Asian And Pacific Economic Review
ISSN: 1000-6052

FROM VISUAL ATTENTION TO COGNITIVE CHOICE: A HYBRID REVIEW OF EYE-TRACKING IN BEHAVIOURAL DECISION-MAKING

Pallavi Vats[1]
Department of Management Studies; Industrial Engineering (DMSIE), Indian Institute of Technology (Indian School of Mines) Dhanbad, Jharkhand
Sabnam Basu[2]
Department of Management Studies, Industrial Engineering (DMSIE) Indian Institute of Technology (Indian School of Mines) Dhanbad, Jharkhand

Abstract

In the modern digitalized world full of choices, it is crucial to know how individuals allocate their visual attention in the decision-making process. Eye-tracking has emerged as a form of invaluable method by which cognitive and perceptual processes leading to behavioural decision-making can be studied. Despite growing interest, existing literature is fragmented, without a comprehensive synthesis across various disciplines and contexts. The current review is a systematic analysis of 255 peer-reviewed articles published between 2014-2023, obtained from Web of Science database. Using a hybrid review method combining bibliometric analysis, topic modeling based on non-negative matrix factorization, and TCCM framework, this cross-disciplinary review has identified seven obscure research themes and theoretical shortcomings in the discipline. The present research contributes to the literature by identifying relatively underdeveloped fields such as HR decision-making and the field of public policy as well as outlines possible research plan in the future. It also offers theoretical knowledge, establishing eye-tracking as the mechanism to comprehend bounded rationality and cognitive effort in decision-making situations. The research findings are useful to researchers, marketers, and HR professionals, particularly in developing economies such as India, which aim at enhancing the presentation of visual information and reducing biases in making strategic decisions.

Keywords: Behavioural decision-making, Eye-tracking, Bibliometric analysis, TCCM, Nonnegative matrix factorization.

1. Introduction

In a world filled with information abundance, individuals often make decisions relying on limited visual information that they are exposed to through digital and physical experiences. Whether to evaluate products in online platforms, shortlisting job candidates, or answer advertisements, attention serves as the screening mechanism of decision-making. Subsequently, eye-tracking has become a worthwhile technique in getting detailed and real-time information about how people process visual information. Eye-tracking is a neurophysiological measure that interprets choice behaviour and perceptual decision-making through both quantitative and qualitative gaze analysis (Ashby et al., 2016). By analyzing gaze patterns, fixation duration, and saccades, researchers can obtain deeper insight on the behavioural, emotional and cognitive processes involved in the human decision-making process.

Over the last decade, research in behavioural decision-making has advanced by incorporating knowledge from psychology, marketing, economics, and cognitive science. Behavioural decision-making studies individual decision-making, considering the psychological, social, and behavioural factors that determine the choice (Korteling & Paradies, 2023). It has also been boosted by the advancement of technology in eye-tracking, enabling biases, heuristics, framing effects, and bounded rationality to be empirically studied using visual attention. Although gaining in popularity, the current literature remains methodologically fragmented and contextually dispersed, with studies being allocated to various areas, including consumer research, advertising, pricing, HR, and moral judgment. This literature lacks a unifying framework that coherently links theory, practice, and methodology.

Recently, numerous reviews have been published that provide useful insight into eye-tracking studies but have focused on niche applications of eye-tracking. For example, Meißner & Oll (2019) offered a qualitative analysis by focusing on the potential of eye-tracking from the perspective of organisational research and illustrated future avenues in different domains, while Borozan et al. (2022) performed a quantitative bibliometric study within the specific area of financial decision-making. Hu et al. (2024) focused on the impact of visual attention on risky decisions with primary attention to psychological experimentation. Correspondingly, Wedel et al. (2023) built gaze behaviour models following computational and econometric approaches, without identifying general research trends or incorporating emerging clusters. In HR contexts, Bonilla-Chaves & Palos-Ssanchez (2023), along with Thakral et al. (2023), applied topic modeling in the study of digitalization in human resource management but failed to include eye-tracking and decision-related behaviour constructs. However, there is a need to have a deeper understanding of the cognitive process during behavioural decision-making by using eye-tracking.

Majority of the research works in this field employ a qualitative, quantitative, or experimental approach individually without integrating a multi-method approach. This lack of systematic conceptual review deprives us of knowing how eye-tracking can be conjoined to behavioural decision-making analysis in different disciplines. To our knowledge, no prior study has combined bibliometrics, machine learning-based topic modeling, and theory-driven synthesis (through the TCCM framework) to provide a comprehensive, interdisciplinary view of this topic. To fill this gap, the present research uses a hybrid systematic literature review, with three analytical elements namely, Bibliometric analysis to identify the global trends, major contributors, and influential journals. Non-negative matrix factorization, a method of topic modeling to uncover theme-based clusters. Conceptual synthesis and organisation of the results in terms of TCCM theory, context, characteristics, and methodology. Based on a well-chosen sample of 255 peer-reviewed articles that appeared in 2014-2023 in the Web of Science database, this review provides a clear vision of the role of eye-tracking in behavioural decision-making. The study seeks to answer the following research questions:

RQ1: What are the annual publication trends, most influential journals, and the top contributors in the field of eye-tracking and behavioural decision-making?

RQ2: What are latent themes and conceptual categories within eye-tracking in behavioural decision-making?

RQ3: What are the underlying theories, contextual applications, and methodological patterns that characterize contemporary research?

RQ4 What future research directions can be recommended, particularly in under-explored areas?

Through this hybrid approach, this paper aims to provide a comprehensive mapping of the field, reconciling methodological differences, and developing a unified conceptual ground for future interdisciplinary research.

2. Methodology

2.1. Data Collection and Processing

Data was collected from the Web of Science database (WoS), a well-known and extensive bibliographic resource. A strategic approach was taken to identify and gather scientific documents using specific keywords that are relevant to the research topic. The following search string was used in the title-abstract-keyword field:

("eye track*" OR "eye-track*" OR "eye track*") AND ("decision*"OR “decision-making" OR "decision process" OR "choice" OR "judgment" OR "decision analysis")

The data retrieval occurred in January 2023, resulting in 2073 documents initially. These documents were further refined based on the Web of Science categories, document type, citation topic meso, and specified time frame. Following this, a thorough review of the titles and abstracts from a collection of articles relevant to the theme of the potential of eye-tracking in behavioural decision-making was done. Articles not addressing this specific criterion were excluded. This process refined the pool to 255 documents, which were then utilized for the analysis. The entire document selection methodology is depicted in Figure 1. To ensure accurate analysis of textual data using machine learning techniques, a series of preprocessing steps were implemented (Werner de Vargas et al., 2023). These steps involved converting all text to lowercase, filtering out numbers, and removing punctuation. The data was then tokenized to separate phrases into individual words. Unigram tokenization was used as it has greater predictive potential compared to the bigram and trigram models at low-level representation (Ojo et al., 2021). Following this, a combination of commonly recognized English stop words according to academic literature, as well as specific stop words established for this study, were eliminated. Then stemming was applied, which reduced the words to their root form. Finally, lemmatization—emphasizing nouns, verbs, adjectives, and adverbs was used to reduce data dimensionality while maintaining the core of the material.

2.2 Bibliometric Analysis

The evaluation of behavioural decision-making using eye-tracking literature was conducted using bibliometric analysis through R programming by the “Biblioshiny ()” application. Bibliometric analysis is a quantitative method that helps us get the literature's statistical data. It is an unbiased method of review as it is based on review protocol and analytical techniques as compared to other methods of literature review (Thangavel & Chandra, 2023). This technique, renowned for its efficacy in various academic fields, including business studies, allows for an in-depth examination of trends, conceptual frameworks, and transformative

insights within the realm of academic literature (Kumar et al., 2021). Research streams their evolution and the relationship among researchers, institutions, countries, and articles can be known from this analysis. Performance analysis, along with science mapping, is used in this study for the analysis. Performance analysis gives knowledge regarding the contributions of research elements, and science mapping provides information regarding relationships between research elements (Vanhala et al., 2020). This study provides insights regarding descriptive information, annual scientific production, most relevant sources, most productive countries by the corresponding authors, top ten most cited institutions, most relevant authors with articles & citations, and most frequently occurring keywords, which will be valuable for future researchers in the field of behavioural decision-making. We discuss these insights in detail in the results and findings section.

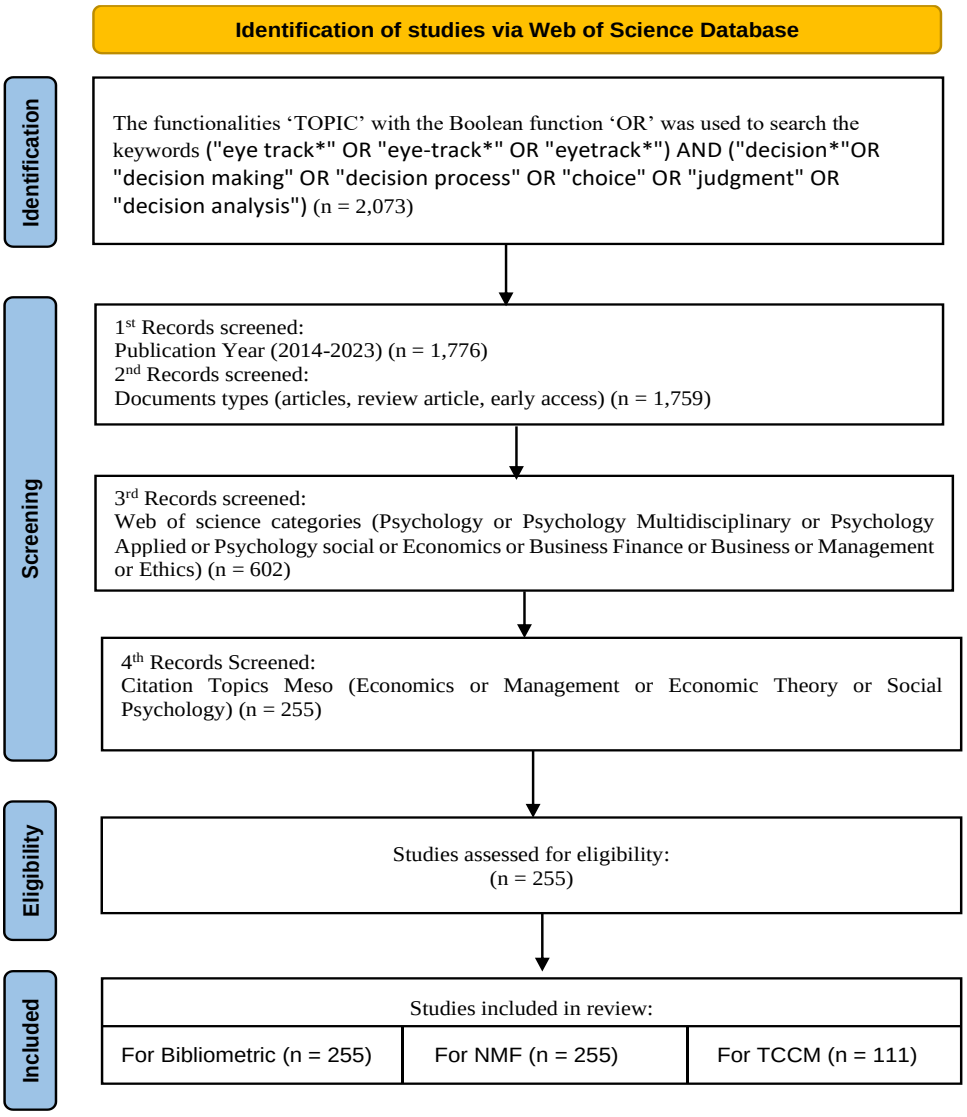


Figure 1. PRISMA Flow Diagram

Source: The Authors.

2.3 Non-negative Matrix Factorisation(NMF) Analysis

Non-negative Matrix Factorization, a machine learning tool used for dimensionality reduction and feature extraction from text data. NMF reduces a non-negative matrix, i.e. Term-document matrix(V) into a low-dimensional matrix, i.e., the basic matrix (W) and the coefficient matrix (H). Where matrix 'W' is basic vectors or topics (words-topics matrix) and matrix 'H' is the coefficient or weights of each topic for each document (topics-documents matrix). 'V' is the original matrix (words-documents matrix) which breaks down the corpus into W & H (Kim & Park, 2008). Cao et al. (2023) suggested that this technique is based on linear algebra, so factorisation is accomplished by minimising the Frobenius norm of the variance between the original matrix and its approximated product. After breaking down the original matrix 'V' into column matrix 'W' and row matrix 'H', W discovers topics and V discovers the topic distributions for each document. As the name suggests, all elements in each matrix are non-negative. The mathematical function is:

$$V \approx WH$$

NMF is a valuable tool of topic modeling used to extract essential themes and patterns from the dataset. By breaking down the data into different components, NMF enables the identification of crucial themes and shifts within the literature (W.-S. Chen et al., 2023). Topics are created by grouping words with higher coherence. This technique is particularly useful for clustering similar topics and highlighting emerging trends, ultimately illuminating the conceptual framework and paradigm changes in the field.

2.4 TCCM Analysis

This comprehensive framework includes a thorough review of literature by focussing on theory development (T), context (C), characteristics (C), and methodology (M) employed. According to Paul et al. (2023), the TCCM technique is a useful tool for summarizing the information, identifying potential gaps in the literature, and suggesting potential directions for further study. This framework clarifies the theoretical and empirical aspects of the research domain by addressing the shortcomings of conventional systematic reviews. By highlighting the significance of TCCM, this analysis makes space for investigating the less explored or under-researched regions. It is therefore a helpful tool that ensures a full understanding of a specific research field.

3. Results and Findings

3.1 Bibliometric Analysis

3.1.1 Descriptive Analysis

Table 1. depicts 255 documents used for this study, out of which 245 are articles and 10 are review papers and these documents are published in 111 different research outlets from 2014 to 2023. The average document life is 4.84 years and the average citation per article is 17.39. The total number of keywords plus an author's keywords are 839 and 865 and the co-authors per document is 3.57. These are the main information which is shown in the below table.

Table 1. Main Information

Description	Results
Timespan	2014:2023
Sources (Journals, Books, etc)	111
Total Documents	255
Documents Average life	4.84
Articles	245
Review	10
Average citations per article	17.39
References	11463
Keywords Plus (ID)	839
Author's Keywords (DE)	865
Authors	656
Single-authored docs	11
Co-Authors per document	3.57

3.1.2. Performance Analysis

A performance analysis was conducted through R programming to know the contribution of research elements such as articles, researchers, countries, journals, and institutions. This analysis is performed to answer our first research question.

3.1.2.1 Publication trends

Publication trend determines the researcher's interest and development tendency in a research field. Figure 2. elucidates the year-wise publication trend of research articles in eye-tracking and behavioural decision-making from 2014- 2023. The number of articles published in 2014 can be seen to be 10, with a slight increase to 15 in 2015, while a sudden increase to 35 can be seen in 2016. A slight dip can be observed in the year 2017 with 17 publications. A further rise in publications can be seen in 2018 and 2019 with 28 and 22 publications respectively. In 2020, it further increased to 35 and has been stable to 31 publications from 2021 to 2023.

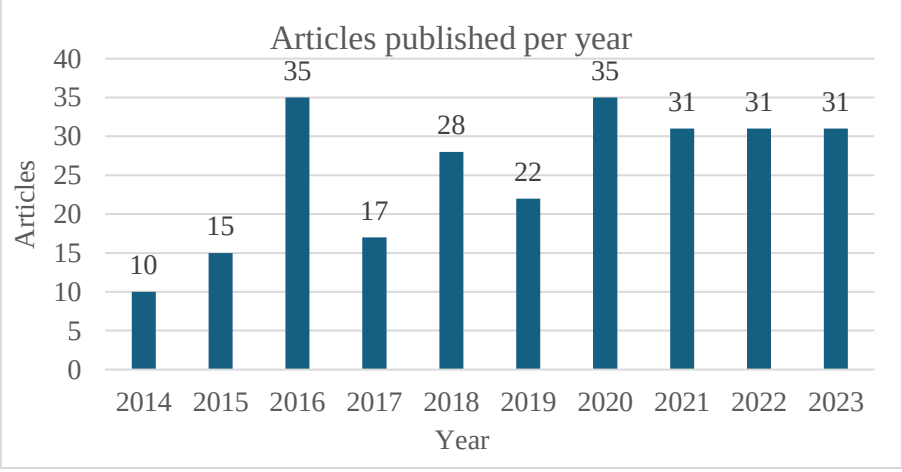


Figure 2. Publication trend

3.1.2.2 Most Productive Journals

Table 2. presents the top ten most influential journals with the number of articles published and h-index, in the area of behavioural decision-making. The Journal of Behavioural Decision-making is at the leading position with 22 articles, followed by Frontiers in Psychology which published 17 articles. The Journal of Business Research published 16 articles and has the highest h-index of 236 among all the journals. The h-index shows the quality and relative success of a journal and it also strengthens the journal's ranking (Bihari et al., 2023). This reveals the increasing importance of eye-tracking and behavioural decision-making in different domains.

Table 2. Most relevant sources

Sources	**Articles**	**h-index**
Journal of Behavioural Decision-making	22	87
Frontiers in Psychology	17	157
Journal of Business Research	16	236
Judgment and Decision-making	11	68
Journal of Retailing and Consumer Services	10	120
Journal of Marketing Research	8	192
Journal of Choice Modeling	7	35
Games and Economic Behaviour	5	102
Journal of Neuroscience, Psychology, and Economic	5	28
Behavioural Sciences	4	39

3.1.2.3 Most Influential Countries

Table 3. describes the top 10 productive countries with the number of articles published by single country production (SCP) and multiple countries production (MCP) along with frequency and multiple countries production ratio (MCP ratio). The MCP ratio indicates international collaboration in the research field. The USA published 56 articles in which it alone published 39 articles and 17 articles along with other countries. China ranks second with 34 articles, comprising 26 SCP and 8 MCP articles. Germany follows with 28 articles, including 13 SCP and 15 MCP articles, indicating a higher number of research papers resulting from international collaborations, which contributes to the high MCP ratio of 0.53. Figure 3. graphically represents the top 10 cited countries. The top three are the United States with 1217 citations followed by the United Kingdom (493), and Germany (400).

Table 3. Most productive countries by the corresponding author

Country	Articles	SCP	MCP	Freq	MCP ratio
USA	56	39	17	0.20	0.30
China	34	26	8	0.13	0.24
Germany	28	13	15	0.11	0.54
United Kingdom	25	12	13	0.10	0.52
Italy	16	8	8	0.06	0.5
Switzerland	10	3	7	0.04	0.7
Spain	9	7	2	0.04	0.22
Sweden	9	2	7	0.04	0.78
Netherland	8	2	6	0.03	0.75
Canada	7	5	2	0.03	0.29

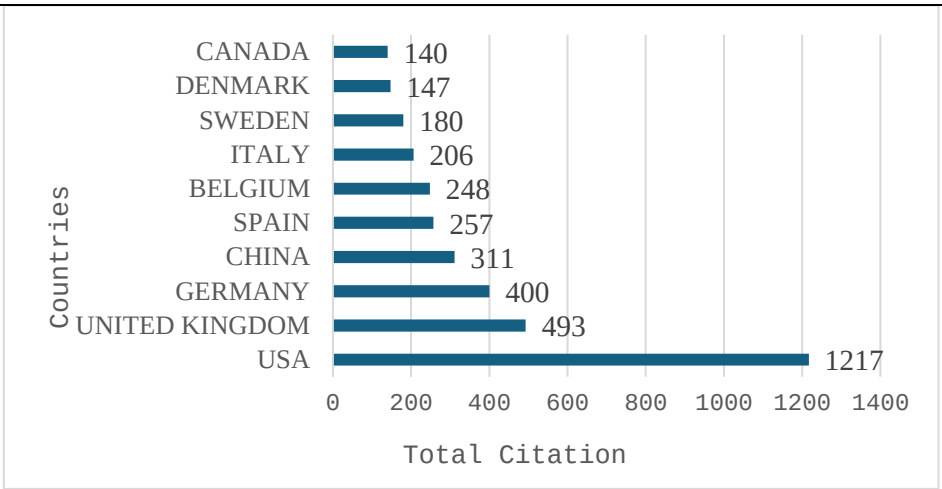


Figure 3. Top 10 most cited countries

3.1.2.4 Most Productive Institutions

Figure 4. elucidates the top 10 institutions in the field of behavioural decision-making. University of Florida and Manchester is the most productive institution with 21 articles each. These universities are investing more time and resources in research. University of Konstanz published 20 articles, followed by Michigan State University (15). Karlstad University, Nankai University, Bern University, and the University of Pennsylvania published 13 articles by each country. The University of Amsterdam and the University of Trento published 12 articles.

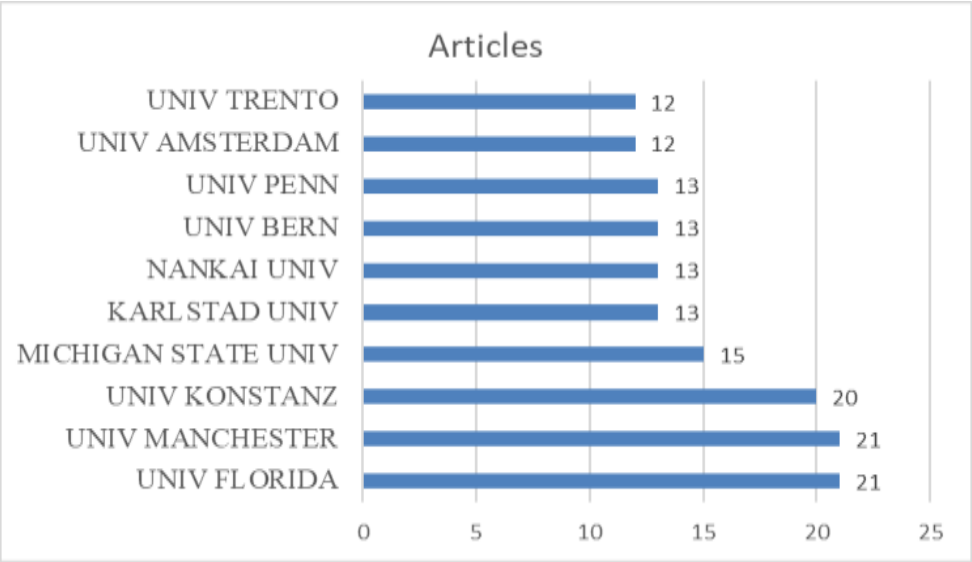


Figure 4. Top 10 most productive Institutions

3.1.2.5 Most Influential Authors

Table 4. represents the top 10 authors with the number of articles published related to the current area of research and the most cited papers and total citations in the field of behavioural decision-making by the authors. Michal Krol is the author with the maximum number of articles, while Bridget K. Behe is the author who had the maximum citations followed by Luca Polonio.

Table 4. Most relevant authors with articles and citation

Authors	**Articles**	**Most cited papers**	**Total citation**
Krol M	7	"A novel approach to studying strategic decisions with eye-tracking and machine learning"	16
Hausfeld J	5	"Tracing risky decisions for oneself and others: The role of intuition and deliberation"	20
Polonio L	5	"Strategic sophistication and attention in games: An eye-tracking study"	60
Behe BK	4	"The effect of involvement on visual attention and product choice"	91
Fiedler S	4	"I can see it in your eyes": Biased Processing and Increased Arousal in Dishonest Responses	32
Grebitus C	4	"The Impact of Brand and Attention on Consumers' Willingness to Pay: Evidence from an Eye-tracking Experiment"	21
Jaudas A	4	"Attentional shifts and preference reversals: An eye-tracking study"	10

Khachatryan H	4	"Consumer preferences for organic production methods and origin promotions on ornamental plants: evidence from eye-tracking experiments"	43
Liu HZ	4	"Visual attention and time preference reversals"	7
Meissner M	4	"Eye-Tracking-Based Classification of Information Search Behaviour using Machine Learning: Evidence from Experiments in Physical Shops and Virtual Reality Shopping Environments"	44

3.1.3 Science Mapping

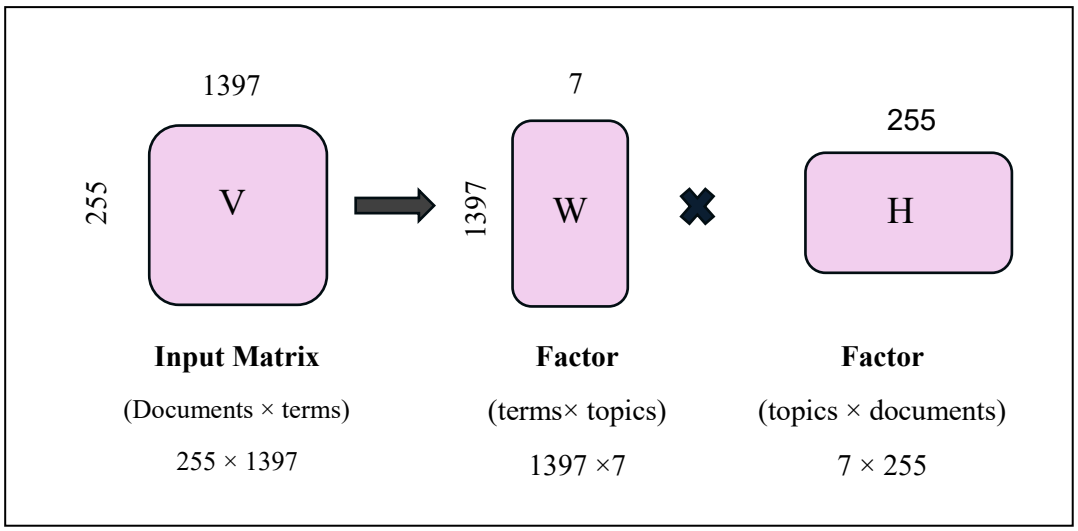
Science Mapping examines the relationship and patterns within the existing body of literature (Bhandari, 2024) which will be valuable for future researchers interested in examining the role of eye-tracking in behavioural decision-making. One of the techniques of science mapping is co-word analysis, the author's keywords and keyword plus are analysed to discover the most frequently occurring words related to this field (Das et al., 2023). Table 5. describe the most frequently occurring keywords. The top words in the area of behavioural decision-making are the word 'choice' which occurred 83 times, followed by 'information' which occurred 70 times, 'attention' 62 times, 'eye-tracking' 59 times, and so on. These words are important terms in this field.

