

Aesthetic Measures in Interactive Narratives: A Model Validation Approach Using Expert Reviews

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Abstract: This paper presents the validation of an extended interaction design IxD-model developed for digital graphic novels (DGNs), emphasizing the integration of both narrative structure and visual aesthetics in user engagement. While existing models focus on narrative flow and basic visual elements, the proposed model broadens this scope by incorporating five core dimensions of IxD usability, functionality, interaction, aesthetics, and context. By aligning them with aesthetic measures such as balance, symmetry, simplicity, and cohesion. This multidimensional approach aims to enhance not only the interactivity and usability of DGNs but also their aesthetic values, creating a more immersive and engaging experience for users. To assess the model's clarity, relevance, and applicability, a review was conducted with five experts from diverse design and development backgrounds. Their evaluations confirmed that the model can be a useful tool for guiding DGN design, showing how it effectively balances user experience with visual quality, while also offering helpful suggestions for improvement. This study contributes to a validated framework for the design and evaluation of interactive narratives, positioning the model as a valuable theoretical and practical tool for researchers, educators, and designers engaged in the fields of interaction design and digital storytelling.

Keywords: *Digital Graphic Novels, Interaction Design, Visual Design, User Engagement, Storytelling*

1.0 INTRODUCTION

The evolution of digital storytelling platforms has introduced new forms of interaction between users and narratives, particularly through digital graphic novels (DGNs). Unlike traditional media, DGNs offer interactive experiences where visual design, visual narrative, and user interface elements unite. The real challenge is designing the interfaces that do more than just deliver the story but can actively engage users by engaging with aesthetic elements that enhance the overall experience. Interaction Design (IxD) consists of a five-dimensional framework which are words (1D), visual representations (2D), physical objects/space (3D), time (4D), and behavior (5D). It helps users to interact, design and evaluate digital products, influencing their overall experience and satisfaction. However, IxD-based storytelling continues to grow, few models successfully incorporating in the aesthetic principles essential for creating immersive and emotionally meaningful user experiences.

To address this gap, this study proposes and validates an extended IxD-based model that incorporates detailed aesthetic values and measures. These include design elements such as composition, rhythm, unity, and proportion that are mapped to relevant IxD dimensions. Validation was carried out through an expert review process involving five specialists from design, multimedia, human-computer interaction, and software development fields. Their evaluations and suggestions offer insights into the model's usability in real-world DGN design. This paper outlines the model's structure, the rationale

behind its aesthetic components, and the feedback gathered from experts. In this way, the study aims to offer a practical framework for developing an extended model of IxD-based DGN.

To address this gap, this study consists of three objectives. The first is to develop an extended interaction design (IxD) model that thoughtfully incorporates aesthetics. The second is to explore how these elements can be meaningfully connected to the five dimensions of IxD in the specific context of digital graphic novels. Finally, the third objective is to validate the model through expert input from professionals in design, multimedia, human-computer interaction, and software development. This paper presents the structure of the proposed model, explains the reasoning behind the chosen aesthetic components, and shares valuable insights from expert evaluations.

2.0 LITERATURE REVIEW

2.1 Interaction Design (IxD) and Its Dimensions

Interaction Design (IxD) is a discipline that focuses on the design of interactive digital systems, emphasizing user engagement, usability, and experience. According to Gillian Crampton Smith and further developed by Cooper et al. (2014), the IxD framework is structured around five dimensions: 1D – Words, 2D – Visual Representations, 3D – Physical Objects/Space, 4D – Time, and 5D – Behaviour. These dimensions cooperatively serve as a foundation for designing systems that are both functionally effective and emotionally engaging. In the context of DGNs, these dimensions help guide how narratives are delivered, interacted with, and perceived.

2.2 Aesthetics in Interaction Design

Aesthetic considerations have become central in modern interaction design, moving beyond decoration toward elements that influence usability, engagement, and emotion. Tractinsky et al. (2000) introduced the idea that "what is beautiful is usable," emphasizing that visual aesthetics directly influence user satisfaction and trust. In interactive narratives like DGNs, aesthetics is not merely supportive, they are integral to how stories are experienced. Perrig et al. (2023) conducted an online experiment to assess the impact of interface aesthetics on user experience and performance in smartphone applications.

2.3 Aesthetic Values and Measures in Interface Design

Aesthetic values refer to the subjective qualities that users perceive as beautiful, engaging, or harmonious (Lu et al., 2024). However, to evaluate these qualities in research or structured design processes, aesthetic measures must be introduced. Derived from the work of Ngo, Teo, and Byrne (2003), aesthetic measures include quantifiable elements such as balance, symmetry, unity, simplicity,

rhythm, and sequence. These measures allow designers and researchers to assess visual interfaces objectively, making aesthetics an evaluative rather than merely subjective element.

2.4 Digital Graphic Novels (DGNs) as Interactive Narratives

Digital graphic novels represent a hybrid form of storytelling that blends traditional comics with interactive technologies. They often include navigation interfaces, animation, audio elements, and user-triggered events (Sayılğan, 2023). Unlike linear print comics, DGNs require careful integration of interaction and design principles to maintain narrative coherence while enabling user control. Ali and Husni (2022) highlight that the important of integrating aesthetic measure in DGN as ideal medium to apply and test multi-dimensional IxD frameworks and aesthetic measures.

2.5 Expert Review in Model Validation

Model validation through expert review is a common technique in the fields of HCI, design, and education. Experts bring domain-specific insight that can identify conceptual gaps, usability issues, and practical enhancements. According to Fernández et al. (2011), involving 3–5 experts is sufficient to validate the conceptual clarity and relevance of a model. This method is especially effective for design frameworks where both theoretical soundness and practical application must be aligned.

3.0 METHODOLOGY

This study employed a qualitative expert review methodology to validate an extended model for designing DGNs that incorporates both IxD dimensions and aesthetic measures. The goal was to assess the clarity, relevance, and applicability of each model component on how aesthetic elements are linked to user interaction across different dimensions. The following are the phases in the methodology of this study, as shown in Figure 1.

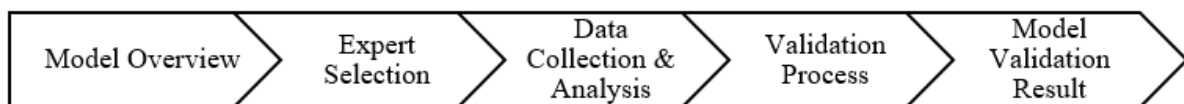


Figure 1: Methodology Step

3.1 Model Overview

The IxD-based DGN model aims to enhance the understanding of interaction design and aesthetic value in the design process. It focuses on the three core dimensions of IxD that are integral to UI design: 1D - IxD Word, 2D - IxD Visual Representations, and 4D - IxD Time. The third dimension of IxD, 3D

- IxD Physical Objects and Space, emphasizes the user's direct interaction with tools in relation to UI design. In DGN, the 3D - IxD Physical Objects and Space is not only about physical tools like a mouse or keyboard, but rather how users interact with and navigate the digital space where the content is displayed. Instead of physical interaction with objects, it's about how the design helps users engage with and experience the narrative visually and interactively. Furthermore, the fifth dimension, 5D - IxD Behaviour, extends the previous model by incorporating visual narrative and storytelling elements into the DGN design. Figure 2 shows an Extended IxD-Based Model for Digital Graphic Novels.

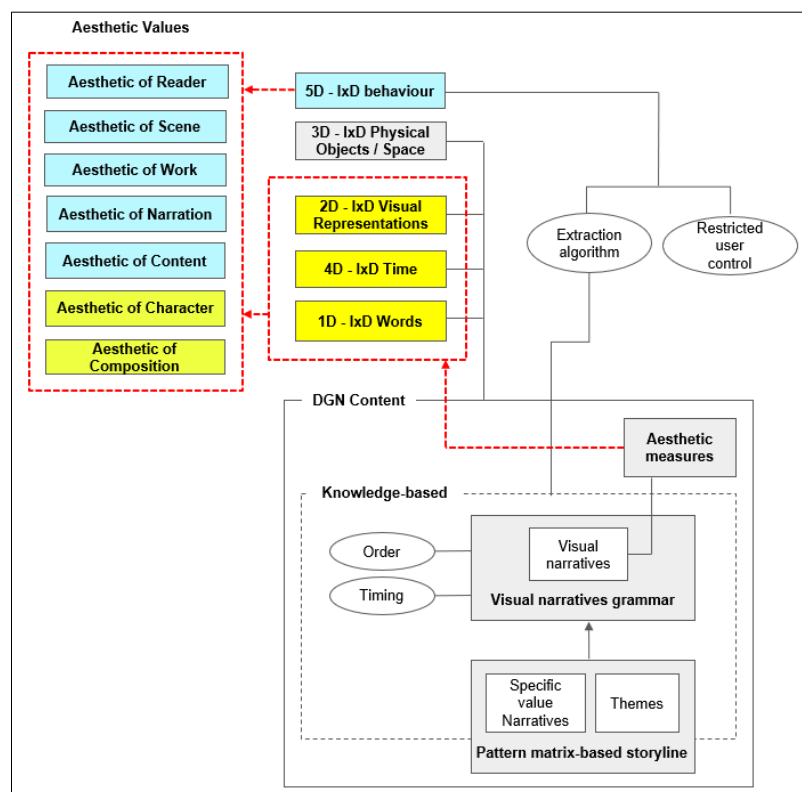


Figure 2: An Extended IxD-Based Model for Digital Graphic Novels

3.2 Expert Selection

Several guidelines were taken into consideration in this study when determining the expert to be chosen for expert review evaluations. According to Hallowell and Gambatese (2010), the expert must meet at least two of the following requirements: (i) authorship, (ii) conference presenter, (iii) committee member or chair, (iv) employed in practice with five years of experience, and (v) employment as a faculty member at higher education institutions. Therefore, these requirements were followed to choose the most suitable experts for this study. In addition, the number of experts involved in the evaluation depends on the suitability of the verification process. In this study, there are a total of five experts contributing their time and knowledge, including researcher, academician, and designer. The background of the experts is listed in Table 1 below.

Table 1: Background of Experts

Expert	Qualification	Expertise	Role	Experience
E1	Bachelor's	Design	Designer / Lecturer	17 years
E2	Bachelor's	Design & Multimedia Dev.	Designer	9 years
E3	Master's	App Development	Lecturer	11 years
E4	Ph.D	Human-Computer Interaction	Lecturer	8 years
E5	Master's	Software Development	Lecturer	20 years

3.3 Data Collection and Analysis

The processes to produce an overall verification process were verifying documents and online questionnaires. The online questionnaire aimed to evaluate user knowledge, understanding, and opinion of the proposed model. An appointment is scheduled if the expert requires additional clarification of the proposed model. In providing explanations during the discussion, the researcher conducted an interview to discuss the subject. The interview session consisted of a semi-structured interview format. These researchers utilized a semi-structured interview because the researcher wished to elicit richer and more detailed responses from the expert. The questions in the interview guide were described as the richest possible data (Kallio et al., 2016). Semi-structured interview guides include main themes and follow-up questions. The experts were encouraged to speak freely about their perceptions and experiences within the main themes. The experts analyzed and verified the proposed model after receiving an email with the model and verification document. The verification document contains a hyperlink where an expert must click to answer the online questionnaire. The online questionnaire was created using Google Forms since it is more flexible and easier to fill up. By using the online questionnaire, the experts can answer the questionnaire whenever they're available in less time.

3.4 Validation Process

The validation process was carried out using a set of questions in an online questionnaire. For the model validation, each of these specialists was given an online questionnaire to fill out. In addition to that, it was expected by the experts to provide comments and suggestions. It was decided to hold a meeting with the experts and record it so that any ambiguous comments or suggestions regarding the model verification could be discussed and clarified. The questionnaire served as the primary instrument in the model verification process. In addition to a section in which the experts could offer comments and suggestions, experts were also required to offer their assessments of the following, which are listed below:

- (i) Relevance of Extended Model and IxD
 - (1) all the proposed components are relevant;

- (2) some components may not be related;
- (3) all components are irrelevant
- (ii) Understand Aesthetic Value in Designing IxD-based DGN
 - (1) it is easy to understand;
 - (2) need some explanation;
 - (3) need a very detailed explanation
- (iii) Understand of Aesthetic Measure in Designing IxD-based DGN
 - (1) it is easy to understand;
 - (2) need some explanation;
 - (3) need a very detailed explanation
- (iv) The connections and flows of all components (Comment / Suggestion)
- (v) Readability of proposed extended model (Comment / Suggestion)

3.5 Model Validation Result

Experts evaluated the relevance and applicability of the proposed components, the clarity of aesthetic elements and measures, as well as the overall structure and readability of the model. Key aspects assessed included the alignment between aesthetic measures and IxD dimensions, comprehensibility of design elements, logical flow between components, and visual clarity of the model. The feedback provided valuable insights for refining and improving the proposed model, ensuring its practicality and relevance in the intended context. The detailed validation results are presented in the following section.

4.0 DATA ANALYSIS AND FINDINGS

The responds and feedback to the following five questions are presented in the form of tables and percentages to illustrate each value provided by each expert. According to Table 2, the entirety of the model has been validated. The five experts agreed on the opinion that each of the components are significant. The feedback provided was clear and constructive, demonstrating the experts' understanding and involvement in the evaluation. Overall, the results from the online validation were useful and helped confirm the validity and relevance of the model components.

Table 2: Validation Results of the Overall Model

Parts	Frequency (n = 5)		
	All proposed components are relevant	Some components may be irrelevant	All components are irrelevant
Aesthetic Measure	5		-
IxD Dimension	5	-	-
Aesthetic Values	5	-	-

Table 3 presents the result of component in IxD dimension that relates to aesthetic values. All the experts agreed that the content is easy to understand for five aesthetics namely aesthetic of reader, aesthetic of scene, aesthetic of work, aesthetic of narration, and aesthetic. Meanwhile, one expert commented on the aesthetic worth of character, suggesting that it requires two types of aesthetic evaluation whether it involves character, related to the development of the character itself or the implementation of character in interface design. For this study, the aesthetic component of character is mainly focused on the utilization of existing characters in the DGN archetype's interface design. In terms of the aesthetic of medium and aesthetic of composition, three experts agreed that the component in the model is simple to understand, while two experts believed that the aesthetic value requires further explanation.

Table 3: Validation Results of Component in IxD dimension for each Aesthetic Value

Components	Frequency (n = 5)		
	It is easy to understand	Need some explanation	Need a very detailed explanation
Aesthetic of Reader	5	-	-
Aesthetic of Scene	5	-	-
Aesthetic of Work	5	-	-
Aesthetic of Narration	5	-	-
Aesthetic of Content	5	-	-
Aesthetic of Character	4	1	-
Aesthetic of Medium	3	2	-
Aesthetic of Composition	3	2	-

The outcome of the validation of the IxD dimension component is shown in Table 4. For the purposes of this study, the dimension that focuses on design consists of three dimensions: words, visual representations, and time. While the physical object / space dimension does not entail aesthetic value, it still comprises the IxD dimension because it involves the interaction between the user's access medium and the DGN archetype. Regarding IxD behaviour, it emphasizes the aesthetic value of how users can conduct actions on a DGN and the narrative within the DGN. