is the eye-movement field confused about fixations and saccades? A survey among 124 researchers. Royal Society Open Science, 5(8), 180502.
Hine, T. (1995). The total package: The evolution and secret meanings of boxes, bottles, cans, and tubes. Little, Brown and Company.
Höfling, T. T. A., Gerdes, A. B., Föhl, U., & Alpers, G. W. (2020). Read my face: automatic facial coding versus psychophysiological indicators of emotional valence and arousal. Frontiers in Psychology, 11, 1388.
Holbrook, M. B., & Batra, R. (1987). Assessing the role of emotions as mediators of consumer responses to advertising. Journal of Consumer Research, 14(3), 404–420. https://doi.org/10.1086/209123
Holbrook, M. B., & Hirschman, E. C. (1982). The experiential aspects of consumption: Consumer fantasies, feelings, and fun. Journal of Consumer Research, 9(2), 132–140.
Holmqvist, K. (2017). Common predictors of accuracy, precision and data loss in 12 eye-trackers. In The 7th Scandinavian Workshop on Eye Tracking, Turku, Finland.
Holmqvist, K., Nyström, M., & Mulvey, F. (2012, March). Eye tracker data quality: What it is and how to measure it. In Proceedings of the Symposium on Eye Tracking Research and Applications (pp. 45–52).
Holton, R. H. (1958). The distinction between convenience goods, shopping goods, and specialty goods. Journal of Marketing, 23(1), 53–56.
Hommel, B., Chapman, C. S., Cisek, P., Neyedli, H. F., Song, J.-H., & Welsh, T. N. (2019). No one knows what attention is. Attention, Perception, & Psychophysics, 81(7), 2288–2303. https://doi.org/10.3758/s13414-019-01846-w
Howard, J. A., & Sheth, J. N. (1969). The theory of buyer behavior. John Wiley & Sons.
Hsu, L., & Chen, Y. J. (2019). Music and wine tasting: An experimental neuromarketing study. British Food Journal, 122(8), 2725–2737. https://doi.org/10.1016/j.tics.2011.09.008
Huang, G., Li, Y., Zhu, H., Feng, H., Shen, X., & Chen, Z. (2023). Emotional stimulation processing characteristics in depression: Meta-analysis of eye tracking findings. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.1089654
Huddleston, P., Behe, B. K., Minahan, S., & Fernandez, R. T. (2015). Seeking attention: An eye-tracking study of in-store merchandise displays. International Journal of Retail & Distribution Management, 43(6), 561–574. https://doi.org/10.1108/IJRDM-06-2013-0120
iMotions. (2015). Eye tracking: The complete pocket guide. iMotions A/S. https://imotions.com/blog/learning/best-practice/eye-tracking/
Itti, L., Koch, C., & Niebur, E. (1998). A model of saliency-based visual attention for rapid scene analysis. IEEE Transactions on Pattern Analysis and Machine Intelligence, 20(11), 1254–1259. https://doi.org/10.1109/34.730558
Iyengar, S. S., & Lepper, M. R. (2000). When choice is demotivating: Can one desire too much of a good thing? Journal of Personality and Social Psychology, 79(6), 995–1006. DOI: 10.1037/0022-3514.79.6.995
Izard, C. E. (1971). The face of emotion. Appleton Century Crofts.

Izard, C. E. (1977). Human emotions. Plenum Press.
Jaeger, S. R., Cardello, A. V., & Schutz, H. G. (2013). Emotion questionnaires: A consumer-centric perspective. Food Quality and Preference, 30, 229–241.
James, W. (1890). The principles of psychology. Henry Holt and Company.
Jang, S., Kim, S., Kim, C., Lee, H., & Choi, K. (2016). Attentional processing of emotional faces in schizophrenia: Evidence from eye tracking. Journal of Abnormal Psychology, 125(7), 894–906. https://doi.org/10.1037/ABN0000198
Jiménez-Buedo, M., & Miller, L. (2010). Why a trade-off? The relationship between the external and internal validity of experiments. Theoria. https://doi.org/10.1387/THEORIA.779
Johnson, R. M. (1974). Trade-off analysis of consumer values. Journal of Marketing Research, 11(2), 121–127. https://doi.org/10.1177/002224377401100201
Jovancevic-Misic, J., & Hayhoe, M. (2009). Adaptive gaze control in natural environments. Journal of Neuroscience, 29(19), 6234–6238. https://doi.org/10.1523/JNEUROSCI.5570-08.2009
Juntongjin, P. (2022). Does involvement matter in S-commerce? The integrated role of emotion to explain satisfaction and loyalty in S-commerce for low vs. high involvement products. Cogent Business & Management, 9(1), 2104439. https://doi.org/10.1080/23311975.2022.2104439
Kahneman, D. (1973). Attention and effort. Prentice-Hall.
Kahneman, D. (2011). Thinking, fast and slow. Farrar, Straus and Giroux.
Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. Econometrica, 47(2), 263–291. https://doi.org/10.2307/1914185
Katsuki, F., & Constantinidis, C. (2014). Bottom-up and top-down attention: different processes and overlapping neural systems. The Neuroscientist, 20(5), 509–521.
Kauffman, S., Pape, S., & Holmqvist, K. (2019). Consumer attention and perception in eye-tracking research: Interpreting complex visual behaviour in marketing contexts. Journal of Marketing Behavior, 5(2), 145–167.
Kelly, R., & Hoptman, M. (2022). Replicability in brain imaging. Brain Sciences, 12(3), 397. https://doi.org/10.3390/brainsci12030397
Kempf, D. S. (1999). Attitude formation from product trial: Distinct roles of cognition and affect for hedonic and functional products. Psychology & Marketing, 16(1), 35–50.
Kessler, S. J., Jiang, F., & Hurley, R. A. (2020). The state of automated facial expression analysis (AFEA) in evaluating consumer packaged beverages. Beverages, 6(27), 1–24. https://doi.org/10.3390/beverages6020027
Kihlstrom, J. (2021). Ecological validity and "ecological validity". Perspectives on Psychological Science, 16, 466–471. https://doi.org/10.1177/1745691620966791
Kim, J. (2016). The influence of hedonic versus utilitarian consumption situations on the compromise effect. Marketing Letters, 27(2), 387–401. https://doi.org/10.1007/s11002-014-9331-0
King, M. F., & Bruner, G. C. (2000). Social desirability bias: A neglected aspect of validity testing. Psychology & Marketing, 17(2), 79–103. https://doi.org/10.1002/(SICI)1520-6793(200002)17:2<79::AID-MAR2>3.0.CO;2-0
Kissler, J., & Koessler, S. (2011). Emotionally positive stimuli facilitate lexical decisions – An ERP study. Biological Psychology, 86, 254–264. https://doi.org/10.1016/j.biopsycho.2010.12.006
Koch, C., & Ullman, S. (1985). Shifts in selective visual attention: Towards the underlying neural circuitry. Human Neurobiology, 4(4), 219–227.