Table 5. Most Frequently occurred keywords

Keywords	Occurrences	Keywords	Occurrences
choice	83	Impact	29
information	70	eye-movements	27
attention	62	movements	24
eye-tracking	59	willingness-to-pay	21
decision-making	49	preferences	19
model	44	Brand	18
visual attention	37	decision	18
behaviour	31	consumer choice	17
Search	31	memory	17
eye-tracking	59	perception	15

3.2 NMF (Non-negative Matrix Factorization) analysis

We used the Non-negative Factorisation(NMF) method to address research questions 2 and 3. According to (Egger & Yu, 2022) NMF is a non-probabilistic, decomposition method that uses matrix factorisationand is a member of the linear-algebraic algorithm family. NMF operates on TF-IDF converted data by splitting down a matrix into two lower-ranking matrices. In particular, TF-IDF is a measure used to assess a word's significance over a set of documents(J. Wang & Zhang, 2023). As illustrated in Figure 5. NMF breaks down its input, which is a term-document matrix V in which the number of documents (255) and the number of unique words or terms (1397) are converted into a term-topics matrix W, and the topics-documents matrix H. Matrix W contains the basis vectors and H contains the corresponding weights.



3.2.1Topic Identification

This section describes each of the seven topics extracted from documents in detail using the scikit-learn function of Python. To achieve this, we examined the phrases extracted from the articles' titles and abstracts. We then used NMF to weigh the correlation of terms across the topics, and the terms for each topic are displayed in table 7. Keywords furnished by the author are too included in this study in addition to the title and abstract to disclose further insights per topic. To help illustrate the content of topics in further detail Table 7. offers a comprehensive summary of the high-frequency keywords about each topic. Word clouds depicted in figure 6. are generated by extracting the top words along with their weights from the topic-term matrix, providing a clear overview of the most relevant terms within each topic. To give a brief, understandable summary of the contents for each of the seven topics, we have examined the top important terms and keywords in the sections that are described below:

Table 7. Topic Label

Topic Number	Theme	Top 10 words
1	Decision-making	['maker', 'estim', 'discret', 'motiv', 'probabl', 'lotteri', 'nonattend', 'attend', 'ce', 'ignor', 'condit', 'heurist', 'riski', 'dce', 'ana']
2	Advertisement	['tv', 'imag', 'platform', 'semant', 'attitud', 'label', 'viewer', 'luxuri', 'messag', 'divid', 'eye', 'content', 'user', 'ad', 'advertis']
3	Purchasing Behaviour and Pricing	['lower', 'versu', 'firm', 'plant', 'end', 'label', 'numer', 'final', 'total', 'buy', 'perceiv', 'unit', 'purchas_intent', 'volum', 'price']
4	Social perception and Judgments	['stimulus', 'social', 'decoy', 'bodi', 'rate', 'woman', 'human', 'unattract', 'sexual', 'masculin', 'femal', 'judgment', 'facial', 'face', 'attract']
5	Game Theory	['domin', 'competit', 'rule', 'acquisit', 'cluster', 'belief', 'learn', 'lookup', 'play', 'social', 'player', 'equilibrium', 'strateg', 'payoff', 'game']
6	Brand Perception and Consumer Behaviour	['label', 'assort', 'percept', 'virtual', 'emot', 'premium', 'stimulus', 'sale', 'shop', 'custom', 'categori', 'packag', 'wtp', 'store', 'brand']
7	Framing Effect	['valuat', 'text', 'gain', 'loss', 'content', 'purchas_intent', 'valenc', 'shop', 'perceiv', 'page', 'element', 'help', 'neg', 'frame', 'review']

In the following section, we are using the complete set of the top ten words generated through NMF (Non-negative Matrix Factorization) for simplicity and ease of analysis.

Topic 1: Decision-making

Topic 1 labeled as decision-making encompasses the top words like maker, estimate, discrete, motive, probably, lottery, nonattendance, attendance, choice experiment, ignored, conditions, heuristic, risk, discrete choice experiment, and attribute non-attendance related to making choice or decision. Research on decision-making examines the behavioural dynamics and cognitive processes of making choices, whether individuals or groups make the decision. Recent research regarding decision-making suggests that the influence of decoy effects in decision-making can be mitigated by increasing the number of alternatives in choice sets. Particularly, more alternatives lead to decreased attention to information and a shift towards simpler decision-making strategies (Stanley & Wedell, 2024). Moreover, information visualization enhances decision quality and speed, but its effects on decision confidence are mixed and influenced by user and task characteristics (Eberhard, 2023). The multidisciplinary study of decision-making incorporates elements from public policy, psychology, economics,

and medicine. Decision-making also includes behavioural decision-making like sound investment decisions as well as behavioural biases or illogical conduct in decision-making that are collectively generated by heuristic bias, framing effect, cognitive illusions, and herd mentality aspects (G, 2024).

Topic 2: Advertisement

This topic contains the words 'television', 'image', 'platform', 'semantic', 'attitude', 'label', 'viewer', 'luxury', 'message', 'divide', 'eye', 'content', 'user', 'ad', 'advertise'. In the field of advertisement, we see recent research related to the Affective Computational Advertising (ACAD) framework taking into account the emotional content of ads to maximize ad memory and provide accurate ad assessments (Narayana et al., 2023). Digital advertising preferences can be built through interactive advertising, opt-in advertising, social media networks, search engine advertising, and mobile advertising, and are related to consumer behaviour through brand awareness (Wong et al., 2024). Further, this topic also concerns research on how the high visual salience of products in influencer advertising can mitigate the negative effects of ad recognition by enhancing user attention and acceptance (Brüns & Meißner, 2023).

Topic 3: Purchasing behaviour and pricing

This topic is formed by the terms like 'lower', 'versus', 'firm', 'plant', 'end', 'label', 'number', 'final', 'total', 'buy', 'perceive', 'unit', 'purchase intention', 'volume', 'price' primarily related to pricing strategies and purchasing behaviour of the consumer. Price i.e. often perceived as an indicator of product quality and is a key factor in the purchasing decision (Hustic & Gregurec, 2015). Recent findings in this topic suggest that consumer purchase decisions can be influenced by creating a control-effort trade-off, where increased feelings of control without perceived effort enhance pricing outcomes (Wang et al., 2021). Furthermore, Lim & Kim (2022) found that unmindfulness significantly influences impulse buying behaviours in online shopping.

Topic 4: Social Perception and Judgment

This topic consists of words like 'stimulus', 'social', 'decoy', 'body', 'rate', 'women', 'human', 'unattractive', 'sexual', 'masculine', 'female', 'judgment', 'facial', 'face', 'attractive. This involves analyzing and interpreting social information influenced by factors such as moral judgments, stereotypes, facial appearance, body language, and gender. A recent study has examined how face-voice gender consistency affects the assessment of impressions, revealing a preference for those who exhibit consistency in both gender and the impact of gender information on the assessment of warmth and competence (Wen et al., 2023). Hester & Hehman in 2023, applied the valence-dominance model of face perception and found that first impressions, particularly social judgments, are often based on appearance. Research has indicated that certain visual features that reflect embedded stereotypes such as the idea that unattractive faces are connected to characteristics like incapacity and unreliability are the primary drivers of social class judgments (Pillai et al., 2017).

Topic 5: Game theory

This topic encompasses words which are 'dominance', 'competition', 'rule', 'acquisition', 'cluster', 'belief', 'learn', 'lookup', 'play', 'social', 'player', 'equilibrium', 'strategic', 'payoff', 'game'. Game theory gives an arithmetical design to carry strategic analysis alongside optimal

decision-making under conflicting and behavioural uncertainty which is crucial for understanding modern economics offering approaches for solving intricate strategic dilemmas in numerous human activities (Mayiwar et al., 2024). Recent research has explained a model of game-theoretic decision-making for power grid homes that optimizes the spatial-temporal distribution of energy resources (Bhatia et al., 2023). Game theory is connected to psychology via incorporating intellectual characteristics, theories of limits on iterated thinking alongside arithmetical premises of how individual players learn and influence one another (Arisdakessian et al., 2023).

Topic 6: Brand perception and consumer behaviour

This topic incorporates words like 'label', 'assort', 'perception', 'virtual', 'emotions', 'premium', 'stimulus', 'sale', 'shop', 'customer', 'category', 'package', 'willingness to pay (wtp)', 'store', 'brand'. Recent findings in this area suggest that information and communication technologies are used to study consumer behaviour in the process of brand management, focusing on social networks' contribution to a high level of personalization (Yahelska et al., 2023). Moreover, perceived contingency in social media brand chatbots increases consumer engagement and also results in better consumer-brand relationships through gratifications of information-seeking social interaction, and entertainment (Lin & Wu, 2023). Liakou-Zarda & Tzafilkou in 2024 find that mouse tracking can effectively assess consumer emotions, brand awareness, and purchase intent during gamified marketing campaigns.

Topic 7: Framing Effect

Contains the words 'valuation', 'text', 'gain', 'loss', 'content', 'Purchase intention', 'valence', 'shop', 'perceived', 'pages', 'elements', 'help', 'negative', 'frame', 'reviews'. Framing i.e. presentation of information influences choices and decisions by incorporating the perception of reality frequently impacted by how options are presented in terms of gains or losses. This topic includes recent research related to the framing effect influencing decision-making significantly can lead to preference reversals (Kühberger, 2023). Individual differences and quantifier characteristics play a moderating role in the effectiveness of framing, indicating that judgments are influenced by both rational and experiential processing when framing effects are present (Holford et al., 2022).

Topic 1: Decision-making

Topic 2: Advertisement

Topic 3: Purchasing Behaviour and pricing

Topic 4: Social perception and judgment

Topic 5 Game Theory

Topic 6 Brand Perception consume behaviour

Topic 7 Framing Effect

Figure 6. Word cloud of ten emerging research topics in behavioural decision-making.

3.2.2 Topic Occurrence Analysis

The topic occurrence analysis has been performed through Python packages (NumPy and Matplotlib) which is shown by a bar plot, showing how frequently the seven topics appear in the corpus as a result of Non-negative Matrix Factorisation(NMF). A topic is represented by each bar, and the height of the bar indicates how frequently the topic appears in the documents. Higher bars indicate topics that are more prevalent or prominent in the corpus, while lower bars suggest topics that occur less frequently (George & Vasudevan, 2021). In Figure 7. Topic 1 has

the highest occurrence count, shortly followed by topic 6, and then we see topics 2,5, and 7 also to be topics that occur quite frequently. However, topics 3 and 4 particularly in this analysis are found to be the least frequently occurring in our study. However, all the topics still are found to have occurrences more than 40 times. The visualization provides information on the thematic composition of the corpus by highlighting themes that are frequently discussed or depicted within the documents.

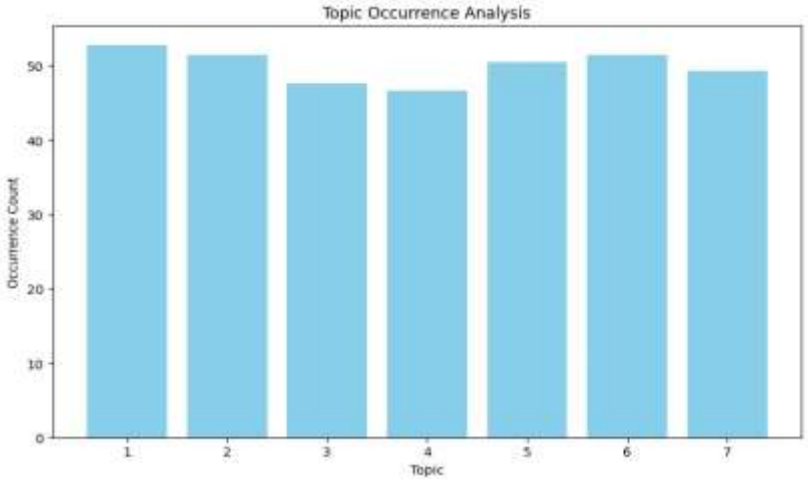


Figure 7. Topic Occurrence Analysis

3.2.3 Cosine Similarity matrix

The cosine similarity matrix presented in Table 6. provides a measure of similarity between two topics based on their vector representations in a high-dimensional space(Zhu & Cunningham, 2022). Each cell in the matrix shows the cosine similarity score between two topics, with values ranging from 0 to 1. When a score is 1 it shows perfect similarity, which means that topics are identical, whereas a score of 0 denotes no resemblance. Higher values show a greater resemblance between the corresponding topics, which suggests that they have similar themes or concepts. On the other hand, lower scores indicate dissimilarity, indicating that the themes are not the same. In Table 6. we can see that topics 1 and 6 have the maximum cosine value which indicates that topic 1 which is decision-making and topic 6 which is brand perception and consumer behaviour have the maximum similarities and topics 3 and 5 which is purchasing behaviour and pricing, and game theory has the minimum cosine scores. Through an analysis of the cosine similarity matrix, researchers can gain enhanced insight into the relationships and connections among the topics within the corpus.

Table 6. Topic Cosine Similarity

	Topic1	**Topic2**	**Topic3**	**Topic4**	**Topic5**	**Topic6**	**Topic7**
Topic1	1.000000						
Topic2	0.906293	1.000000					

Topic3	0.700000	0.672411	1.000000				
Topic4	0.900000	0.906293	0.833333	1.000000			
Topic5	0.908025	0.714006	0.657536	0.688847	1.000000		
Topic6	0.930949	0.816497	0.895144	0.895144	0.908108	1.000000	
Topic7	0.759072	0.786796	0.897085	0.777844	0.777844	0.889499	1.000000

3.2.4 Trending topics

Figure 8. displays the popularity trend of topics from 2014 to 2023 through a line graph. Here, the x-axis depicts the year of publication while the y-axis displays the number of publications. A lot of variabilities can be seen in the popularity of the topics over the years. Despite the ups and downs, the number of publications is consistently higher for the topic of decision-making as compared to other topics. However, steady growth can be seen for topics 2 (advertisement), topic 4(social perception and judgment), and topic 7(framing effect) over the years.

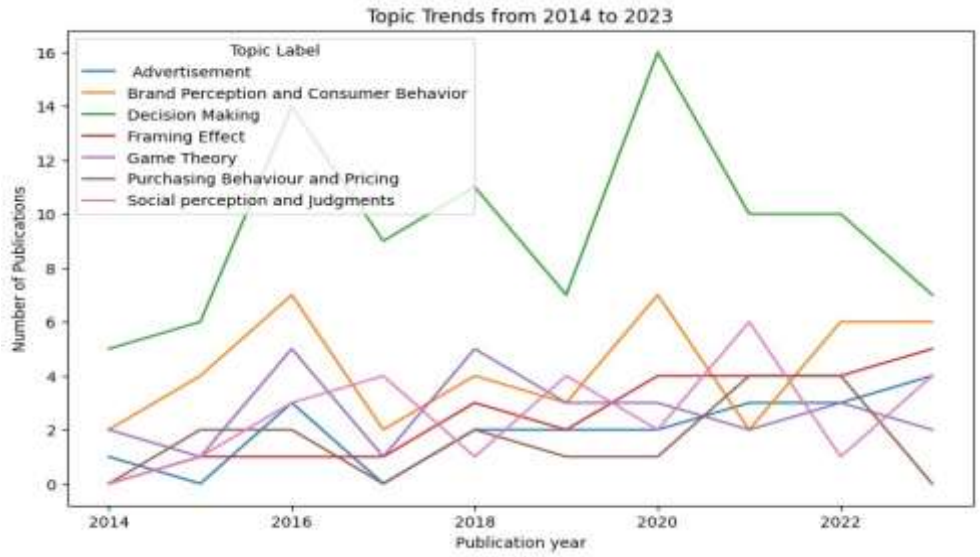


Figure 8. The topic trend from 2014 to 2023

3.3 TCCM Analysis

The TCCM incorporates a systematic review of eye-tracking and behavioural decision-making literature. In this section, we highlight the gaps put forward in the previous work on the topics in the form of theory, context, characteristics, and methodology, along with the research agenda for future advancements in the field. A total of 111 documents out of 255 are selected for this analysis which belongs to Q1, A*, and A category journals. The most popular "theories" are summed up in the first section of this paper's study. The second section evaluates the "contexts" in the different countries and industries that were considered in the previous study. The "characteristics" connected to behavioural decision-making are examined in the third part. The fourth section discusses the "methodologies" that earlier researchers have used to explain the decision-making process.

3.3.1 Theories

Numerous theories and frameworks can be used with behavioural decision-making research to characterize the phenomenon accurately. The influential theories in the context of behavioural decision-making literature being scrutinized in this review are important for further developments in the respective domain. Bounded rationality theory has been widely used to study the subject domain where decisions are taken in complex or risky choice situations, dynamic discrete choice model, and attribute non-attendance (ANA) in stated-choice experiments (e.g., Bansal et al., 2024). This theory focuses on rational decision-making considering the decision maker's cognitive constraints, including knowledge and computational capability restrictions where individuals or decision makers select a decision that is satisfactory rather than optimal. The second most used theory i.e. dual process and information evaluation theory states moral judgments and decision-making are the result of two competing processes: a quick, automatic, affect-driven process, effortless and a long, deliberative, reason-based process, which is also called system 1 and system 2 model (e.g., Fadel et al., 2015). This theory is widely used in behavioural decision-making processes in the form of a heuristic-systematic processing model, examining how consumers assess product pages and reviews using heuristic and systematic clues. The next most popular theory is the satisficing theory which challenges the conventional assumption of homo economicus in microeconomic theory. According to this theory, people frequently settle for an option that satisfies their desire level (satisficing), in contrast to looking for the best alternative (maximizing utility) in stated choice experiments (e.g., Sandorf & Campbell, 2019). Next, we have the Consumer choice theory which examines consumers' spending patterns by making use of limited resources such as time and money to fulfill their needs and desires (e.g., Bigné et al., 2016). Apart from this, several other theories like cognitive dissonance theory (e.g., Lutz et al., 2023), self-control theory (e.g., Radon et al., 2021), schema congruity theory (e.g., Luan et al., 2016), signaling theory (e.g., Mou & Shin, 2018), cumulative prospect theory (e.g., Ouyang & Jia, 2022), fuzzy trace theory (Bigne et al., 2020), affective reflective theory (e.g., Timme et al., 2023), theory of intuitive generosity(e.g., Recalde et al., 2018) also guide the work in the behavioural decision-making.

3.3.2 Context

In terms of context, we examine and evaluate industries and countries that have contributed to eye-tracking and behavioural decision-making research. This domain has been recognized as a major process for achieving multifaceted results in different disciplines. With systematic review, it has been noted that most of studies were conducted in retail industry (e.g., Bigné et al., 2016; Juárez-Varón et al., 2023), e-commerce industry (e.g., T. Chen et al., 2022), tourism and hospitality industry (e.g., Bigne et al., 2020), apparel industry (e.g., Menon et al., 2016), psychology, financial market (e.g., Borozan et al., 2022), decision neuroscience (e.g., e.g., Wei et al., 2022), behavioural economics and policy simulation (e.g., Ribeiro et al., 2023) and in context of business and organisation (e.g., Y. Chen et al., 2016). On the other hand, the majority of research studies were carried out in the context of developed nations like the United States (USA), China, Germany, Australia, the United Kingdom (UK), and Spain. These findings indicate that more industries need to be investigated in further research studies. Therefore, to address the gap in the literature, more attention needs to be paid in the context of developing countries.

3.3.3 Characteristics

The majority of the existing literature concentrates on identifying the most important characteristics in the field to boost relationship-building research. The identified traits have been employed as antecedents or results of behavioural decision-making in a different discipline of knowledge. Many research studies have identified a range of variables related to business and organisation, like choice presentation, feedback reception, physiological response, budget size, self-efficacy, framing effect, cognitive biases, decision error, manager focus, information search behaviour, time pressure, superior compensation structure, political orientation, nationality, and decision time and accuracy (e.g., Amasino et al., 2023; Roberts et al., 2022). Other variables related to marketing such as purchase intention, consumer purchasing behaviour, customer attitude, consumer preference, and choice, consumer perception about the products, consumer involvement and engagement, product attributes, pricing, actual sale, atmosphere effects of the store environment, willingness to pay (WTP), online reviews, display cues, brand choice, and customer satisfaction (e.g., Grebitus & Van Loo, 2022; Johnson et al., 2022). Further studies can make use of these variables in their subject area as per research requirements as independent, dependent, moderating, and mediating variables.

3.3.4 Methodology

In this section, we evaluated 111 articles in terms of methodology and statistical techniques applied to determine the key connections in behavioural decision-making research. The most widely used methodology includes mixed method approach where eye-tracking combined with different methodologies such as field data analysis, laboratory experiments, e-survey, mouse tracking, online experimental, store experiment, electrocardiography (ECG), electroencephalogram (EEG), choice-based conjoint experiment, video-based job interview and simulations (e.g., Radon et al., 2021; Bigne et al., 2020; Lutz et al., 2023). For statistical analysis like qualitative comparative analysis (QCA), network analysis, diffusion analysis, correlation, chi-square tests, logistic regression and machine learning techniques like artificial neural network, random forest, and support vector machine (SVM) have also been performed (e.g., Amasino et al., 2023; Ouyang & Jia, 2022; Pfeiffer et al., 2020). Future researchers are encouraged to use experimental research in their studies.

4. Discussion

Through the performance analysis, we have identified the top journals, countries, institutions, and authors. The top two countries contributing to this field of research are the USA and China, the top two journals being “The Journal of Behavioural Decision-making” and “Frontiers in Psychology”. The top institutions are the University of Florida and Manchester with 21 articles each. The most relevant authors in this field are Michal Krol and Jan Hausfeld. Science mapping helps to identify the domain’s most used keywords which can help interested researchers in effectively exploring this field. The top keywords are choice, information, attention, and eye-tracking. NMF provides the seven themes related to this area. Given the nature of the seven identified topics, we see that most of the work so far using eye-tracking technology focuses either on consumer behaviour or biases and heuristics in behavioural decision-making. In consumer behaviour, we see words like advertisement, pricing, buying,

willingness to pay, packaging, brand perception, etc used. In heuristics and biases, we see an important word like attribute non-attendance, discrete choice experiment, and risky decision having great applicability in the current scenario. Delving deeper we can see that the framing effect, a decision-making heuristic, emerges as a separate distinct theme implying the high applicability of eye-tracking technology in the framing effect. Even in topic of social perception and judgment biases emerged. In game theory words like probability, competition, payoff, strategies etc all are related to risky decision-making which serves as important area for future research.

Finally, TCCM analysis also helps to highlight some potential research gaps. We have seen that many theories have been used in the study of behavioural decision-making and eye-tracking, among them bounded rationality theory is used most widely used. In terms of context, it has been seen that most of the studies were conducted in the retail and e-commerce industry with the majority of work related to this area being performed in developed countries like the USA, China, and Germany. Most of the variables used are related to marketing areas like consumer preference, perception, and pricing, and other variables like cognitive biases, time effect, and decision error. The most widely used methodology includes mixed methods where eye-tracking is combined with other different methodologies like field data analysis, laboratory experiments, e-survey, mouse tracking, online experimental, electrocardiography (ECG), electroencephalogram (EEG), and video-based job interviews. The results of this study highlight the importance of eye-tracking in behavioural decision-making research and would help future researchers conduct research in this area using different contexts and considering different developing countries.

5. Future research and Implication

The current review paper highlights some potential areas of future research in the field of eye-tracking studies and behavioural decision-making. Following the results of both bibliometric analysis (RQ1) and topic models (RQ2), future research could investigate eye-tracking in combination with a particular heuristic or cognitive bias, e.g., anchoring, confirmation bias, or availability heuristic, to determine their influence on decision-making during the real-time (e.g., concerning the hiring process, negotiation, consumer decision-making). Also, the convergence of eye-tracking with newer domains such as recruitment and public-policy, and in particular in developing economies (such as India - RQ4) has not been adequately explored.

In terms of methodology (RQ3), blending the eye-tracking methodology with other neuromarketing applications, like EEG or fMRI, could be useful in the future, due to the ability to present a more profound, multidimensional picture of visual attention, emotional arousal, and decision effort. Another area of research that should be touched upon concerns how theoretical models (i.e., dual-process theory, bounded rationality, and out of control information) could be proven empirically based on eye-tracking data, thereby leading to theory development within the field of decision-making. The researchers must also examine how theoretical frameworks such as dual-process theory, bounded rationality, information overload etc. could be proven empirically based on eye-tracking data, thereby aiding in refinement of theory in decision-making.

Managerial implications are also derived in the findings of this review. For example, knowing the framing effects via the gaze behaviour can enable marketers in creating more convincing advertising and pricing messages. Themes such as visual content optimization, consumer attention, and brand perception can help to make strategic placements of product information online or in the store. Themes such as visual content optimization, consumer attention, and brand perception can guide intelligent positioning of product details either on the internet or in the retail setting. In human resource, eye-tracking can be used in recruitment and performance appraisal to detect any form of bias in the process, allowing fairer and evidence-based judgment. In addition, visual analytics can also be used by managers to streamline user interfaces, e-commerce layouts, and digital branding approaches to improve customer interaction and build loyalty. To conclude, eye-tracking and behavioural decision-making have extended significance to marketing, HR, consumer research, and public policies. The multidisciplinary and methodologically heterogeneous approach to further research will not only enhance our knowledge about cognitive processes but also lead to better results in strategic decision-making not only within the academic sphere but also in real-world environments.

6. Conclusion

This study aimed to structurally and systematically analyse the literature on eye-tracking and behavioural decision-making using the hybrid review method, combining the bibliometric analysis and TCCM framework along with NMF for topic modeling of 255 documents ranging from 2014 to 2023, offering a comprehensive overview of behavioural decision-making research using eye-tracking. Seven themes have been identified in the last 10 years, which indicate that eye-tracking technology finds high applicability in these areas.

Looking at the increasing trends of most of these themes, it can be said that the future of eye-tracking technology in behavioural decision-making is bright with enormous opportunity.

Our findings are limited to the WoS database and are influenced by the keywords we used. Therefore, there are some drawbacks to this study. First, only publications from the WoS database and JCR Q1 and ABDC A* and A journals were examined and summarised. Also, the scope of this research is confined to the integration of eye-tracking in behavioural decision-making. Moreover, although a systematic approach could be provided by the bibliometric studies, they should be complemented with in-depth qualitative content analysis for a deeper understanding. This review focuses on published research results and does not contain ongoing or unpublished research. Despite limitations, this study provides insight into the structure and development of behavioural decision-making using eye-tracking as well as recommendations for future research.

We anticipate that behavioural decision-making will be a more interdisciplinary field of research in the academic and practical fields due to the development of eye-tracking technology. This paper offers a wide and detailed insight into the possibilities of eye-tracking in the behavioural-decision-making research. It not only offers insights into decision-making processes but also covers all necessary fundamental information for its implementation. We expect that our conversation and research agenda will intensify and encourage more researchers to conduct studies on behavioural decision-making using eye-tracking in the future.

