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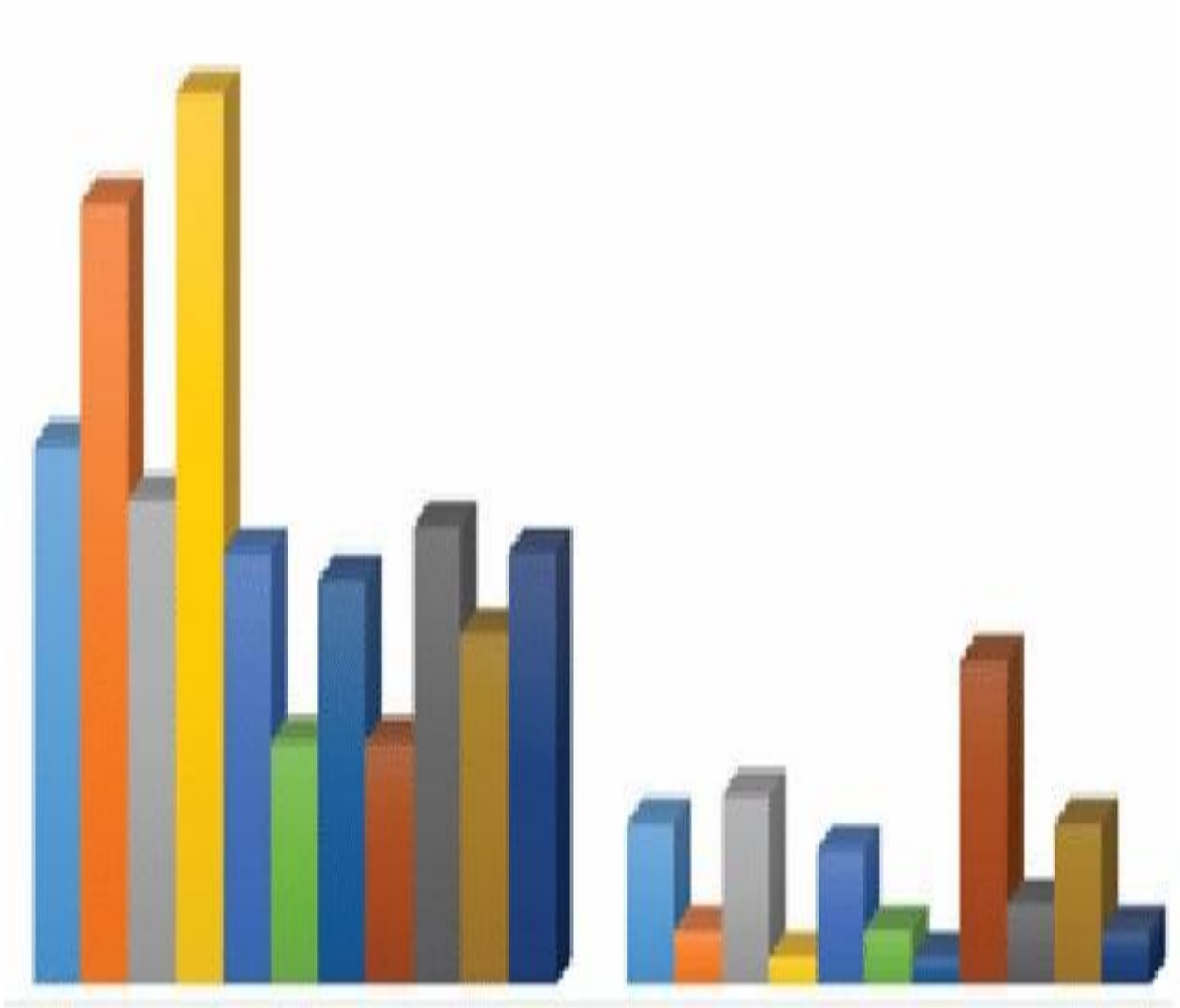

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Research Article

User Experiences of Eco-Infographics: An Interpretive Study of Audience Interaction

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ABSTRACT

Eco-infographics have emerged as influential tools for communicating complex environmental information in visually engaging and accessible formats. This study investigates user experiences of eco-infographics through an interpretive qualitative approach based on secondary data, including academic literature, case studies, and user-generated digital content. Grounded in visual communication theory, cognitive load theory, and environmental psychology, the research examines how users perceive, interpret, and emotionally respond to eco-infographics, and how these experiences influence behavioural intentions. The findings reveal that clarity, visual hierarchy, and narrative coherence significantly enhance comprehension, while poorly structured designs increase cognitive load and hinder engagement. Emotional responses, particularly a balance between concern and hope, play a critical role in motivating pro-environmental attitudes. Additionally, cultural and contextual factors shape interpretation, highlighting the need for localised and inclusive design strategies. Although eco-infographics can effectively foster awareness and encourage behavioural change, their impact is constrained by issues such as information overload, lack of credibility cues, and user scepticism. The study contributes to environmental communication scholarship by offering a comprehensive framework for understanding audience interaction and provides practical insights for designing more effective sustainability-oriented visual content.

Keywords: eco-infographics, visual communication, user experience, cognitive load, environmental psychology, audience engagement, sustainability communication

1. Introduction

The contemporary world is increasingly confronted with complex environmental challenges, including climate change, biodiversity loss, deforestation, and pollution. These issues are not only scientifically intricate but also socially and politically contested, requiring effective communication strategies that can bridge the gap between expert knowledge and public understanding. Traditional modes of environmental communication-primarily text-heavy reports and scientific publications-often fail to engage broader audiences due to their technical language and cognitive demands (Moser, 2010). In response, visual communication tools such as eco-infographics have gained prominence as accessible and persuasive mediums for disseminating environmental information.

Eco-infographics, defined as visually structured representations of environmental data and narratives, combine elements of graphic design, data visualisation, and storytelling to convey complex information in simplified formats (Smiciklas, 2012). These infographics are widely used across digital platforms, educational contexts, advocacy campaigns, and governmental communication strategies. Their popularity stems from their ability to capture attention, enhance comprehension, and facilitate memory retention through the integration of text and visuals (Lester, 2013). In an era characterised by information overload and shrinking attention spans, eco-infographics offer a compelling solution for communicating sustainability-related issues effectively.

The rise of digital media ecosystems has further amplified the relevance of eco-infographics. Social media platforms, websites, and mobile applications prioritise visually engaging content, making infographics particularly suitable for rapid dissemination and user engagement. Research indicates that visual content is significantly more likely to be shared and remembered than textual content, thereby increasing its potential impact on public awareness and behaviour (Berger & Milkman, 2012). In the context of environmental communication, this capacity for virality can play a crucial role in mobilising collective action and fostering pro-environmental attitudes.

Despite their widespread use, the effectiveness of eco-infographics is not uniform. User experiences vary depending on several factors, including design quality, cultural context, prior knowledge, and emotional resonance. While some infographics successfully simplify complex information and inspire action, others may overwhelm users with excessive data or fail to convey meaningful insights (Mayer, 2009). This variability underscores the importance of understanding how users interact with eco-infographics and how these interactions shape their perceptions and behaviours.

User experience (UX) is a critical dimension in this regard. UX encompasses the cognitive, emotional, and behavioural responses of users when interacting with a visual artefact (Norman, 2013). In the case of

eco-infographics, UX involves not only the comprehension of information but also the emotional engagement and motivational impact of the content. For instance, an infographic that effectively communicates the urgency of climate change may evoke concern and prompt behavioural change, whereas a poorly designed one may lead to confusion or disengagement.

Furthermore, the interpretation of eco-infographics is influenced by cognitive processes such as attention, perception, and memory. Cognitive Load Theory (Sweller, 1988) suggests that individuals have limited cognitive capacity for processing information, and excessive complexity can hinder learning and comprehension. Eco-infographics must therefore strike a balance between informational richness and cognitive simplicity to ensure effective communication. Visual hierarchy, colour coding, and spatial organisation are among the design elements that can facilitate cognitive processing and enhance user understanding (Ware, 2012).

Emotional engagement also plays a pivotal role in shaping user experiences. Environmental issues often evoke strong emotions, including fear, anxiety, hope, and empathy. These emotional responses can influence attitudes and behaviours, making them a key consideration in infographic design (Nabi et al., 2018). However, the relationship between emotion and engagement is complex. While moderate emotional arousal can enhance attention and motivation, excessive negative emotions may lead to avoidance or denial (O'Neill & Nicholson-Cole, 2009). Thus, eco-infographics must carefully balance emotional appeal with informational accuracy.

Another important dimension is cultural and contextual relevance. Eco-infographics are often designed for global audiences, but cultural differences in visual literacy, symbolism, and environmental priorities can affect how they are interpreted. For example, colour meanings and iconography may vary across cultures, leading to potential misinterpretations. Understanding these contextual factors is essential for designing inclusive and effective communication tools.

Given these considerations, there is a need for a comprehensive examination of user experiences with eco-infographics. While existing studies have explored design principles and effectiveness metrics, relatively few have adopted an interpretive approach that focuses on how users perceive, interpret, and emotionally engage with these visual artefacts. This study addresses this gap by employing a qualitative interpretive methodology based on secondary data sources.