Kollmorgen, S., Nortmann, N., Schröder, S., & König, P. (2010). Influence of low-level stimulus features, task dependent factors, and spatial biases on overt visual attention. PLoS Computational Biology, 6(5), e1000791.
Kotler, P. (2000). Marketing management. Prentice Hall.
Kotler, P., & Keller, K. L. (2014). Marketing management (15th ed.). Pearson Prentice Hall.
Kovač, A., Kovačević, D., Bota, J., & Brozović, M. (2019). Consumers' preferences for visual elements on chocolate packaging. Journal of Graphic Engineering and Design, 10(1), 13–21. https://doi.org/10.24867/JGED-2019-1-013
Krishna, A. (2006). Interaction of senses: The effect of vision versus touch on the elongation bias. Journal of Consumer Research, 32(4), 557–566.
Krishna, A. (2012). An integrative review of sensory marketing: Engaging the senses to affect perception, judgment and behavior. Journal of Consumer Psychology, 22(3), 332–351. https://doi.org/10.1016/j.jcps.2011.08.003
Kruskal, J. B. (1964). Multidimensional scaling by optimizing goodness of fit to a nonmetric hypothesis. Psychometrika, 29, 1–27; Nonmetric multidimensional scaling: A numerical method. 29, 115–129
Kumar, H. H. A., John, F. S., & Senith, S. (2014). A study on factors influencing consumer buying behavior in cosmetic products. Semantic Scholar.
Kuvykaite, R., Dovaliene, A., & Navickiene, L. (2009). Impact of package elements on consumer's purchase decision. Economics and Management, 14, 441–447.
Kuvykaitė, R., Dovalienė, A., & Navickiene, L. (2015). Impact of package elements on consumer's purchase decision. Economics and Management, 20(14), 441-447. https://doi.org/10.5755/j01.em.0.14.9405
Lavidge, R. J., & Steiner, G. A. (1961). A model for predictive measurements of advertising effectiveness. Journal of Marketing, 25(6), 59–62. https://doi.org/10.1177/002224296102500611
Lazarus, R. S. (1982). Thoughts on the relations between emotion and cognition. American Psychologist.
Lee, N., Broderick, A. J., & Chamberlain, L. (2007). What is 'neuromarketing'? A discussion and agenda for future research. International Journal of Psychophysiology, 63(2), 199–204.
Lerner, J. S., Li, Y., Valdesolo, P., & Kassam, K. S. (2015). Emotion and decision making. Annual Review of Psychology, 66, 799–823.
Lewinski, P., Fransen, M. L., & Tan, E. S. (2014). Predicting advertising effectiveness by facial expressions in response to amusing persuasive stimuli. Journal of Neuroscience, Psychology, and Economics, 7(1), 1–14. https://doi.org/10.1037/npe0000012
Lewis, E. S. (1898). Catch-line and argument. The Book-Keeper, 15(2), 124–128.
Li, H., Wu, F., & Ho, C. (2024). Exploring the impact of packaging information on consumer purchase decision. AHFE International. https://doi.org/10.54941/ahfe1004975
Liao, L. X., Corsi, A. M., Chrysochou, P., & Lockshin, L. (2015). Emotional responses towards food packaging: A joint application of self-report and physiological measures of emotion. (Published in the journal Food Quality and Preference).
Lilienfeld, S. O., & Strother, A. N. (2020). Psychological measurement and the replication crisis: Four sacred cows. Canadian Psychology / Psychologie Canadienne, 61(4), 281–291. https://doi.org/10.1037/cap0000236
Lim, W. M. (2018). Demystifying neuromarketing. Journal of Business Research, 91, 205–220.

Lockshin, L. S., Spawton, A. L., & Macintosh, G. (1997). Using product, brand and purchasing involvement for retail segmentation. Journal of Retailing and Consumer Services, 4(3), 171–183. https://doi.org/10.1016/S0969-6989(96)00048-3
Loewenstein, G. (2000). Emotions in economic theory and economic behavior. American Economic Review, 90(2), 426–432. https://doi.org/10.1257/aer.90.2.426
Loewenstein, G., & Lerner, J. S. (2003). The role of affect in decision making. In R. J. Davidson, K. Scherer, & H. Goldsmith (Eds.), Handbook of affective science (pp. 619–642). Oxford University Press.
Loomes, G., & Sugden, R. (1982). Regret theory: An alternative theory of rational choice under uncertainty. The Economic Journal, 92(368), 805–824.
Louviere, J. J., Flynn, T. N., & Carson, R. T. (2010). Discrete choice experiments are not conjoint analysis. Journal of Choice Modelling, 3(3), 57–72. https://doi.org/10.1016/S1755-5345(13)70014-9
Lu, J., Liu, Z., & Fang, Z. (2016). Hedonic products for you, utilitarian products for me. Judgment and Decision Making, 11(4), 332–341.
Luce, R. D., & Tukey, J. W. (1964). Simultaneous conjoint measurement: A new type of fundamental measurement. Journal of Mathematical Psychology, 1(1), 1–27. https://doi.org/10.1016/0022-2496(64)90015-X
Ma, G., & Zhuang, X. (2021). Nutrition label processing in the past 10 years: Contributions from eye tracking approach. Appetite, 156, 104859.
MacInnes, J. J., Iqbal, S., Pearson, J., & Johnson, E. N. (2018). Wearable eye-tracking for research: Automated dynamic gaze mapping and accuracy/precision comparisons across devices. bioRxiv. https://doi.org/10.1101/299925
Magno, F., Cassia, F., & Ugolini, M. M. (2017). Impact of voluntary product recalls on utilitarian and hedonic attitudes: Is it the same for all brands? Australian Journal of Management, 42, 161–174.
Malhotra, N. K. (1982). Information load and consumer decision making. Journal of Consumer Research, 8(4), 419–430.
Malladi, S., Mukherjee, J., Larabi, M., & Chaudhury, S. (2022). EG-SNIK: A free viewing egocentric gaze dataset and its applications. IEEE Access, 10, 129626–129641. https://doi.org/10.1109/ACCESS.2022.3228484
Manokara, K., & Sauter, D. A. (2021). Emotion universals: The foundation from which cultural variability of emotion emerges. https://doi.org/10.31219/osf.io/72twd
Marsh, K., & Bugusu, B. (2007). Food packaging – roles, materials, and environmental issues. Journal of Food Science, 72(3), R39–R55. https://doi.org/10.1111/j.1750-3841.2007.00301.x
Mason, R. (2005). Missing links: Product classification theory and the social characteristics of goods. Marketing Theory, 5(3), 309–322.
Matsumoto, D., & Hwang, H. S. (2011). Evidence for training the ability to read microexpressions of emotion. Motivation and Emotion, 35(2), 181–191.
Maxwell, S. E., Lau, M. Y., & Howard, G. S. (2015). Is psychology suffering from a replication crisis? What does “failure to replicate” really mean? The American Psychologist, 70(6), 487–498. https://doi.org/10.1037/a0039400
Mehta, R., Sharma, C., Kanala, M., Thakur, M., Harrison, R., & Torrico, D. D. (2021). Self-reported emotions and facial expressions on consumer acceptability: A study using energy drinks. Foods, 10(2), 330. https://doi.org/10.3390/foods10020330
Meißner, M., Musalem, A., & Huber, J. (2017). Eye tracking reveals processes that enable conjoint choices to become increasingly efficient with practice. Journal of Marketing Research, 54(4), 557–574. https://doi.org/10.1509/jmr.14.0213

Mellers, B. A., Schwartz, A., & Ritov, I. (1999). Emotion-based choice. Journal of Experimental Psychology: General, 128(3), 332–345. https://psycnet.apa.org/doi/10.1037/0096-3445.128.3.332
Michaelidou, N., & Dibb, S. (2008). Consumer involvement: A new perspective. The Marketing Review, 8(1), 83–99. https://doi.org/10.1362/146934708X290403
Micu, A., & Plummer, J. T. (2010). Measurable emotions: How television ads really work-patterns of reactions to commercials can demonstrate advertising effectiveness. Journal of Advertising Research, 50(2), 137–153. https://doi.org/10.2501/S0021849910091300
Miller, K. J., Shenhav, A., & Ludvig, E. A. (2019). Habits without values. Psychological Review, 126(2), 292–311. https://doi.org/10.1037/rev0000120
Mittal, B. (1989). A theoretical analysis of two recent measures of involvement. Psychology & Marketing, 6(3), 183–195. https://doi.org/10.1002/mar.4220060304
Mittal, B., & Lee, M. S. (1989). A causal model of consumer involvement. Journal of Economic Psychology, 10(3), 363–389. https://doi.org/10.1016/0167-4870(89)90030-5
Mokatren, M., Kuflik, T., & Shimshoni, I. (2018). Exploring the potential of a mobile eye tracker as an intuitive indoor pointing device: A case study in cultural heritage. Future Generation Computer Systems, 81, 528–541.
Morawski, J. (2019). The replication crisis: How might philosophy and theory of psychology be of use? Journal of Theoretical and Philosophical Psychology, 39(3), 123–134. https://doi.org/10.1037/teo0000129
Morin, C. (2011). Neuromarketing: The new science of consumer behavior. Society, 48(2), 131–135. https://doi.org/10.1007/s12115-010-9408-1
Mundel, J., Huddleston, P., Behe, B. K., Sage, L., & Latona, C. (2018). An eye-tracking study of minimally branded products: Hedonism and branding as predictors of purchase intentions. Journal of Product & Brand Management, 27(2), 146–157. https://doi.org/10.1108/JPBM-07-2016-1282
Murphy, P. E., & Enis, B. M. (1986). Classifying products strategically. Journal of Marketing, 50(3), 24–42.
Navalpakkam, V., Kumar, R., Li, L., & Sivakumar, D. (2012). Attention and selection in online choice tasks. In User modeling, adaptation, and personalization: 20th International Conference, UMAP 2012 (pp. 200–211). Springer.
Niehorster, D. C., Cornelissen, T. H. W., Holmqvist, K., Hooge, I. T. C., & Hessels, R. S. (2018). What to expect from your remote eye-tracker when participants are unrestrained. Behavior Research Methods, 50(1), 213–227. https://doi.org/10.3758/s13428-017-0863-0
Niehorster, D., Hessels, R., & Benjamins, J. (2020b). GlassesViewer: Open-source software for viewing and analyzing data from the Tobii Pro Glasses 2 eye tracker. Behavior Research Methods, 52, 1244–1253. https://doi.org/10.3758/s13428-019-01314-1
Niehorster, D., Santini, T., Hessels, R., Hooge, I., Kasneci, E., & Nyström, M. (2020a). The impact of slippage on the data quality of head-worn eye trackers. Behavior Research Methods, 52, 1140–1160. https://doi.org/10.3758/s13428-019-01307-0
Nielsen. (2014). Breakthrough innovation report.
Nilashi, M., Yadegaridehkordi, E., Samad, S., Mardani, A., Ahani, A., Aljojo, N., & Tajuddin, T. (2020). Decision to adopt neuromarketing techniques for sustainable product marketing: A fuzzy decision-making approach. Symmetry, 12(2), 305.

North, E., & de Vos, R. (2002). The use of conjoint analysis to determine consumer buying preferences: A literature review. Journal of Family Ecology and Consumer Sciences, 30, 32–39.
Nummenmaa, L., Hyönä, J., & Calvo, M. G. (2006). Eye movement assessment of selective attentional capture by emotional pictures. Emotion, 6(2), 257–268. https://doi.org/10.1037/1528-3542.6.2.257
O'Cass, A. (2000). An assessment of consumers' product, purchase decision, advertising and consumption involvement in fashion. Journal of Economic Psychology, 21(5), 545–576. https://doi.org/10.1016/S0167-4870(00)00018-0
Ohme, R., & Matukin, M. (2012). A small frog that makes a big difference: Brain wave testing of TV advertisements. IEEE Pulse, 3(3), 28–33. http://dx.doi.org/10.1109/MPUL.2012.2189169
Orquin, J. L., & Holmqvist, K. (2018). Threats to the validity of eye-movement research in psychology. Behavior Research Methods, 50(4), 1645–1656. https://doi.org/10.3758/s13428-017-0998-z
Orquin, J. L., & Lagerkvist, C. J. (2015). Effects of salience are both short- and long-lived. Acta Psychologica, 160, 69–76. https://doi.org/10.1016/j.actpsy.2015.07.001
Orth, U. R., & Malkewitz, K. (2008). Holistic package design and consumer brand impressions. Journal of Marketing, 72(3), 64–81. https://doi.org/10.1509/jmkg.72.3.64
Ortony, A., Clore, G. L., & Collins, A. (1988). The cognitive structure of emotions. Cambridge University Press.
Page, G. (2012). Scientific realism: What 'neuromarketing' can and can't tell us about consumers. International Journal of Market Research, 54(2), 287–290.
Park, C., & Moon, B. (2003). The relationship between product involvement and product knowledge: Moderating roles of product type and product knowledge type. Psychology & Marketing, 20, 977–997.
Pashler, H. (1994). Dual-task interference in simple tasks: Data and theory. Psychological Bulletin, 116(2), 220–244. https://doi.org/10.1037/0033-2909.116.2.220
Pedale, T., Macaluso, E., & Santangelo, V. (2019). Enhanced insular/prefrontal connectivity when resisting from emotional distraction during visual search. Brain Structure & Function, 224, 2009–2026. https://doi.org/10.1007/s00429-019-01873-1
Pentus, K. (2023). A systematic review of food product conjoint analysis research. ACCESS: Access to Science, Business, Innovation in Digital Economy, 4(3), 480–502. https://doi.org/10.46656/access.2023.4.3(11)
Pentus, K., Mehine, T., & Kuusik, A. (2014). Considering emotions in product package design through combining conjoint analysis with psycho physiological measurements. Procedia – Social and Behavioral Sciences, 148, 280–290. https://doi.org/10.1016/j.sbspro.2014.07.044
Pentus, K., Ploom, K., Mehine, T., Koiv, M., Tempel, A., & Kuusik, A. (2020). Mobile and stationary eye-tracking comparison: Package design and in-store results. Journal of Consumer Marketing, 37(3), 259–269. https://doi.org/10.1108/JCM-04-2019-3190
Peschel, A. O., & Orquin, J. L. (2013). A review of the findings and theories on surface size effects on visual attention. Frontiers in Psychology, 4, 902. https://doi.org/10.3389/fpsyg.2013.00902
Pieters, R., & Wedel, M. (2004). Attention capture and transfer in advertising: Brand, pictorial, and text-size effects. Journal of Marketing, 68(2), 36–50. https://doi.org/10.1509/jmkg.68.2.36.27794
Pieters, R., Rosbergen, E., & Wedel, M. (1999). Visual attention to repeated print advertising: A test of scanpath theory. Journal of Marketing Research, 36(4), 424–438.