References

Ahn, J.-H., Bae, Y.-S., Ju, J., & Oh, W. (2018). Attention Adjustment, Renewal, and Equilibrium Seeking in Online Search: An Eye-Tracking Approach. *Journal of Management Information Systems*, *35*(4), 1218–1250. https://doi.org/10.1080/07421222.2018.1523595

Amasino, D. R., Dolgin, J., & Huettel, S. A. (2023). Eyes on the account size: Interactions between attention and budget in consumer choice. *Journal of Economic Psychology*, *97*, 102632. https://doi.org/10.1016/j.joep.2023.102632

Arisdakessian, S., Wahab, O. A., Mourad, A., Otrok, H., & Guizani, M. (2023). A Survey on IoT Intrusion Detection: Federated Learning, Game Theory, Social Psychology, and Explainable AI as Future Directions. *IEEE Internet of Things Journal*, *10*(5), 4059–4092. IEEE Internet of Things Journal. https://doi.org/10.1109/JIOT.2022.3203249

Ashby, N. J., Johnson, J. G., Krajbich, I., & Wedel, M. (2016). *Applications and innovations of eye-movement research in judgment and decision making.* https://psycnet.apa.org/record/2016-18541-003

Bansal, P., Kim, E.-J., & Ozdemir, S. (2024). Discrete choice experiments with eye-tracking: How far we have come and ways forward. *Journal of Choice Modelling*, *51*, 100478. https://doi.org/10.1016/j.jocm.2024.100478

Bhandari, A. (2024). Demystifying Organisation Success: A Bibliometric Analysis and Future Research Agenda. *FIIB Business Review*, 23197145231216861. https://doi.org/10.1177/23197145231216861

Bhatia, M., Ahanger, T. A., & Alqahtani, A. (2023). Game-Theoretic Decision Making for Intelligent Power Consumption Analysis. *IEEE Internet of Things Journal*, *10*(9), 7537–7544. IEEE Internet of Things Journal. https://doi.org/10.1109/JIOT.2022.3218576

Bigne, E., Chatzipanagiotou, K., & Ruiz, C. (2020). Pictorial content, sequence of conflicting online reviews and consumer decision-making: The stimulus-organism-response model revisited. *Journal of Business Research*, *115*, 403–416. https://doi.org/10.1016/j.jbusres.2019.11.031

Bigné, E., Llinares, C., & Torrecilla, C. (2016). Elapsed time on first buying triggers brand choices within a category: A virtual reality-based study. *Journal of Business Research*, *69*(4), 1423–1427. https://doi.org/10.1016/j.jbusres.2015.10.119

Bihari, A., Tripathi, S., & Deepak, A. (2023). A review on h-index and its alternative indices. *Journal of Information Science*, *49*(3), 624–665. https://doi.org/10.1177/01655515211014478

Bogomolova, S., Oppewal, H., Cohen, J., & Yao, J. (2020). How the layout of a unit price label affects eye-movements and product choice: An eye-tracking investigation. *Journal of Business Research*, *111*, 102–116. https://doi.org/10.1016/j.jbusres.2018.10.049

Bonilla-Chaves, E. F., & Palos-Sánchez, P. R. (2023). Exploring the evolution of human resource analytics: A bibliometric study. *Behavioural Sciences*, *13*(3), 244.

Borozan, M., Loreta, C., & Riccardo, P. (2022). Eye-tracking for the study of financial decision-making: A systematic review of the literature. *Journal of Behavioural and Experimental Finance*, *35*, 100702. https://doi.org/10.1016/j.jbef.2022.100702

Brüns, J. D., & Meißner, M. (2023). Show me that you are advertising: Visual salience of products attenuates detrimental effects of persuasion knowledge activation in influencer advertising. *Computers in Human Behaviour*, *148*, 107891. https://doi.org/10.1016/j.chb.2023.107891

Cao, S., He, S., Li, Z., & Wang, Z. (2023). Extreme Ratio Between Spectral and Frobenius Norms of Nonnegative Tensors. *SIAM Journal on Matrix Analysis and Applications*, *44*(2), 919–944. https://doi.org/10.1137/22M1502951

Chen, T., Samaranayake, P., Cen, X., Qi, M., & Lan, Y.-C. (2022). The Impact of Online Reviews on Consumers' Purchasing Decisions: Evidence From an Eye-Tracking Study. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.865702

Chen, W.-S., Xie, K., Liu, R., & Pan, B. (2023). Symmetric nonnegative matrix factorization: A systematic review. *Neurocomputing*, 126721.

Chen, Y., Jermias, J., & Panggabean, T. (2016). The Role of Visual Attention in the Managerial Judgment of Balanced-Scorecard Performance Evaluation: Insights from Using an Eye-Tracking Device. *Journal of Accounting Research*, *54*(1), 113–146. https://doi.org/10.1111/1475-679X.12102

Das, K., Patel, J. D., Sharma, A., & Shukla, Y. (2023). Creativity in marketing: Examining the intellectual structure using scientometric analysis and topic modeling. *Journal of Business Research*, *154*, 113384. https://doi.org/10.1016/j.jbusres.2022.113384de

Eberhard, K. (2023). The effects of visualization on judgment and decision-making: A systematic literature review. *Management Review Quarterly*, *73*(1), 167–214. https://doi.org/10.1007/s11301-021-00235-8

Egger, R., & Yu, J. (2022). A Topic Modeling Comparison Between LDA, NMF, Top2Vec, and BERTopic to Demystify Twitter Posts. *Frontiers in Sociology*, *7*. https://doi.org/10.3389/fsoc.2022.886498

Fadel, K. J., Meservy, T. O., & Jensen, M. L. (2015). Exploring Knowledge Filtering Processes in Electronic Networks of Practice. *Journal of Management Information Systems*, *31*(4), 158–181. https://doi.org/10.1080/07421222.2014.1001262

G, S. (2024). Impact of Financial Literacy and Behavioural Biases on Investment Decision-making. *FIIB Business Review*, *13*(1), 72–86. https://doi.org/10.1177/23197145211035481

Grebitus, C., & Van Loo, E. J. (2022). Relationship between cognitive and affective processes, and willingness to pay for pesticide-free and GMO-free labeling. *Agricultural Economics*, *53*(3), 407–421. https://doi.org/10.1111/agec.12701

Holford, D. L., Juanchich, M., & Sirota, M. (2022). Characteristics of quantifiers moderate the framing effect. *Journal of Behavioural Decision Making*, *35*(1), e2251. https://doi.org/10.1002/bdm.2251

Hu, M., Chang, R., Sui, X., & Gao, M. (2024). Attention biases the process of risky decision-making: Evidence from eye-tracking. *PsyCh Journal*, *13*(2), 157–165. https://doi.org/10.1002/pchj.724

Hustic, I., & Gregurec, I. (2015). The influence of price on customer's purchase decision. *Central European Conference on Information and Intelligent Systems*, 27. https://search.proquest.com/openview/35c02f049666b27237b5bb3ac034618b/1?pq-origsite=gscholar&cbl=1986354

Johnson, R. L., Nambiar, D., & Suman, G. (2022). Using eye-movements to assess underlying factors in online purchasing behaviours. *International Journal of Consumer Studies*, *46*(4), 1365–1380. https://doi.org/10.1111/ijcs.12762

Kim, J., & Park, H. (2008). Toward faster nonnegative matrix factorization: A new algorithm and comparisons. *2008 Eighth IEEE International Conference on Data Mining*, 353–362. https://doi.org/10.1109/ICDM.2008.149

Korteling, J., & Paradies, G. L. (2023). Cognitive bias and how to improve sustainable decision making. *Frontiers in Psychology*, *14*, 1129835. https://doi.org/10.3389/fpsyg.2023.1129835

Kühberger, A. (2023). A SYSTEMATIC REVIEW OF RISKY-CHOICE FRAMING EFFECTS. *EXCLI Journal*, *22*, 1012–1031. Scopus. https://doi.org/10.17179/excli2023-6169

Kumar, S., Lim, W. M., Pandey, N., & Christopher Westland, J. (2021). 20 years of Electronic Commerce Research. *Electronic Commerce Research*, *21*(1), 1–40. https://doi.org/10.1007/s10660-021-09464-1

Lim, S. H., & Kim, D. J. (2022). The effect of unmindfulness on impulse purchasing behaviours in the context of online shopping from a classical attitude theory perspective. *Behaviour & Information Technology*, *41*(16), 3432–3449. https://doi.org/10.1080/0144929X.2021.1996630

Lin, J.-S. (Elaine), & Wu, L. (2023). Examining the psychological process of developing consumer-brand relationships through strategic use of social media brand chatbots. *Computers in Human Behaviour*, *140*, 107488. https://doi.org/10.1016/j.chb.2022.107488

Luan, J., Yao, Z., Zhao, F., & Liu, H. (2016). Search product and experience product online reviews: An eye-tracking study on consumers' review search behaviour. *Computers in Human Behaviour*, *65*, 420–430. https://doi.org/10.1016/j.chb.2016.08.037

Lutz, B., Adam, M. T. P., Feuerriegel, S., Pröllochs, N., & Neumann, D. (2023). Affective Information Processing of Fake News: Evidence from NeuroIS. *European Journal of Information Systems*, *0*(0), 1–20. https://doi.org/10.1080/0960085X.2023.2224973

Mayiwar, L., Hærem, T., & Løhre, E. (2024). Self-Distancing Regulates the Effect of Incidental Anger (vs. Fear) on Affective Decision-Making Under Uncertainty. *Journal of Behavioural Decision Making*, *37*(2), e2378. https://doi.org/10.1002/bdm.2378

Meißner, M., & Oll, J. (2019). The Promise of Eye-Tracking Methodology in Organisational Research: A Taxonomy, Review, and Future Avenues. *Organisational Research Methods*, *22*(2), 590–617. https://doi.org/10.1177/1094428117744882

Menon, R. G. V., Sigurdsson, V., Larsen, N. M., Fagerstrøm, A., & Foxall, G. R. (2016). Consumer attention to price in social commerce: Eye tracking patterns in retail clothing. *Journal of Business Research*, *69*(11), 5008–5013. https://doi.org/10.1016/j.jbusres.2016.04.072

Mou, J., & Shin, D. (2018). Effects of social popularity and time scarcity on online consumer behaviour regarding smart healthcare products: An eye-tracking approach. *Computers in Human Behaviour*, *78*, 74–89. https://doi.org/10.1016/j.chb.2017.08.049

Narayana, S., Jain, S., Katti, H., Goecke, R., & Subramanian, R. (2023). Affective computational advertising based on perceptual metrics. In *Affective Computing in Healthcare: Applications based on biosignals and artificial intelligence* (pp. 4–1).

IOP Publishing Bristol, UK. https://iopscience.iop.org/book/edit/978-0-7503-5182-9/chapter/bk978-0-7503-5182-9ch4

Ojo, O. E., Gelbukh, A., Calvo, H., & Adebanji, O. O. (2021). Performance Study of N-grams in the Analysis of Sentiments. *Journal of the Nigerian Society of Physical Sciences*, 477–483. https://doi.org/10.46481/jnsps.2021.201

Ouyang, J., & Jia, Y. (2022). The Presence of a Visual Dividing Line Increases Consumer Memory Through Attention Grabbing. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.848471

Paul, J., Khatri, P., & Kaur Duggal, H. (2023). Frameworks for developing impactful systematic literature reviews and theory building: What, Why and How? *Journal of Decision Systems*, 1–14. https://doi.org/10.1080/12460125.2023.2197700

Pfeiffer, J., Pfeiffer, T., Meißner, M., & Weiß, E. (2020). Eye-Tracking-Based Classification of Information Search Behaviour Using Machine Learning: Evidence from Experiments in Physical Shops and Virtual Reality Shopping Environments. *Information Systems Research*, *31*(3), 675–691. https://doi.org/10.1287/isre.2019.0907

Pillai, K. G., Hodgkinson, G. P., Kalyanaram, G., & Nair, S. R. (2017). The Negative Effects of Social Capital in Organisations: A Review and Extension. *International Journal of Management Reviews*, *19*(1), 97–124. https://doi.org/10.1111/ijmr.12085

Radon, A., Brannon, D. C., & Reardon, J. (2021). Ketchup with your fries? Utilizing complementary product displays to transfer attention to a focal product. *Journal of Retailing and Consumer Services*, *58*, 102339. https://doi.org/10.1016/j.jretconser.2020.102339

Recalde, M. P., Riedl, A., & Vesterlund, L. (2018). Error-prone inference from response time: The case of intuitive generosity in public-good games. *Journal of Public Economics*, *160*, 132–147. https://doi.org/10.1016/j.jpubeco.2018.02.010

Ribeiro, M., Avoyan, A., Schotter, A., Schotter, E., Vaziri, M., & Zou, M. (2023). Planned vs. Actual Attention. *Management Science*. https://doi.org/10.1287/mnsc.2023.4834

Roberts, I. D., Teoh, Y. Y., & Hutcherson, C. A. (2022). Time to Pay Attention? Information Search Explains Amplified Framing Effects Under Time Pressure. *Psychological Science*, *33*(1), 90–104. https://doi.org/10.1177/09567976211026983

Rumpf, C., & Breuer, C. (2018). Focus on Brand Choice: Assessing the Behavioural Response to Sponsorship-Linked Communication. *Journal of Sport Management*, *32*(6), 531–541. https://doi.org/10.1123/jsm.2017-0294

Sandorf, E. D., & Campbell, D. (2019). Accommodating satisficing behaviour in stated choice experiments. *European Review of Agricultural Economics*, *46*(1), 133–162. https://doi.org/10.1093/erae/jby021

Stanley, J. M., & Wedell, D. H. (2024). Impact of choice set complexity on decoy effects. *Journal of Behavioural Decision Making*, *37*(2), e2373. https://doi.org/10.1002/bdm.2373

Thakral, P., Srivastava, P. R., Dash, S. S., Jasimuddin, S. M., & Zhang, Z. (2023). Trends in the thematic landscape of HR analytics research: A structural topic modeling approach. *Management Decision*, *61*(12), 3665–3690.

Thangavel, P., & Chandra, B. (2023). *Two Decades of M-Commerce Consumer Research: A Bibliometric Analysis Using R Biblioshiny. Sustainability 2023, 15, 11835*. https://www.academia.edu/download/105311010/pdf.pdf

Timme, S., Brand, R., & Raboldt, M. (2023). Exercise or not? An empirical illustration of the role of behavioural alternatives in exercise motivation and resulting theoretical considerations. *Frontiers in Psychology*, *14*. https://doi.org/10.3389/fpsyg.2023.1049356

Totzek, D., & Jurgensen, G. (2021). Many a little makes a mickle: Why do consumers negatively react to sequential price disclosure? *Psychology & Marketing*, *38*(1), 113–128. https://doi.org/10.1002/mar.21426

Vanhala, M., Lu, C., Peltonen, J., Sundqvist, S., Nummenmaa, J., & Järvelin, K. (2020). The usage of large data sets in online consumer behaviour: A bibliometric and computational text-mining–driven analysis of previous research. *Journal of Business Research*, *106*, 46–59. https://doi.org/10.1016/j.jbusres.2019.09.009

Wang, C. X., Beck, J. T., & Yuan, H. (2021). The Control–Effort Trade-Off in Participative Pricing: How Easing Pricing Decisions Enhances Purchase Outcomes. *Journal of Marketing*, *85*(5), 145–160. https://doi.org/10.1177/0022242921990351

Wang, J., & Zhang, X.-L. (2023). Deep NMF topic modeling. *Neurocomputing*, *515*, 157–173. https://doi.org/10.1016/j.neucom.2022.10.002

Wedel, M., Pieters, R., & van der Lans, R. (2023). Modeling Eye Movements During Decision Making: A Review. *Psychometrika*, *88*(2), 697–729. https://doi.org/10.1007/s11336-022-09876-4

Wen, F., Gao, J., Ke, W., Zuo, B., Dai, Y., Ju, Y., & Long, J. (2023). The Effect of Face–Voice Gender Consistency on Impression Evaluation. *Archives of Sexual Behaviour*, *52*(3), 1123–1139. https://doi.org/10.1007/s10508-022-02524-z

Werner de Vargas, V., Schneider Aranda, J. A., Dos Santos Costa, R., Da Silva Pereira, P. R., & Victória Barbosa, J. L. (2023). Imbalanced data preprocessing techniques for machine learning: A systematic mapping study. *Knowledge and Information Systems*, *65*(1), 31–57. https://doi.org/10.1007/s10115-022-01772-8

Wong, K. H., Chang, H. H., Lin, Y.-H., & Lin, S. Y. (2024). How do mobile app users react to embedded advertising? A perspective from psychological reactance theory. *Behaviour & Information Technology*, *0*(0), 1–18. https://doi.org/10.1080/0144929X.2024.2359644

Yahelska, K., Vasylyshyna, L., & Shkurov, Y. (2023). DEVELOPMENT OF INFORMATION AND COMMUNICATION TECHNOLOGIES TO STUDY CONSUMER BEHAVIOUR IN THE PROCESS OF BRAND MANAGEMENT. *Eastern-European Journal of Enterprise Technologies*, *3*(13(123)), Article 13(123). Scopus. https://doi.org/10.15587/1729-4061.2023.279615

Yang, L. (Cathy), Toubia, O., & De Jong, M. G. (2015). A Bounded Rationality Model of Information Search and Choice in Preference Measurement. *Journal of Marketing Research*, *52*(2), 166–183. https://doi.org/10.1509/jmr.13.0288

Yegoryan, N., Guhl, D., & Klapper, D. (2020). Inferring attribute non-attendance using eye tracking in choice-based conjoint analysis. *Journal of Business Research*, *111*, 290–304. https://doi.org/10.1016/j.jbusres.2019.01.061

Yu, J., Droulers, O., & Lacoste-Badie, S. (2022). Why display motion on packaging? The effect of implied motion on consumer behaviour. *Journal of Retailing and Consumer Services*, *64*, 102840. https://doi.org/10.1016/j.jretconser.2021.102840

Zhu, L., & Cunningham, S. W. (2022). Unveiling the knowledge structure of *technological forecasting and social change* (1969–2020) through an NMF-based hierarchical topic model. *Technological Forecasting and Social Change*, *174*, 121277. https://doi.org/10.1016/j.techfore.2021.121277