The primary aim of this research is to explore the multifaceted experiences of users interacting with eco-infographics. Specifically, it seeks to understand how design elements influence perception, how cognitive and emotional processes shape interpretation, and how these experiences translate into awareness and behavioural intentions. By integrating insights from visual communication theory, cognitive psychology, and environmental psychology, the study provides a holistic understanding of eco-infographic effectiveness.

The significance of this research lies in its potential to inform the design and dissemination of eco-infographics in various contexts, including education, policy communication, and environmental advocacy. By identifying the factors that enhance or hinder user engagement, the study contributes to the development of more effective communication strategies that can support sustainability goals.

2. Literature Review

Eco-infographics have emerged as a vital component of contemporary environmental communication strategies. They serve as a bridge between complex scientific data and public understanding, translating abstract concepts into visually accessible formats. According to Tufte (2001), effective data visualisation should maximise data density while minimising cognitive strain. Eco-infographics extend this principle by incorporating narrative elements that contextualise environmental issues, making them more relatable and actionable.

Environmental communication scholars emphasise the importance of framing in shaping public perception. Moser (2010) argues that the way environmental information is presented can significantly influence how it is understood and acted upon. Eco-infographics, with their ability to integrate visuals and narratives, are particularly effective in framing environmental issues in ways that resonate with audiences. For instance, infographics that highlight local impacts of climate change may be more effective than those presenting global statistics.

Moreover, eco-infographics are increasingly used in digital advocacy campaigns, where their shareability enhances their reach and impact. Berger and Milkman (2012) found that visually engaging content is more likely to be shared on social media, amplifying its influence. This characteristic makes eco-infographics a powerful tool for raising awareness and mobilising collective action.

2.1 Visual Communication and Perception

Visual communication plays a central role in shaping user experiences of eco-infographics. Lester (2013) notes that humans process visual information more quickly than text, making visuals an efficient means of communication. Gestalt principles, such as proximity, similarity, and closure, influence how users perceive and organise visual elements (Ware, 2012). These principles are essential for creating coherent and intuitive infographic designs.

Research in information visualisation highlights the importance of visual hierarchy in guiding user attention. Elements such as size, colour, and positioning can be used to emphasise key information and create a logical flow. Poorly designed infographics that lack a clear hierarchy may lead to confusion and misinterpretation.

Additionally, the concept of visual literacy is critical in understanding user interaction with eco-infographics. Visual literacy refers to the ability to interpret and make meaning from visual information. Users with higher levels of visual literacy are better equipped to understand complex infographics, while those with lower levels may struggle. This

variability underscores the need for inclusive design practices that accommodate diverse audiences.

2.2 Cognitive Load and Information Processing

Cognitive Load Theory (Sweller, 1988) provides a framework for analysing how users process information in eco-infographics. The theory distinguishes between intrinsic, extraneous, and germane cognitive load. Intrinsic load relates to the complexity of the information, while extraneous load is influenced by the design of the material. Germane load refers to the cognitive effort invested in learning.

Effective eco-infographics aim to reduce extraneous cognitive load by presenting information in clear and organised formats. Mayer's (2009) principles of multimedia learning, such as coherence, signalling, and redundancy, are particularly relevant in this context. For example, removing unnecessary details and highlighting key information can enhance comprehension.

However, poorly designed infographics can increase cognitive load, leading to cognitive overload and reduced understanding. This is particularly problematic in environmental communication, where the complexity of the subject matter is already high. Designers must therefore carefully consider the balance between information richness and simplicity.

2.3 Emotional Engagement and Persuasion

Emotional engagement is a key factor in the effectiveness of eco-infographics. Nabi et al. (2018) argue that emotions can mediate the relationship between information exposure and behavioural outcomes. Eco-infographics often use imagery, colour, and narrative elements to evoke emotions such as fear, hope, and empathy.

Berger and Milkman (2012) found that emotionally arousing content is more likely to be shared, suggesting that emotion plays a role in the dissemination of information. In environmental contexts, fear-based messages can highlight the urgency of issues, while hope-based messages can motivate action.

However, the use of emotion must be carefully managed. O'Neill and Nicholson-Cole (2009) found that excessive fear can lead to disengagement or denial, particularly when individuals feel powerless to act. Therefore, eco-infographics should aim to balance emotional appeal with actionable information.

2.4 User Experience and Interaction

User experience (UX) encompasses the overall interaction between users and eco-infographics, including usability, satisfaction, and emotional response (Norman, 2013). UX research highlights the importance of user-centred design, which involves understanding the needs, preferences, and limitations of users.

In the context of eco-infographics, UX is influenced by factors such as readability, navigation, and interactivity. Interactive infographics, which allow users to explore data dynamically, can enhance engagement and learning. However, they also require higher levels of digital literacy.