Pinto, Y., van der Leij, A. R., Sligte, I. G., Lamme, V. A., & Scholte, H. S. (2013). Bottom-up and top-down attention are independent. Journal of Vision, 13(3), 16.
Plutchik, R. (1980). Emotion: A psychoevolutionary synthesis. Harper & Row.
Poels, K., & Dewitte, S. (2006). How to Capture the Heart? Reviewing 20 Years of Emotion Measurement in Advertising. Journal of Advertising Research, 46(1), 18–37. https://doi.org/10.2501/S0021849906060041
Poels, K., & Dewitte, S. (2019). The role of emotions in advertising: A call to action. Journal of Advertising, 48(1), 81–90.
Pool, E., Brosch, T., Delplanque, S., & Sander, D. (2016). Attentional bias for positive emotional stimuli: A meta-analytic investigation. Psychological Bulletin, 142(1), 79–106. https://doi.org/10.1037/bul0000026
Porter, S., & ten Brinke, L. (2008). Reading between the lies: Identifying concealed and falsified emotions in universal facial expressions. Psychological Science, 19(5), 508–514.
Posner, M. I. (1980). Orienting of attention. Quarterly Journal of Experimental Psychology, 32(1), 3–25.
Prendergast, G., & Pitt, L. (1996). Packaging, marketing, logistics and the environment: Are there trade-offs? International Journal of Physical Distribution & Logistics Management, 26(6), 60–72.
Priyanto, A., & Yeh, H. (2024). Increasing the confidence of local brand through package design and information label. Frontier Management Science. https://doi.org/10.53893/fms.vli2.313
Rabinowitz, A. (2002). The power of packaging. Design Management Journal, 13(4), 32–36.
Raghubir, P., & Greenleaf, E. A. (2006). Ratios in proportion: What should the shape of the package be? Journal of Marketing, 70(2), 95–107.
Ray, M. L. (1973). Marketing communication and the hierarchy-of-effects. In P. Clarke (Ed.), New models for mass communication research (pp. 147–176). Sage.
Rayner, K. (2009). Eye movements and attention in reading, scene perception, and visual search. Quarterly Journal of Experimental Psychology, 62(8), 1457–1506. https://doi.org/10.1080/17470210902816461
Reimann, M., Zaichkowsky, J., Neuhaus, C., Bender, T., & Weber, B. (2010). Aesthetic package design: A behavioral, neural, and psychological investigation. Journal of Consumer Psychology, 20(4), 431–441.
Ren, C., & Anuar, T. (2024). Packaging's impact on consumer purchase intention: A comprehensive review. International Journal of Entrepreneurship and Management Practices.
Rettie, R., & Brewer, C. (2000). The verbal and visual components of package design. Journal of Product & Brand Management, 9(1), 56–70.
Richins, M. L., & Bloch, P. H. (1991). Post-purchase product satisfaction: Incorporating the effects of involvement and time. Journal of Business Research, 23(2), 145–158. https://doi.org/10.1016/0148-2963(91)90025-S
Rohr, M., Tröger, J., Michely, N., Uhde, A., & Wentura, D. (2017). Recognition memory for low- and high-frequency-filtered emotional faces: Low spatial frequencies drive emotional memory enhancement, whereas high spatial frequencies drive the emotion-induced recognition bias. Memory & Cognition, 45, 699–715. https://doi.org/10.3758/s13421-017-0695-2
Rook, D. W., & Gardner, M. P. (1993). In the mood: Impulse buying's affective antecedents. Research in Consumer Behavior, 6, 1–28.

Rosenberg, M. J., & Hovland, C. I. (1960). Cognitive, affective, and behavioral components of attitudes. In M. J. Rosenberg & C. I. Hovland (Eds.), Attitude organization and change: An analysis of consistency among attitude components (pp. 1–14). Yale University Press.

Rundh, B. (2005). The multi-faceted dimension of packaging. British Food Journal, 107(9), 670–684.

Rundh, B. (2009). Packaging design: Creating competitive advantage with product packaging. British Food Journal, 111(9), 988–1002. https://doi.org/10.1037/h0077714

Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology, 39*(6), 1161–1178.

Russell, J. A. (1994). Is there universal recognition of emotion from facial expression? A review of the cross-cultural studies. Psychological Bulletin, 115(1), 102-141. https://doi.org/10.1037/0033-2909.115.1.102

Russell, J. A., & Barrett, L. F. (1999). Core affect, prototypical emotional episodes, and other things called emotion: Dissecting the elephant. Journal of Personality and Social Psychology, 76(5), 805-819. https://doi.org/10.1037/0022-3514.76.5.80

Ryan, G. S., & Sfar-Gandoura, H. (2018). Introduction to positivism, interpretivism and critical theory. Nurse Researcher, 25(4), 41–49. https://doi.org/10.7748/nr.2018.e1466

Salnikova, E., Baglione, S. L., & Stanton, J. L. (2020). New product introduction success for private label products compared to branded by product category. Journal of International Food & Agribusiness Marketing, 1–15.

Sarter, M., Givens, B., & Bruno, J. P. (2001). The cognitive neuroscience of sustained attention: where top-down meets bottom-up. Brain research reviews, 35(2), 146-160. https://doi.org/10.1016/S0165-0173(01)00044-3

Scheibehenne, R., Greifeneder, R., & Todd, P. M. (2010). Can there ever be too many options? A meta-analytic review of choice overload. Journal of Consumer Research, 37(3), 409–425. https://doi.org/10.1086/651235

Schoormans, J. P. L., & Robben, H. S. J. (1997). The effect of new package design on product attention, categorization and evaluation. Journal of Economic Psychology, 18(2–3), 271–287. https://doi.org/10.1016/S0167-4870(97)00008-1

Schreij, D., Owens, C., & Theeuwes, J. (2008). Abrupt onsets capture attention independent of top-down control settings. Perception & Psychophysics, 70(2), 208–218. https://doi.org/10.3758/PP.70.2.208

Shrestha, B. K., & Sharma, L. (2024). Discerning the distinctive characteristics of key research paradigms and their constituents. Nepal Journal of Development and Rural Studies. https://doi.org/10.3126/njmr.v7i2.68191

Shrout, P. E., & Rodgers, J. L. (2018). Psychology, science, and knowledge construction: Broadening perspectives from the replication crisis. Annual Review of Psychology, 69, 487–510. https://doi.org/10.1146/annurev-psych-122216-011845

Silayoi, P., & Speece, M. (2004). Packaging and purchase decisions: An exploratory study on the impact of involvement level and time pressure. British Food Journal, 106(8), 607–628.

Simola, J., Torniainen, J., Moisala, M., Kivikangas, M., & Krause, C. (2013). Eye movement related brain responses to emotional scenes during free viewing. Frontiers in Systems Neuroscience, 7. https://doi.org/10.3389/fnsys.2013.00041

Simon, H. A. (1955). A behavioral model of rational choice. The Quarterly Journal of Economics, 69(1), 99–118. https://doi.org/10.2307/1884852

Simon, H. A. (1957). Models of man: Social and rational. Wiley.
Sivak, M. (1996). The information that drivers use: is it indeed 90% visual? Perception, 25(9), 1081–1089.
Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2007). The affect heuristic. European Journal of Operational Research, 177(3), 1333–1352.
Snow, R. (1974). Representative and quasi-representative designs for research on teaching. Review of Educational Research, 44, 265–291. https://doi.org/10.3102/00346543044003265
Sørensen, H. S., Clement, J., & Gabrielsen, G. (2012). Food labels – an exploratory study into label information and what consumers see and understand. The International Review of Retail, Distribution and Consumer Research, 22(1), 101–114.
Spanjaard, D., & Freeman, L. (2012). The hidden agenda: Emotions in grocery shopping. The International Review of Retail, Distribution and Consumer Research, 22(5), 473–488. https://doi.org/10.1080/09593969.2012.711251
Spelke, E., Hirst, W., & Neisser, U. (1976). Skills of divided attention. Cognition, 4(3), 215–230. https://doi.org/10.1016/0010-0277(76)90018-4
Spence, C., & Van Doorn, G. (2022). Visual communication via the design of food and beverage packaging. Cognitive Research: Principles and Implications, 7(1), 64. https://doi.org/10.1186/s41235-022-00391-9
Stasi, A., Songa, G., Mauri, M., Ciceri, A., Diotallevi, F., Nardone, G., & Russo, V. (2018). Neuromarketing empirical approaches and food choice: A systematic review. Food Research International, 108, 650–664.
Steinmetz, K., Waring, J., & Kensinger, E. (2014). The Effect of Divided Attention on
Emotion-Induced Memory Narrowing. Cognition & Emotion, 28 (5), 881-892. https://doi.org/10.1080/02699931.2013.858616
Stephenson, K., Luke, S., & South, M. (2019). Separate contributions of autistic traits and anxious apprehension, but not alexithymia, to emotion processing in faces. Autism, 23, 1830–1842. https://doi.org/10.1177/1362361319830090
Stewart, D. W., & Furse, D. H. (1982). Applying psychophysiological measures to marketing and advertising research problems. Current Issues and Research in Advertising, 5(1), 1–38.
Strong, E. K. (1925). The psychology of selling and advertising. Journal of Applied Psychology, 9(1), 75–86. https://doi.org/10.1037/h0070123
Sweller, J. (2011). Cognitive load theory. In Psychology of learning and motivation (Vol. 55, pp. 37–76). Academic Press.
Takahashi, R., Suzuki, H., Chew, J. Y., Ohtake, Y., Nagai, Y., & Ohtomi, K. (2018). A system for three-dimensional gaze fixation analysis using eye tracking glasses. Journal of Computational Design and Engineering, 5(4), 449–457.
Talmi, D. (2013). Enhanced emotional memory: Cognitive and neural mechanisms. Current Directions in Psychological Science, 22(6), 430–436.
Tassawa, C., & Khumhome, B. (2023). An investigation into the role of packaging design elements on perceived value and price fairness. ABAC Journal. https://doi.org/10.59865/abacj.2023.32
Tatler, B. W. (2007). The central fixation bias in scene viewing: Selecting an optimal viewing position independently of motor biases and image feature distributions. Journal of Vision, 7(14), 1–17.
Theeuwes, J. (2010). Top–down and bottom–up control of visual selection. Acta Psychologica, 135(2), 77–99.

Tice, D. M., Bratslavsky, E., & Baumeister, R. F. (2001). Emotional distress regulation takes precedence over impulse control: If you feel bad, do it! Journal of Personality and Social Psychology, 80(1), 53–67. https://psycnet.apa.org/doi/10.1037/0022-3514.80.1.53

Tonkin, C., Ouzts, A. D., & Duchowski, A. T. (2011). Eye tracking within the packaging design workflow: Interaction with physical and virtual shelves. In V. Sundstedt & C. C. Sennersten (Eds.), Proceedings of the 1st Conference on Novel Gaze-Controlled Applications (NGCA '11) (Article 3 / pp. 1–8). ACM. https://doi.org/10.1145/1983302.1983305

Trafimow, D. (2022). A new way to think about internal and external validity. Perspectives on Psychological Science, 18, 1028–1046. https://doi.org/10.1177/17456916221136117

Treisman, A. M. (1969). Strategies and models of selective attention. Psychological Review, 76(3), 282–299. https://doi.org/10.1037/h0027242

Turyahikayo, E. (2021). Philosophical paradigms as the bases for knowledge management research and practice. Knowledge Management & E-Learning: An International Journal, 13(2), 183–199. https://doi.org/10.34105/j.kmel.2021.13.012

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. Science, 185(4157), 1124–1131. https://doi.org/10.1126/science.185.4157.1124

Tyng, C. M., Amin, H. U., Saad, M. N., & Malik, A. S. (2017). The influences of emotion on learning and memory. Frontiers in Psychology, 8, 1454.

Underwood, R. L. (2003). The communicative power of product packaging: Creating brand identity via lived and mediated experience. Journal of Marketing Theory and Practice, 11(1), 62–76.

Vakratsas, D., & Ambler, T. (1999). How advertising works: What do we really know? Journal of Marketing, 63(1), 26–43. https://doi.org/10.2307/1251999

van Der Lans, R., Pieters, R., & Wedel, M. (2008b). Eye movement analysis of search effectiveness. Journal of the American Statistical Association, 103(482), 452–461.

van der Lans, R., Pieters, R., & Wedel, M. (2008a). Competitive brand salience. Marketing Science, 27(5), 922–931. https://doi.org/10.1287/mksc.1070.0327.

Vermeir, I., & Roose, G. (2020). Visual design cues impacting food choice: A review and future research agenda. Foods, 9(10), 1495. https://doi.org/10.3390/foods9101495

Verplanken, B., & Sato, A. (2011). The psychology of impulse buying: An integrative self-regulation approach. Journal of Consumer Policy, 34(2), 197–210. https://link.springer.com/article/10.1007/s10603-011-9158-5

Vidal, L., Antúnez, L., Sapolinski, A., Giménez, A., Maiche, A., & Ares, G. (2013). Can eye-tracking techniques overcome a limitation of conjoint analysis? Case study on healthfulness perception of yogurt labels. Journal of Sensory Studies, 28(5), 370–380.

Vidyadharan, V., & Harish, M. (2018). Comments on "specific learning disabilities: Issues that remain unanswered". Indian Journal of Psychological Medicine, 40, 590–591. https://doi.org/10.4103/IJPSYM.IJPSYM_384_18

Visschers, V. H. M., Hess, R., & Siegrist, M. (2010). Health motivation and product design determine consumers' visual attention to nutrition information on food products. Public Health Nutrition, 13(7), 1099–1106. https://doi.org/10.1017/S1368980009993235

Vitu, F., Kapoula, Z., Lancelin, D., & Lavigne, F. (2004). Eye movements in reading isolated words: Evidence for strong biases towards the center of the screen. Vision Research, 44(3), 321–338. https://doi.org/10.1016/j.visres.2003.06.002

