

The Mechanism of Dynamic Visual Narrative in Interaction Design for User Information Understanding and Memory Retention

Ranwei Huang

Jilin Polytechnic of Water Resources and Electric Engineering, Changchun, China

1060998279@qq.com

Keywords: Dynamic visual narrative, Interaction design, Time dimension, Cognitive load

Abstract: With the advent of the digital age, the role of interaction design in user experience is becoming increasingly important. Dynamic visual narrative, as an innovative design approach, combines visual elements with temporal changes, creating an infectious narrative experience through animation, video, and interactive feedback. The aim of this study is to explore the mechanism by which dynamic visual storytelling affects user information understanding and memory retention in interaction design. Firstly, this article summarizes the relevant theories of interaction design, visual narrative, and cognitive psychology, and analyzes how dynamic visual narrative activates users' cognitive processes through visual stimuli, thereby improving the perception and understanding of information. Next, the paper focuses on how design elements such as dynamic elements, temporal dimensions, and interactivity work together to optimize the user's memory processing process and enhance the long-term retention of information. In addition, this article combines case analysis to explore the application effects and challenges of dynamic visual narrative in education, advertising, gaming and other fields, and proposes its future development direction in multi platform design and personalized customization. Research has shown that dynamic visual storytelling not only enhances the effectiveness of information transmission, but also significantly promotes users' understanding and memory retention of information, which has important theoretical significance and practical value in the field of interaction design.

1. Introduction

With the rapid development of the digital era, the way of information dissemination is constantly updated, especially in the environment of the network and mobile Internet, interactive design and dynamic visual narrative have gradually become an important part of user experience design that cannot be ignored. Interaction design, as a design method that focuses on the interaction between users and information systems, aims to improve the communication efficiency and experience quality between users and products. Dynamic visual narrative, on the other hand, is a narrative method that combines dynamic elements (such as animation, video, etc.) with the flow of time, telling a story through visual means, attracting users' attention, stimulating emotional resonance, and enhancing the effectiveness of information transmission.

In modern society, people are exposed to a large amount of information every day, which enters their cognitive system through different transmission channels. However, due to the vastness and complexity of information, users often feel confused or overlook its importance in the process of understanding it. Therefore, how to improve users' comprehension and memory in information dissemination has become an important issue in the field of interaction design. Dynamic visual narrative provides new ideas for enhancing information understanding and memory retention due to its ability to present information through rhythmic visual elements and emotional expressions. It can not only increase user engagement through visual stimulation, but also form a deep impression on users' cognitive and emotional levels, thereby enhancing long-term memory of information.

Therefore, studying the role of dynamic visual narrative in interaction design is of great significance for improving users' cognitive effects and the quality of information dissemination. By cleverly utilizing dynamic elements, information can be better presented to users and help them form

deep and lasting memories.

2. Theoretical Basis

This chapter systematically explores the theoretical basis of dynamic visual narrative from three aspects: interaction design theory, visual narrative and cognitive psychology, and memory and information processing theory. It analyzes its key role in optimizing user experience and information transmission, as shown in Figure 1.

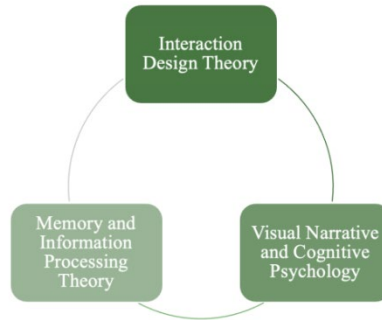


Fig. 1. Theoretical basis

2.1 Interaction Design Theory

Interaction design refers to the use of scientific design methods and technological means to promote effective interaction between users and information systems, thereby improving the user experience. The core principles of interaction design include user centricity, situational awareness, usability, and ease of use. According to user experience theory, users' emotions, needs, and behaviors are the key factors that affect the design effect. Therefore, interaction design is not only about arranging interface elements, but also needs to consider users' cognitive and behavioral characteristics in order to design interaction processes that meet user needs [1].

In interactive design, dynamic visual storytelling, as an emerging design technique, can enhance user engagement and attention through animation, transition effects, and visual feedback. Through carefully designed dynamic elements, interaction design can guide users' attention towards important information, while enhancing the efficiency of information dissemination through changes and feedback. Dynamic visual storytelling, by fully considering users' cognitive load and emotional needs, makes information presentation more intuitive and vivid, helping users better understand and remember information.