Studies have shown that positive user experiences are associated with increased engagement and information retention. Conversely, negative experiences, such as confusion or frustration, can hinder learning and reduce the likelihood of behavioural change.

2.5 Cultural and Contextual Factors

Cultural and contextual factors play a significant role in shaping user experiences of eco-infographics. Visual symbols, colours, and narratives may have different meanings across cultures, affecting interpretation. For example, colours associated with environmental themes in one culture may not have the same connotations in another.

Moreover, environmental priorities vary across regions, influencing how information is perceived. Infographics that address locally relevant issues are more likely to resonate with audiences. This highlights the importance of contextualising environmental communication.

3. Theoretical Framework

This study adopts an integrative theoretical framework that combines Visual Communication Theory, Cognitive Load Theory, and Environmental Psychology to examine user experiences of eco-infographics. These complementary perspectives enable a multidimensional understanding of how users perceive, interpret, and respond to visually mediated environmental information.

3.1 Visual Communication Theory

Visual Communication Theory posits that meaning is constructed through visual elements such as images, symbols, typography, colour, and spatial organisation. Unlike textual communication, which is processed sequentially, visual communication is processed holistically and rapidly, allowing users to grasp complex information more efficiently (Lester, 2013). In the context of eco-infographics, visual communication plays a central role in translating scientific data into accessible and engaging representations.

A key concept within this theory is semiotics, which examines how signs and symbols convey meaning. Eco-infographics rely heavily on symbolic representations-such as icons for recycling, emissions, or biodiversity-that must be interpreted correctly by users. The effectiveness of these symbols depends on their cultural familiarity and contextual relevance (Ware, 2012). Misinterpretation can occur when symbols are ambiguous or culturally specific, thereby limiting the communicative impact of the infographic.

Another important dimension is visual hierarchy, which refers to the arrangement of elements in a way that guides user attention. Designers use size, contrast, colour, and positioning to emphasise key information and create a logical flow (Tufte, 2001). In eco-infographics, visual hierarchy is crucial for directing users toward the most important environmental messages, such as statistics on climate change or actionable recommendations.

Furthermore, Gestalt principles-including proximity, similarity, closure, and continuity-provide insights into how users organise visual information. These principles suggest that users perceive visual elements as part of a unified whole rather than as isolated components (Ware, 2012). Effective eco-infographics leverage these principles to enhance coherence and readability, thereby improving user comprehension.

3.2 Cognitive Load Theory

Cognitive Load Theory (CLT), developed by Sweller (1988), provides a framework for understanding how users process information and the limitations of human cognitive capacity. According to CLT, working memory has a finite capacity, and excessive cognitive demands can hinder learning and comprehension. This is particularly relevant for eco-infographics, which often present complex and data-rich content.

CLT distinguishes between three types of cognitive load:

- **Intrinsic load**, which is determined by the complexity of the information itself;
- **Extraneous load**, which arises from the way information is presented;
- **Germane load**, which refers to the cognitive effort devoted to constructing meaningful understanding (Sweller, 1988).

In eco-infographic design, minimising extraneous cognitive load is essential for enhancing user experience. Poor design choices-such as cluttered layouts, excessive text, or inconsistent visual elements-can increase extraneous load and impede comprehension. Conversely, well-structured visuals that use clear labelling, logical sequencing, and appropriate spacing can reduce cognitive burden and facilitate learning.

Mayer's (2009) Multimedia Learning Theory, which builds upon CLT, introduces principles such as coherence, signalling, redundancy, and spatial contiguity. These principles are highly relevant to eco-infographics. For example, the coherence principle suggests that unnecessary information should be removed to prevent distraction, while the signalling principle emphasises the use of cues to highlight important information. Applying these principles can significantly improve the effectiveness of eco-infographics.

Moreover, the concept of dual coding-the simultaneous processing of verbal and visual information-further supports the use of infographics in environmental communication. By engaging both visual and verbal channels, eco-infographics can enhance memory retention and comprehension (Mayer, 2009). However, this dual processing must be carefully managed to avoid cognitive overload.

3.3 Environmental Psychology

Environmental Psychology provides a theoretical lens for understanding how individuals perceive and respond to environmental information. It examines the interplay between cognitive, emotional, and behavioural processes in shaping environmental attitudes and actions (Gifford, 2014). In the context of eco-infographics, this perspective is essential for analysing how

visual communication influences user engagement and pro-environmental behaviour.

One key concept in environmental psychology is risk perception, which refers to how individuals interpret and respond to environmental threats. Eco-infographics often aim to communicate risks associated with issues such as climate change or pollution. However, risk perception is influenced by factors such as personal experience, cultural values, and trust in information sources (Moser, 2010). Infographics that fail to align with users' perceptions may be less effective in conveying urgency.

Another important dimension is emotional engagement. Emotions such as fear, hope, guilt, and empathy play a significant role in shaping environmental attitudes (Nabi et al., 2018). Eco-infographics frequently use visual and narrative elements to evoke emotional responses, which can enhance attention and motivation. However, as noted by O'Neill and Nicholson-Cole (2009), excessive reliance on fear-based messaging can lead to disengagement or denial. Therefore, a balanced emotional approach is necessary to sustain user engagement.

Environmental psychology also emphasises the role of behavioural intention and actionability. Information alone is often insufficient to drive behaviour change; users must perceive that they have the ability and opportunity to act (Gifford, 2014). Eco-infographics that include clear calls to action, such as reducing energy consumption or supporting conservation efforts, are more likely to influence behaviour.

3.4 Integrated Framework

By integrating Visual Communication Theory, Cognitive Load Theory, and Environmental Psychology, this study provides a comprehensive framework for analysing user experiences of eco-infographics. Visual Communication Theory explains how design elements shape perception; Cognitive Load Theory elucidates how users process information; and Environmental Psychology highlights the emotional and behavioural implications of communication.

This integrative approach allows for a nuanced understanding of eco-infographic effectiveness, recognising that user experience is not solely determined by design or content but by the interaction between cognitive, emotional, and contextual factors. The framework thus serves as a foundation for interpreting the findings of this study and for informing the design of more effective eco-infographics.

4. Methodology

This study employs a qualitative interpretive research design to explore user experiences of eco-infographics. The interpretive paradigm is grounded in the assumption that reality is socially constructed and that meaning emerges through interaction and interpretation (Creswell & Poth, 2018). This approach is particularly suitable for examining subjective experiences, such as how users perceive and respond to visual communication.

Unlike positivist approaches that seek to measure objective outcomes, interpretive

research focuses on understanding the meanings that individuals assign to phenomena. In the context of this study, the goal is not to quantify the effectiveness of eco-infographics but to explore how users experience and interpret them.

4.1 Data Sources and Sampling

The study relies on secondary data sources, which provide a rich and diverse set of perspectives on user interaction with eco-infographics. These sources include:

- **Peer-reviewed journal articles** on infographic design, visual communication, and environmental communication;
- **Case studies** of eco-infographic campaigns published by organisations and research institutions;
- **User-generated content**, such as comments, reviews, and discussions on digital platforms (e.g., social media, blogs);
- **Digital analytics reports**, including metrics such as engagement rates, click-through rates, and sharing behaviour.

A purposive sampling strategy was used to select relevant data sources. Criteria for inclusion included relevance to eco-infographics, focus on user experience or interaction, and credibility of the source. This approach ensures that the data are both meaningful and reliable.

Secondary data analysis offers several advantages, including access to large datasets and the ability to examine real-world user interactions. However, it also presents challenges, such as limited control over data quality and context (Johnston, 2017). These limitations were addressed through careful source selection and critical evaluation.

4.2 Data Collection Procedures

Data collection involved a systematic review of selected sources. Academic databases such as Google Scholar, Scopus, and Web of Science were used to identify relevant literature. Keywords included "eco-infographics," "environmental communication," "visual communication," and "user experience."

User-generated content was collected from publicly accessible platforms, ensuring compliance with ethical standards. Only anonymised and non-identifiable data were used in the analysis.

Digital analytics reports were sourced from published case studies and organisational reports. These data provide insights into user engagement patterns and complement qualitative findings.

4.3 Data Analysis

The study employs thematic analysis, a widely used qualitative method for identifying and interpreting patterns in data (Braun & Clarke, 2006). The analysis followed six stages:

- **Familiarisation**: Immersion in the data through repeated reading;
- **Initial coding**: Identification of relevant segments and assignment of codes;
- **Theme development**: Grouping codes into broader themes;

- **Reviewing themes**: Refining and validating themes;
- **Defining and naming themes**: articulation of themes;
- **Interpretation**: Linking themes to theoretical concepts.

Themes identified in this study include perception and interpretation, cognitive processing, emotional engagement, and behavioural implications. These themes align with the theoretical framework and provide a structured basis for analysis.

4.4 Trustworthiness and Rigour

To ensure the quality and credibility of the research, several strategies were employed:

- **Credibility**: Triangulation of multiple data sources enhances the validity of findings.
- **Dependability**: A clear and transparent research process allows for replication.
- **Confirmability**: Findings are grounded in data and supported by evidence;
- **Transferability**: Detailed descriptions enable readers to assess applicability to other contexts (Lincoln & Guba, 1985).