Vlaev, I., Chater, N., Stewart, N., & Brown, G. D. (2011). Does the brain calculate value?. Trends in cognitive sciences, 15(11), 546-554.
Von Neumann, J., & Morgenstern, O. (1944). Theory of games and economic behavior. Princeton University Press.
Voss, K., Spangenberg, E., & Grohmann, B. (2003). Measuring the hedonic and utilitarian dimensions of consumer attitude. Journal of Marketing Research, 40(3), 310–320. https://doi.org/10.1509/jmkr.40.3.310.19238
Wang, F., Wang, H., & Cho, J. H. (2022). Consumer preference for yogurt packaging design using conjoint analysis. Sustainability, 14(6), 3463. https://doi.org/10.3390/su14063463
Wang, Y. J., & Minor, M. S. (2008). Validity, reliability, and applicability of psychophysiological techniques in marketing research. Psychology & Marketing, 25(2), 197–232.
Warm, J. S., Parasuraman, R., & Matthews, G. (2008). Vigilance requires hard mental work and is stressful. Human Factors, 50(3), 433–441. https://doi.org/10.1518/001872008X312152
Wästlund, E., Otterbring, T., Gustafsson, A., & Shams, P. (2015). Heuristics and resource depletion: eye-tracking customers' in situ gaze behavior in the field. Journal of Business Research, 68(1), 95–101.
Wedel, M., & Pieters, R. (2006). Eye tracking for visual marketing. Foundations and Trends in Marketing, 1(4), 231–320. https://doi.org/10.1561/1700000011
Weinberg, P., & Gotwald, W. (1982). Impulsive consumer buying as a result of emotions. Journal of Business Research, 10(1), 43–57.
Wells, L. E., Farley, H., & Armstrong, G. A. (2007). The importance of packaging design for own-label food brands. International Journal of Retail & Distribution Management, 35(9), 677–690.
Wickens, C. D. (2008). Multiple resources and mental workload. Human Factors, 50(3), 449–455. https://doi.org/10.1518/001872008X288394
Wiggins, B. J., & Christopherson, C. D. (2019). The replication crisis in psychology: An overview for theoretical and philosophical psychology. Journal of Theoretical and Philosophical Psychology, 39(3), 121–139. https://doi.org/10.1037/teo0000137
Wilson, T., Lindsey, S., & Schooler, T. Y. (2000). A model of dual attitudes. Psychological Review, 107, 101–126.
Wittink, D. R., & Cattin, P. (1989). Commercial use of conjoint analysis: An update. Journal of Marketing, 53(3), 91–96. https://doi.org/10.1177/002224298905300308
Wojdeł, A., & Rothkrantz, L. J. M. (2005). Parametric generation of facial expressions based on FACS. Computer Graphics Forum, 24(4), 743–757. https://doi.org/10.1111/j.1467-8659.2005.00899.x
Wolfe, J. M. (1994). Guided search 2.0: A revised model of visual search. Psychonomic Bulletin & Review, 1(2), 202–238. https://doi.org/10.3758/BF03200774
Wood, O. (2012). How emotional tugs trump rational pushes: The time has come to abandon a 100-year-old advertising model. Journal of Advertising Research, 52(1), 31–39.
Wright, R. D., & Ward, L. M. (2008). Orienting of attention. Oxford University Press.
Wu, W. (2023). Movements of the Mind: A Theory of Attention, Intention and Action. Oxford University Press.
Wundt, W. (1948). Principles of physiological psychology. In Readings in the history of psychology (pp. 248–250). Appleton-Century-Crofts. (Original work published 1873)

Yadav, S. (2024). The influence of packaging on consumer perception. International Journal of Scientific Research in Engineering and Management. https://doi.org/10.55041/ijsrem32315

Zaichkowsky, J. L. (1985). Measuring the involvement construct. Journal of Consumer Research, 12(3), 341–352. https://doi.org/10.1086/208520

Zaichkowsky, J. L. (1986). Conceptualizing involvement. Journal of Advertising, 15(2), 4–14. https://doi.org/10.1080/00913367.1986.10673099

Zeelenberg, R., Wagenmakers, E., & Rotteveel, M. (2006). The impact of emotion on perception. Psychological Science, 17, 287–291. https://doi.org/10.1111/j.1467-9280.2006.01700.x

Zhao, X., Liu, Y., Chen, T., Wang, S., Chen, J., Wang, L., & Liu, G. (2022). Differences in brain activations between micro-and macro-expressions based on electroencephalography. Frontiers in Neuroscience, 16, 903448.

APPENDIX A: Summary of Decision-Making Theories

Theory	Category	Main Thesis	Relation to Neuromarketing
Dual Process Theory (Evans, 2008)	Cognitive Processes	Decision-making involves two systems: fast (intuitive) and slow (deliberative).	Helps explain how consumers make quick decisions in everyday food choices vs. more thoughtful decisions.
Fuzzy-Trace Theory (Reyna, 2012)	Cognitive Processes	People rely on general (gist) representations over detailed (verbatim) ones in decision-making.	Offers insights into how consumers prioritise simple interpretations over detailed product comparisons.
Bounded Rationality (Simon, 1955)	Cognitive Processes	Cognitive limitations lead to satisfying rather than optimising decisions.	Less relevant because it overlaps with heuristics but adds limited new insights to food product choices.
Expected Utility Theory (Von Neumann & Morgenstern, 1944)	Rationality and Utility	Rational decision-makers maximise expected utility.	Good for analysing trade-offs between product attributes in conjoint analysis. Aligns well with conjoint analysis.
Rational Choice Theory (Becker, 1976)	Rationality and Utility	People rationally weigh costs and benefits to maximise personal advantage.	Less relevant due to its assumption of purely rational behaviour, which does not fully apply to food decisions.
Theory of Planned Behaviour (Ajzen, 1991)	Rationality and Utility	Behaviour is determined by intentions shaped by attitudes, norms and perceived control.	Helps understand how long-term intentions (e.g. health goals) influence food choices.

Theory	Category	Main Thesis	Relation to Neuromarketing
Prospect Theory (Kahneman & Tversky, 1979)	Emotion and Bias	People evaluate decisions based on potential losses and gains rather than final outcomes.	Highly relevant for understanding trade-offs in food product package choices, measured with conjoint analysis. Measured mainly through eye-tracking.
Heuristics and Biases (Tversky & Kahneman, 1974)	Emotion and Bias	People use mental shortcuts (heuristics) which can result in systematic biases and errors.	Understanding how consumers rely on short-cuts in food package choices, measurable with eye-tracking.
Regret Theory (Loomes & Sugden, 1982)	Emotion and Bias	Decision-makers consider potential regret when making choices.	Less relevant since regret is more applicable to high-stakes decisions, unlike habitual food choices.
Social Influence Theory (Cialdini & Goldstein, 2004)	Social Influence	People's decisions are influenced by the presence, actions and opinions of others.	Highly relevant for understanding how social factors shape food choices, measurable via eye-tracking and emotion measurement.

CURRICULUM VITAE

Name: Kristian Pentus
Date of birth: June 23, 1989
Citizenship: Estonian
Email: kristian.pentus@gmail.com

Institutions and positions

01.01.2021–...	University of Tartu, Faculty of Social Sciences, School of Economics and Business Administration, Junior Lecturer in Marketing
01.09.2019–31.12.2020	University of Tartu, Faculty of Social Sciences, School of Economics and Business Administration, Assistant in Marketing
01.09.2018–31.08.2019	University of Tartu, Faculty of Social Sciences, School of Economics and Business Administration, Assistant in Marketing
01.09.2018–31.08.2019	University of Tartu, Faculty of Social Sciences, School of Economics and Business Administration, Junior Research Fellow in Marketing
01.01.2016–31.08.2018	University of Tartu, Faculty of Social Sciences, School of Economics and Business Administration, Assistant in Marketing
01.09.2015–31.12.2015	University of Tartu, Faculty of Economics and Business Administration, Dean's Office, Assistant in Marketing
01.02.2015–31.08.2015	University of Tartu, Faculty of Economics and Business Administration, Dean's Office, Personal Assistant

Projects in progress

- SSVPH24170 (TK218U2) "Estonian Center of Excellence of Well-Being Sciences" (01.01.2024−31.12.2030); Principal Investigator: Kairi Kreegipuu; Funder: Ministry of Education and Research.
- RITA-TOIT1 "Promotion of the population's balanced diet – RATTE" (01.10.2025−30.09.2027); Principal Investigator: Eha Nurk; Funder: Estonian Research Council.
- LSVMJ25549 "Promotion of the population's balanced diet" (01.10.2025−30.09.2027); Principal Investigator: Kristian Pentus; Funder: Estonian Research Council (ETAg).
- LSVMJ26161 "Study on the Motivation for Opening a Bank Account and Usage Patterns" (16.03.2026−14.04.2026); Principal Investigator: Tanel Mehine; Funder: Bigbank AS.

Completed projects

- LSVMJ24554 “Study of Behavioral Patterns in Opening Checking Accounts and Savings Deposits” (11.10.2024−03.12.2024); Principal Investigator: Tanel Mehine; Funder: Bigbank AS.
- LSVMJ23130 “Value analysis of Ülemiste City as a campus” (15.02.2023−31.03.2024); Principal Investigator: Kertu Lääts; Funder: Mainor AS.
- LSVMJ23226 “AS BigBank homepage neuromarketing usability test” (15.02.2023−28.04.2023); Principal Investigator: Tanel Mehine; Funder: Bigbank AS.
- LSVMJ20533 (procurement 223841) “Improving Estonian Internal Security Social Campaigns through Neuroscience” (14.10.2020−30.11.2021); Principal Investigator: Kristian Pentus; Funder: Ministry of the Interior.
- RITA2/082 “Improving Estonian Internal Security Social Campaigns through Neuroscience” (14.10.2020−30.11.2021); Principal Investigator: Kristian Pentus; Funder: Estonian Research Council, Ministry of the Interior.
- LSVMJ20339 “Automation of the real time in-shop recommendation system for COOP retail shops” (01.04.2020−20.04.2021); Principal Investigator: Andres Kuusik; Funder: Tulundusühistu Tartu Tarbijate Kooperatiiv.
- LSVJS16320 “Innove and Rajaleidja brand communication study” (31.08.2016−31.10.2016); Principal Investigator: Uku Varblane; Funder: Foundation Innove.

Publications

2025

Pentus, Kristian; Kuusik, Andres; Ploom, Kerli; Dorokhova, Liudmyla (2025). How atypical packaging captures attention and evokes emotion: an eye-tracking and facial-expression study. Ekonomska misao i praksa / Economic thought and practice, Online First (Online First), 1−22. DOI: 10.17818/EMIP/2025/37.

2024

Hiiesalu, Inga; Hint, Helen; Kondratyk, Yurii; Laak, Kristjan-Julius; Lepik, Krista; Marandi, Triin; Pentus, Kristian; Pääbo, Heiko; Rammo, Karl; Tammekänd, Liina (2024). Õppimine ja õpetamine tehisintellekti ajastul: kuidas kasutada tekstiroboteid õppetöös [Learning and teaching in the age of Artificial Intelligence: how to use text-based AI in education].

2023

Dorokhova, Liudmyla; Kuusik, Andres; Dimitrov, Radi; Pentus, Kristian; Dorokhov, Oleksandr; Petrova, Mariana (2023). Planning the digital marketing budget: computer modelling for decision making. ACCESS Access to science business innovation in digital economy, 4 (2), 248−260. DOI: 10.46656/access.2023. 4.2(7).

Dorokhova, Liudmyla; Pentus, Kristian; Kuusik, Andres; Dorokhov, Oleksandr (2023). Comparison of Pharmacy Websites: An Integrated Approach Based on Consumer Perception and Technical Parameters. Studies in Business and Economics, 18 (1), 101−117. DOI: 10.2478/sbe-2023-0006.

Pentus, Kristian; Ruusu, Mariia; Kuusik, Andres; Dorokhova, Liudmyla; Ploom, Kerli (2023). How Sexualised Images in Advertisements Influence the Attention and Preference of Consumers with a Modern View. Organizations and Markets in Emerging Economies, 14 (2(28)), 366−385. DOI: 10.15388/omee.2023.14.97.

Pentus, Kristian (2023). A systematic review of food product conjoint analysis research. Access Journal – Access To Science, Business, Innovation in The Digital Economy, 4 (3), 480−502. DOI: 10.46656/access.2023.4.3(11).

2020

Ploom, Kerli; Pentus, Kristian; Kuusik, Andres; Varblane, Urmas (2020). The Effect of Culture on the Perception of Product Packaging: A Multimethod Cross-Cultural Study. Journal of International Consumer Marketing, 32 (3), 163−177. DOI: 10.1080/08961530.2019.1660752.

Pentus, Kristian; Ploom, Kerli; Mehine, Tanel; Koiv, Madli; Tempel, Age; Kuusik, Andres (2020). Mobile and stationary eye tracking comparison – package design and in-store results. Journal of Consumer Marketing, 37 (3), 259−269. DOI: 10.1108/JCM-04-2019-3190.

Masso, Anu; Tiidenberg, Katrin; Siibak, Andra; Aasa, Anto; Ainsaar, Mare; Beilmann, Mai; Himma, Marju; Ibrus, Indrek; Järv, Olle; Kelli, Aleksei; Kirt, Toomas; Koit, Mare; Kõuts, Ragne; Kull, Irene; Kuusik, Andres; Laineste, Liisi; Lindström, Liina; Liiv, Innar; Masso, Jaan; Muischnek, Kadri ... Vihalemm, Triin (2020). Kuidas mõista andmestunud maailma? Metodoloogiline teejuht [Making sense of the datafied world – a methodological guide]. Tallinn: Tallinna Ülikooli kirjastus.

Pentus, Kristian; Kuusik, Andres (2020). Pilgujälgimine [Eye-tracking]. Masso, Anu; Tiidenberg, Kaitrin; Siibak, Andra (Eds.). Kuidas mõista andmestunud maailma? Metodoloogiline teejuht. (368−404). Tallinn: Tallinna Ülikooli Kirjastus.

2019

Ashyrov, Gaygysyz; Alunurm, Reelika; Pentus, Kristian; Vadi, Maaja (2019). The future of university–industry collaboration: scenario analysis based on case of Estonia. Knowledge Management Research & Practice, 17 (4), 421−435. DOI: 10.1080/14778238.2019.1599307.

2018

Pentus, Kristian; Ploom, Kerli; Kuusik, Andres; Mehine, Tanel (2018). How to optimize sales flyers – novel experiment design. Baltic Journal of Management, 13 (2), 191−208. DOI: 10.1108/BJM-05-2017-0132.

2014

Pentus, Kristian; Mehine, Tanel; Kuusik, Andres (2014). Considering emotions in product package design through combining conjoint analysis with psycho physiological measurements. Procedia – Social and Behavioral Sciences, 148: 2nd International Conference on Strategic Innovative Marketing. Ed. Sakas, Damianos P.; Kavoura, Androniki; Tomaras, Petros. Elsevier, 280−290. DOI: 10.1016/j.sbspro.2014.07.044.

ELULOOKIRJELDUS

Nimi: Kristian Pentus
Sünniaeg: 23. juuni 1989
Kodakondsus: Eesti
E-post: kristian.pentus@gmail.com

Haridus:

2015–2026	PhD (majandusteadus, lõputöö teema: neuroturunduse metoodika), Tartu Ülikool
2015	MA (lõputöö teema: neuroturundus ja reklaamid), Tartu Ülikool
2013	BA (majandusteadus, lõputöö teema: neuroturundus ja pakendi disain), Tartu Ülikool

Teadustöö põhisuunad
ETIS VALDKOND: 2. Ühiskonnateadused ja kultuur; 2.12. Majandusteadus;
CERCS VALDKOND: S191 Turu-uuringud; TÄPSUSTUS: Neuroturundus

Töökohad ja ametid

01.01.2021–...	Tartu Ülikool, Sotsiaalteaduste valdkond, majandusteaduskond, turunduse nooremlektor
01.09.2019–31.12.2020	Tartu Ülikool, Sotsiaalteaduste valdkond, majandusteaduskond, turunduse assistent
01.09.2018–31.08.2019	Tartu Ülikool, Sotsiaalteaduste valdkond, majandusteaduskond, turunduse assistent
01.09.2018–31.08.2019	Tartu Ülikool, Sotsiaalteaduste valdkond, majandusteaduskond, turunduse nooremteadur
01.01.2016–31.08.2018	Tartu Ülikool, Sotsiaalteaduste valdkond, majandusteaduskond, turunduse assistent
01.09.2015–31.12.2015	Tartu Ülikool, Majandusteaduskond, Majandusteaduskonna dekanaat, turunduse assistent
01.02.2015–31.08.2015	Tartu Ülikool, Majandusteaduskond, Majandusteaduskonna dekanaat, referent

Jooksvad projektid

- SSVPH24170 (TK218U2) “Heaoluteaduste tippkeskus. Aju ja tunnetus” (01.01.2024−31.12.2030); Vastutav täitja: Kairi Kreegipuu; Finantseerija: Haridus- ja Teadusministeerium.
- RITA-TOIT1 “Rahvastiku tasakaalustatud toitumise edendamine – RATTE” (01.10.2025−30.09.2027); Vastutav täitja: Eha Nurk; Finantseerija: Sihtasutus Eesti Teadusagentuur.
- LSVMJ25549 “Rahvastiku tasakaalustatud toitumise edendamine” (01.10. 2025−30.09.2027); Vastutav täitja: Kristian Pentus; Finantseerija: Eesti Teadusagentuur (ETAg).

- LSVMJ26161 “Pangakonto avamise motivatsiooni ja kasutamismustrite uuring” (16.03.2026−14.04.2026); Vastutav täitja: Tanel Mehine; Finantseerija: Bigbank AS.

Lõppenud projektid

- LSVMJ24554 “Arvelduskontode ja säästuhoiuste sõlmimise käitumismustrite uuring” (11.10.2024−03.12.2024); Vastutav täitja: Tanel Mehine; Finantseerija: Bigbank AS.
- LSVMJ23130 “Ülemiste City kui eralinnaku väärtusanalüüs” (15.02.2023−31.03.2024); Vastutav täitja: Kertu Lääts; Finantseerija: Mainor AS.
- LSVMJ23226 “AS BigBank kodulehe neuroturunduse uuring” (15.02.2023−28.04.2023); Vastutav täitja: Tanel Mehine; Finantseerija: Bigbank AS.
- LSVMJ20533 (hange 223841) “Eesti siseturvalisuse teavituskampaaniate tõhustamine neurouuringute abil” (14.10.2020−30.11.2021); Vastutav täitja: Kristian Pentus; Finantseerija: Siseministeerium.
- RITA2/082 “Eesti siseturvalisuse teavituskampaaniate tõhustamine neuro-uuringute abil” (14.10.2020−30.11.2021); Vastutav täitja: Kristian Pentus; Finantseerija: Sihtasutus Eesti Teadusagentuur, Siseministeerium.
- LSVMJ20339 “Coop kaupluste sisese soovitussüsteemi automatiseerimine” (01.04.2020−20.04.2021); Vastutav täitja: Andres Kuusik; Finantseerija: Tulundusühistu Tartu Tarbijate Kooperatiiv.
- LSVJS16320 “Innove ja Rajaleidja brändide kommunikatsiooni uuring” (31.08.2016−31.10.2016); Vastutav täitja: Uku Varblane; Finantseerija: SA Innove.

Publikatsioonid

2025

Pentus, Kristian; Kuusik, Andres; Ploom, Kerli; Dorokhova, Liudmyla (2025). How atypical packaging captures attention and evokes emotion: an eye-tracking and facial-expression study. Ekonomska misao i praksa / Economic thought and practice, Online First (Online First), 1−22.

2024

Hiiesalu, Inga; Hint, Helen; Kondratyk, Yurii; Laak, Kristjan-Julius; Lepik, Krista; Marandi, Triin; Pentus, Kristian; Pääbo, Heiko; Rammo, Karl; Tammekänd, Liina (2024). Õppimine ja õpetamine tehisintellekti ajastul: kuidas kasutada tekstiroboteid õppetöös.

2023

Dorokhova, Liudmyla; Kuusik, Andres; Dimitrov, Radi; Pentus, Kristian; Dorokhov, Oleksandr; Petrova, Mariana (2023). Planning the digital marketing budget: computer modelling for decision making. ACCESS Access to science business innovation in digital economy, 4 (2), 248−260.

Dorokhova, Liudmyla; Pentus, Kristian; Kuusik, Andres; Dorokhov, Oleksandr (2023). Comparison of Pharmacy Websites: An Integrated Approach Based

on Consumer Perception and Technical Parameters. Studies in Business and Economics, 18 (1), 101−117.
Pentus, Kristian; Ruusu, Mariia; Kuusik, Andres; Dorokhova, Liudmyla; Ploom, Kerli (2023). How Sexualised Images in Advertisements Influence the Attention and Preference of Consumers with a Modern View. Organizations and Markets in Emerging Economies, 14 (2(28)), 366−385.
Pentus, Kristian (2023). A systematic review of food product conjoint analysis research. Access Journal - Access To Science, Business, Innovation in The Digital Economy, 4 (3), 480−502.

2020

Ploom, Kerli; Pentus, Kristian; Kuusik, Andres; Varblane, Urmas (2020). The Effect of Culture on the Perception of Product Packaging: A Multimethod Cross-Cultural Study. Journal of International Consumer Marketing, 32 (3), 163−177.
Pentus, Kristian; Ploom, Kerli; Mehine, Tanel; Koiv, Madli; Tempel, Age; Kuusik, Andres (2020). Mobile and stationary eye tracking comparison – package design and in-store results. Journal of Consumer Marketing, 37 (3), 259−269.
Masso, Anu; Tiidenberg, Katrin; Siibak, Andra; Aasa, Anto; Ainsaar, Mare; Beilmann, Mai; Himma, Marju; Ibrus, Indrek; Järv, Olle; Kelli, Aleksei; Kirt, Toomas; Koit, Mare; Kõuts, Ragne; Kull, Irene; Kuusik, Andres; Laineste, Liisi; Lindström, Liina; Liiv, Innar; Masso, Jaan; Muischnek, Kadri ... Vihalemm, Triin (2020). Kuidas mõista andmestunud maailma? Metodoloogiline teejuht. Tallinn: Tallinna Ülikooli kirjastus.
Pentus, Kristian; Kuusik, Andres (2020). Pilgujälgimine. Masso, Anu; Tiidenberg, Kaitrin; Siibak, Andra (Toim.). Kuidas mõista andmestunud maailma? Metodoloogiline teejuht. (368−404). Tallinn: Tallinna Ülikooli Kirjastus.

2019

Ashyrov, Gaygysyz; Alunurm, Reelika; Pentus, Kristian; Vadi, Maaja (2019). The future of university–industry collaboration: scenario analysis based on case of Estonia. Knowledge Management Research & Practice, 17 (4), 421−435.

2018

Pentus, Kristian; Ploom, Kerli; Kuusik, Andres; Mehine, Tanel (2018). How to optimize sales flyers – novel experiment design. Baltic Journal of Management, 13 (2), 191−208.

2014

Pentus, Kristian; Mehine, Tanel; Kuusik, Andres (2014). Considering emotions in product package design through combining conjoint analysis with psycho physiological measurements. Procedia – Social and Behavioral Sciences, 148: 2nd International Conference on Strategic Innovative Marketing.

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