2.2 Visual Narrative and Cognitive Psychology

Visual storytelling is a way of expressing a coherent story or conveying information through visual means such as images, animations, videos, etc. Cognitive psychology believes that human cognitive processes are influenced by sensory stimuli, and visual information can quickly attract attention and leave a deep impression. Through the combination of visual elements and the construction of temporal dimensions, visual storytelling can effectively help people establish connections between information and deepen their understanding and memory of it [1].

The Dual Coding Theory in cognitive psychology states that information can be encoded through both language and visual means, and dual coding can enhance the effectiveness of memory. Dynamic visual narrative combines various sensory stimuli such as images, sounds, and animations to transmit information in a multidimensional manner, thereby improving the reliability and persistence of memory. The emotionalization and vividness of visual narrative can promote the activation of the emotional center in the brain, thereby affecting the emotional encoding and long-term memory storage of information.

2.3 Memory and Information Processing Theory

According to information processing theory, the human memory system is divided into three main levels: sensory memory, short-term memory, and long-term memory. Sensory memory refers to the

initial perception of external stimuli, short-term memory is the temporary storage of sensory information, and long-term memory is responsible for storing information that can be preserved for a long time. Dynamic visual narrative can effectively enhance the capacity of short-term memory by guiding user attention, enhancing emotional resonance, and creating narrative rhythm. Through continuous repetition and emotional connection, information can be transformed into long-term memory.

In addition, the dimension of time is also an important factor affecting memory formation. Through the temporal structure in dynamic visual storytelling, the presentation of information can be organically organized according to the flow of time, thereby helping users establish causal relationships and emotional connections between information. This plays a crucial role in the deep processing of information and the formation of long-term memory.

3. Design Elements and Functions of Dynamic Visual Narrative

This chapter analyzes the key design elements and functions of dynamic visual storytelling from three aspects: the use of dynamic elements, the role of time dimensions, and interactivity and user participation. It explores its important role in enhancing user attention, optimizing information transmission, and enhancing user engagement, as shown in Figure 2.

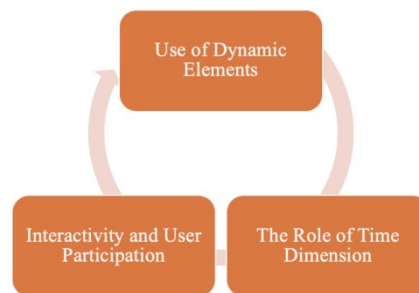


Fig. 2. Design elements and functions of dynamic visual narrative

3.1 Use of Dynamic Elements

Dynamic elements refer to the introduction of temporal factors in visual design through animation, video, transition effects, and other means, so that information is no longer static but changes over time. Dynamic elements can quickly capture the user's attention and guide their focus through a coherent visual flow. Dynamic visual storytelling, through the use of elements such as movement, color changes, and shape changes, not only enhances the visual appeal of information, but also helps users better understand the internal logic of information through the continuity and rhythm of time flow [2].

For example, in educational software, demonstrating the derivation process of mathematical formulas through animations can help students understand abstract mathematical concepts more intuitively; In advertising design, using fast switching dynamic images can effectively convey brand information and attract consumers' attention. These dynamic elements enhance the perception of information through vivid visual representation, making it easier for users to understand and remember.

3.2 The Role of Time Dimension

Time is one of the core elements of dynamic visual storytelling. Time is not only the sequence of events, but also the bond that connects emotions and forms memories. In dynamic visual storytelling, the setting of time structure can be divided into two ways: linear and nonlinear. Linear time structures typically present information in a fixed order, helping users understand the flow of information clearly; Nonlinear time structures, on the other hand, break the traditional chronological order through jumping time arrangements, stimulate users' curiosity and thinking, and enhance the attractiveness and depth of information [3].

The use of time dimension not only facilitates the organization and understanding of information, but also enhances emotional impact through changes in rhythm. For example, fast editing and slow camera switching in video advertisements can create different visual and emotional effects, thereby improving the audience's memory retention.

3.3 Interactivity and User Participation

An important characteristic of interaction design is user engagement, where users actively participate in the process of information transmission through interaction with the information system. Dynamic visual storytelling introduces interactive elements, allowing users to not only passively receive information, but actively participate in the process of information acquisition and processing. For example, in interactive web pages or applications, users can manipulate the display format of information through clicking, sliding, and other means. This interactivity not only enhances users' sense of participation, but also helps them to process information at a deeper level and enhance memory retention.

The feedback mechanism in interaction design is equally important. Through timely feedback, users can understand whether their actions are correct, thereby enhancing their understanding and memory of information. Through this proactive approach, dynamic visual storytelling not only deepens users' understanding of information, but also helps them form long-term memories of the information.

4. The Impact Mechanism of Dynamic Visual Narrative on Information Understanding

Dynamic visual storytelling influences users' understanding and memory of information through various means. This process can be analyzed from the aspects of information visualization, emotional connection and cognitive load balance, as well as memory retention and recall mechanisms, as shown in Figure 3.

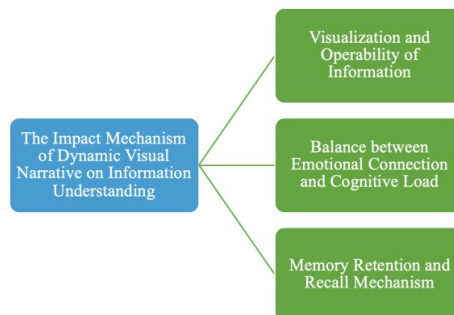


Fig. 3. The impact mechanism of dynamic visual narrative on information understanding

4.1 Visualization and Operability of Information

The primary function of dynamic visual narrative is to present complex information in an intuitive and clear manner. For example, through animation, dynamic charts, and other means, dynamic visual storytelling can quickly convey key information points and help users easily grasp the core content. This visual design allows users to avoid feeling confused when facing complex or massive information, thereby improving understanding efficiency. Further interaction design also provides users with the possibility of manipulating and exploring information, such as clicking to expand more information or dragging to view data from different dimensions, which not only enriches the user experience but also enhances a deeper understanding of information [4].

4.2 Balance between Emotional Connection and Cognitive Load

Dynamic visual narrative has a powerful emotional guidance function in information dissemination. For example, through eye-catching color combinations, dynamic effects, and the use of music, narrative design can evoke emotional resonance in users. This emotional connection is of great significance in information transmission, as emotional activation can enhance attention and memory effects. However, dynamic narrative design must focus on balancing cognitive load and

avoid presenting information that is too complex and overwhelming for users. Through reasonable rhythm design and step-by-step information presentation, dynamic visual storytelling can find the best balance between emotional guidance and information absorption.

4.3 Memory Retention and Recall Mechanism

Dynamic visual storytelling not only helps users quickly understand information, but also effectively promotes the storage of information in long-term memory. This mechanism can be achieved by activating the brain's multisensory integration function. For example, when users watch visual narratives that contain interactive and dynamic effects, their visual, auditory, and tactile information work together to help deeply encode the information in their minds. In addition, dynamic storytelling can also help users quickly extract relevant information when needed through the design of recall clues, such as repetitive elements or iconic visual symbols [5]. This memory enhancement effect is particularly important in scenarios such as education and skill training.

5. The Practical Application and Challenges of Dynamic Visual Narrative in Interaction Design

Dynamic visual storytelling has been widely applied in multiple fields, and its design and application have unique advantages, but also face certain technical and design challenges.

5.1 Analysis of Application Fields

Dynamic visual storytelling has been widely applied in fields such as education, advertising, media, and game design. In the field of education, dynamic storytelling helps students understand complex concepts. For example, using animation to explain scientific principles can significantly improve learning outcomes. In the field of advertising, dynamic visual storytelling captures audience attention through visual impact, while conveying brand information and emotional resonance through narrative content. In the media, dynamic storytelling is used to create interactive news reports so that viewers can choose to focus on the parts they are interested in [6]. In game design, dynamic storytelling not only enhances the immersion of the game, but also helps players understand the rules and goals through narrative design.

5.2 Technical and Design Challenges

Although dynamic visual storytelling has significant advantages, it also faces some technical and design challenges in practice. Firstly, balancing creativity and user experience in design is crucial. Overly complex designs may lead users to get lost in dynamic effects, thereby weakening the effectiveness of information transmission. Secondly, when the amount of information is too large, it can easily lead to an increase in cognitive load, so it is necessary to gradually guide users through hierarchical presentation. In addition, the smooth integration of technology implementation and visual effects is also a major challenge, such as ensuring the smoothness of animation and real-time responsiveness to user input [7].

5.3 Cross platform design and Multimedia Integration

With the diversification of information dissemination platforms, the design of dynamic visual storytelling needs to be adapted to various devices and environments, such as mobile devices, web pages, virtual reality, etc. In cross platform design, it is necessary to address the adaptation issues of different screen sizes, resolutions, and interaction modes while maintaining consistency in user interface style [8]. The development of virtual reality and augmented reality technology provides more possibilities for dynamic narrative design, but at the same time requires higher technological support and innovation capabilities to achieve immersive user experience.

5.4 Personalization and Customization of Dynamic Visual Narrative

In the future, personalized design of dynamic visual storytelling will become a trend. Through big data and artificial intelligence technology, designers can dynamically adjust narrative content based on user behavior, preferences, and needs. This personalized narrative can significantly enhance users'

sense of participation and immersion. For example, in the field of education, adjusting dynamic presentation content based on students' learning progress; In the field of advertising, recommend specific brand stories based on user interests. The implementation of personalized dynamic storytelling also requires balancing privacy protection issues in data collection to ensure user trust [9].

6. Conclusion and Prospect

This study analyzed how dynamic visual storytelling enhances users' information understanding and memory retention through visual elements, temporal dimensions, and interaction mechanisms in interactive design. From information visualization to the balance of emotional connections, and to the activation mechanism of long-term memory, dynamic visual storytelling has shown great potential in enhancing user experience and information transmission.

Future research can be deepened in the following aspects: firstly, exploring the possibility of dynamic visual narrative in cross disciplinary applications, such as the application of medical information dissemination and crisis management; Secondly, research the design patterns and technological implementation paths of personalized dynamic narrative; Thirdly, combining virtual reality and artificial intelligence technology, develop a more immersive and intelligent dynamic visual narrative system. Through continuous technological innovation and practical optimization, dynamic visual storytelling will play a greater role in interaction design, injecting new vitality into information dissemination and user experience improvement.

References

- [1] Roth R E. Cartographic design as visual storytelling: synthesis and review of map-based narratives, genres, and tropes[J]. *The Cartographic Journal*, 2021, 58(1): 83-114.
- [2] Chen Q, Cao S, Wang J, et al. How does automation shape the process of narrative visualization: A survey of tools[J]. *IEEE Transactions on Visualization and Computer Graphics*, 2023.
- [3] Jin Y, Ma M, Zhu Y. A comparison of natural user interface and graphical user interface for narrative in HMD-based augmented reality[J]. *Multimedia tools and applications*, 2022, 81(4): 5795-5826.
- [4] Bilousova L I, Gryzun L E, Zhytienova N V. Interactive methods in blended learning of the fundamentals of UI/UX design by pre-service specialists[J]. *Educational Technology Quarterly*, 2021.
- [5] Rezwana J, Maher M L. Designing creative AI partners with COFI: A framework for modeling interaction in human-AI co-creative systems[J]. *ACM Transactions on Computer-Human Interaction*, 2023, 30(5): 1-28.
- [6] Zhong W, Guo L, Gao Q, et al. Memorybank: Enhancing large language models with long-term memory[C]//*Proceedings of the AAAI Conference on Artificial Intelligence*. 2024, 38(17): 19724-19731.
- [7] Xu X, Gou Z, Wu W, et al. Long time no see! open-domain conversation with long-term persona memory[J]. *arXiv preprint arXiv:2203.05797*, 2022.
- [8] Aprilia A, Aminatun D. INVESTIGATING MEMORY LOSS: HOW DEPRESSION AFFECTS STUDENTS' MEMORY ENDURANCE[J]. *Journal of English Language Teaching and Learning*, 2022, 3(1): 1-11.
- [9] Caramiaux B, Fdili Alaoui S. "Explorers of Unknown Planets" Practices and Politics of Artificial Intelligence in Visual Arts[J]. *Proceedings of the ACM on Human-Computer Interaction*, 2022, 6(CSCW2): 1-24.