4.5 Ethical Considerations

As the study uses secondary data, ethical risks are minimal. However, ethical principles were strictly followed:

- Only publicly available data were used.
- No personal or identifiable information was included (Mannan & Farhana, 2026).
- Proper citation and acknowledgement of sources were ensured.

4.6 Limitations

While the methodology provides valuable insights, it has certain limitations. The reliance on secondary data limits the ability to capture real-time user experiences and contextual nuances. Additionally, user-generated content may not be representative of all audiences.

Future research could address these limitations by incorporating primary data collection methods, such as interviews or experiments, to gain deeper insights into user experiences.

5. Findings and Analysis

This section presents a thematic analysis of user experiences of eco-infographics derived from secondary qualitative data. The findings are organised into four interrelated themes: perception and interpretation, cognitive processing and load management, emotional engagement, and behavioural implications. These themes are interpreted through the integrated theoretical framework of visual communication, cognitive load theory, and environmental psychology.

5.1 Perception and Interpretation of Visual Information

A dominant finding across the data is that users perceive eco-infographics as inherently more accessible than traditional text-based environmental communication. Visual

elements such as icons, colour gradients, and spatial organisation enable users to grasp key ideas rapidly. This aligns with the premise of visual communication theory that images facilitate faster and more intuitive processing than text (Lester, 2013).

Users consistently reported that eco-infographics provide an "entry point" into complex environmental issues. For example, infographics depicting carbon emissions through comparative visuals (e.g., emissions per country or per capita) were perceived as easier to understand than statistical tables. This supports Tufte's (2001) assertion that effective data visualisation enhances clarity by transforming abstract data into concrete visual representations.

However, interpretation is not always straightforward. Thematic analysis reveals that ambiguity in symbols and inconsistent visual metaphors can lead to misinterpretation. For instance, icons representing renewable energy sources were sometimes confused with general industrial symbols, particularly among users with lower levels of visual literacy. This finding underscores the importance of semiotic clarity in infographic design (Ware, 2012).

Another significant observation is the role of visual hierarchy in guiding user attention. Infographics that employ clear hierarchies through size variation, colour contrast, and spatial positioning enable users to prioritise information effectively. Conversely, poorly structured layouts with competing visual elements result in fragmented attention and reduced comprehension. Users often described such infographics as "overwhelming" or "confusing," indicating a breakdown in the communicative process.

Cultural and contextual factors also influence interpretation. Infographics designed for global audiences sometimes fail to account for regional differences in symbolism and environmental relevance. For example, imagery related to polar ice melting may resonate strongly in Western contexts but may appear distant or abstract to users in tropical regions. This suggests that localised design strategies may enhance interpretive effectiveness.

5.2 Cognitive Processing and Load Management

Cognitive processing emerged as a critical determinant of user experience. Consistent with Cognitive Load Theory (Sweller, 1988), users demonstrated limited tolerance for complex or densely packed information. Infographics that presented excessive data without clear organisation were associated with increased cognitive load and reduced comprehension.

Users frequently reported that well-designed eco-infographics "simplify complexity" by breaking down information into manageable segments. Techniques such as chunking, labelling, and the use of visual cues (e.g., arrows, highlights) were particularly effective in facilitating understanding. These findings align with Mayer's (2009) multimedia learning principles, particularly the coherence and signalling principles, which emphasise the removal of extraneous information and the highlighting of key elements.

In contrast, infographics characterised by cluttered layouts, redundant text, and inconsistent design elements were found to increase extraneous cognitive load. Users described experiencing "information fatigue" when confronted with such visuals, leading to disengagement. This is particularly problematic in environmental communication, where the inherent complexity of the subject matter already imposes a high intrinsic cognitive load.

The analysis also highlights the importance of dual coding in enhancing comprehension. Infographics that effectively integrate text and visuals enable users to process information through both verbal and visual channels, thereby improving retention (Mayer, 2009). However, redundancy-such as repeating the same information in multiple formats without adding value-can have the opposite effect, increasing cognitive burden.

An interesting finding is the role of prior knowledge in shaping cognitive processing. Users with higher levels of environmental literacy were better able to interpret complex infographics, while those with limited knowledge struggled. This suggests that eco-infographics should be tailored to the target audience's level of expertise, with varying degrees of complexity.

5.3 Emotional Engagement and Affective Responses

Emotional engagement is a central aspect of user experience in eco-infographics. The data reveal that users often experience a range of emotions, including concern, anxiety, hope, and motivation, depending on the content and design of the infographic.

Infographics that emphasise alarming statistics, such as rising global temperatures or declining biodiversity, tend to evoke negative emotions, particularly fear. These emotional responses can increase attention and perceived urgency, supporting the findings of Nabi et al. (2018), who argue that emotional arousal enhances message processing.

However, the analysis also indicates that excessive negative emotion can lead to disengagement. Users exposed to highly pessimistic or catastrophic visuals reported feelings of helplessness and avoidance. This aligns with O'Neill and Nicholson-Cole's (2009) findings that fear-based communication can backfire if it does not provide actionable solutions.

Conversely, infographics that incorporate positive or solution-oriented narratives-such as renewable energy adoption or community-based conservation efforts-tend to evoke hope and empowerment. These positive emotions are associated with higher levels of engagement and a greater likelihood of behavioural intention.

The use of colour and imagery plays a significant role in emotional engagement. Warm colours (e.g., red and orange) are often associated with urgency and danger, while cool colours (e.g., green and blue) convey calmness and sustainability. The strategic use of colour can thus enhance the emotional impact of eco-infographics.

Another notable finding is the role of empathy in shaping user responses. Infographics that include human or animal elements-such as images of affected

communities or endangered species-tend to elicit empathetic responses. This emotional connection can strengthen the persuasive impact of the infographic.

5.4 Behavioural Implications and User Action

The ultimate goal of eco-infographics is to influence behaviour, and the findings suggest that user experiences play a crucial role in this process. Infographics that are clear, engaging, and emotionally resonant are more likely to motivate users to adopt pro-environmental behaviours.

A key factor in this regard is the presence of actionable information. Infographics that include specific recommendations-such as reducing plastic use, conserving energy, or supporting environmental initiatives-are more effective in translating awareness into action. This supports the notion in environmental psychology that perceived behavioural control is essential for behaviour change (Gifford, 2014).

Social sharing is another important behavioural outcome. Users are more likely to share eco-infographics that are visually appealing, emotionally engaging, and relevant to their social context. This sharing behaviour amplifies the reach and impact of the infographic, contributing to collective awareness.

However, the analysis also reveals barriers to behaviour change. Some users expressed scepticism about the accuracy or credibility of infographic content, particularly when sources were not clearly cited. Others reported feeling overwhelmed by the scale of environmental problems, leading to inaction.

Overall, the findings highlight the complex interplay between perception, cognition, emotion, and behaviour in shaping user experiences of eco-infographics. Effective design must address all these dimensions to achieve meaningful impact.

6. Discussion

The findings of this study provide a nuanced understanding of how users experience eco-infographics, revealing the intricate interplay between visual design, cognitive processing, emotional engagement, and behavioural outcomes. This section interprets these findings in relation to the theoretical framework and existing literature, offering deeper insights into the implications for environmental communication.

6.1 Integrating Visual Communication and User Perception

The prominence of visual perception in shaping user experience reinforces the central tenets of visual communication theory. As Lester (2013) suggests, visual elements enable rapid information processing, making them particularly effective in communicating complex environmental issues. The findings confirm that eco-infographics serve as accessible entry points for users, facilitating initial engagement and comprehension.

However, the study also highlights the limitations of visual communication. The effectiveness of eco-infographics depends not only on the presence of visuals but on their clarity, coherence, and cultural relevance. Misinterpretation of symbols and inconsistent visual metaphors can undermine

the communicative intent, emphasising the importance of semiotic precision (Ware, 2012).

The role of visual hierarchy is particularly significant. Infographics that guide user attention through structured layouts are more effective in conveying key messages. This aligns with Tufte's (2001) principles of information design, which emphasise clarity and organisation. Designers must therefore prioritise hierarchy and coherence to enhance user experience.

6.2 Cognitive Load and Information Design

The findings provide strong support for Cognitive Load Theory (Sweller, 1988) and its application to eco-infographic design. Users' limited cognitive capacity necessitates careful management of information complexity. Infographics that reduce extraneous cognitive load through clear organisation and minimalism are more effective in facilitating understanding.

Mayer's (2009) multimedia learning principles offer practical guidelines for achieving this balance. The coherence and signalling principles, in particular, are critical for optimising user experience. The study demonstrates that users benefit from infographics that highlight key information and eliminate unnecessary details.

At the same time, the findings reveal the importance of tailoring infographics to the audience's level of expertise. Users with higher environmental literacy can handle more complex information, while novices require simpler and more guided presentations. This suggests the need for adaptive or layered infographic designs that cater to diverse audiences.

6.3 Emotional Dynamics in Environmental Communication

The role of emotion in shaping user experience is both significant and complex. Consistent with Nabi et al. (2018), the findings indicate that emotional engagement enhances attention and motivation. However, the type and intensity of emotion are critical determinants of effectiveness.

Fear-based messaging, while effective in highlighting urgency, can lead to disengagement if not accompanied by actionable solutions. This supports O'Neill and Nicholson-Cole's (2009) argument that fear alone is insufficient for promoting behaviour change. Instead, a balanced emotional approach that combines urgency with hope and empowerment is more effective.

The study also underscores the importance of empathy in environmental communication. Infographics that humanise environmental issues by highlighting their impact on individuals and communities are more likely to resonate with users. This emotional connection can serve as a powerful motivational force) for behaviour change.

6.4 From Awareness to Action: Behavioural Implications

One of the most significant contributions of this study is its examination of the link between user experience and behaviour. The findings suggest that eco-infographics can influence behavioural intentions, but this effect is mediated by several factors,

including clarity, emotional engagement, and perceived actionability.

Environmental psychology provides a useful framework for understanding this process. According to Gifford (2014), behaviour change requires not only awareness but also a sense of efficacy and opportunity. Infographics that include clear calls to action and practical recommendations are more likely to translate awareness into behaviour.

However, the study also identifies barriers to behaviour change, including scepticism, information overload, and perceived helplessness. These barriers highlight the limitations of eco-infographics as standalone tools and underscore the need for integrated communication strategies that combine visual communication with broader educational and policy initiatives.

6.5 Cultural and Contextual Considerations

The findings emphasise the importance of cultural and contextual factors in shaping user experiences. Eco-infographics designed for global audiences must account for variations in visual literacy, symbolism, and environmental priorities. Failure to do so can result in misinterpretation and reduced effectiveness.

Localised design strategies, which incorporate culturally relevant symbols and narratives, are likely to enhance engagement and comprehension. This is particularly important in diverse contexts such as developing countries, where environmental issues may have different manifestations and priorities.

6.6 Implications for Design and Practice

The study offers several practical implications for designers, educators, and policymakers:

- **Prioritise clarity and simplicity** to reduce cognitive load.
- **Use visual hierarchy and Gestalt principles** to guide user attention;
- **Balance emotional appeal** with actionable information;
- **Ensure cultural relevance** through localised design;
- **Incorporate credibility cues**, such as data sources, to build trust.

These recommendations highlight the need for a user-centred approach to eco-infographic design, informed by interdisciplinary insights.

6.7 Limitations and Future Research

While the study provides valuable insights, it is limited by its reliance on secondary data. Future research could incorporate primary data collection methods, such as user interviews or experimental studies, to validate and extend the findings.

Additionally, emerging technologies such as interactive and immersive infographics present new opportunities for enhancing user engagement. Further research is needed to explore these developments and their implications for environmental communication.

7. Conclusion

This study has explored the multifaceted user experiences associated with eco-infographics, emphasising their role as dynamic tools for environmental communication in an increasingly visual and information-saturated world. By adopting an interpretive qualitative approach grounded in secondary data, the research provides a comprehensive understanding of how users perceive, cognitively process, emotionally engage with, and behaviorally respond to eco-infographics.

The findings demonstrate that eco-infographics are highly effective in simplifying complex environmental information and enhancing accessibility. Visual elements such as structured layouts, colour schemes, and symbolic representations enable users to quickly grasp key concepts, supporting the principles of visual communication theory. However, the effectiveness of these visual tools is contingent upon thoughtful design. Infographics that lack clarity, coherence, or cultural sensitivity can lead to confusion, misinterpretation, and disengagement. Thus, the success of eco-infographics depends not merely on their visual appeal but on their ability to communicate meaning effectively across diverse audiences.

From a cognitive perspective, the study highlights the critical importance of managing cognitive load. Infographics that present information in a clear, concise, and well-organised manner facilitate comprehension and retention, whereas overly complex or cluttered designs impose excessive cognitive demands. This underscores the relevance of cognitive load theory and multimedia learning principles in guiding effective infographic design.

Emotionally, eco-infographics play a powerful role in shaping user engagement and motivation. The research reveals that a balanced emotional approach-combining elements of urgency with hope and empowerment-is most effective in sustaining attention and encouraging pro-environmental attitudes. Overreliance on fear-based messaging, in contrast, may lead to disengagement or feelings of helplessness.

Importantly, the study also identifies the link between user experience and behavioural outcomes. Eco-infographics that provide actionable information and clear calls to action are more likely to influence behavioural intentions. However, barriers such as scepticism, information overload, and perceived lack of agency can limit their impact. This suggests that eco-infographics should be integrated into broader communication and policy frameworks to achieve meaningful change.

In conclusion, eco-infographics represent a valuable intersection of design, cognition, and environmental communication. To maximise their effectiveness, designers and practitioners must adopt a user-centred approach that prioritises clarity, emotional resonance, cultural relevance, and credibility. Future research should build on these findings by incorporating primary data and exploring emerging formats such as interactive and immersive visualisations. By refining the design and application of eco-infographics, stakeholders can enhance public engagement and contribute to more

informed and sustainable environmental decision-making.

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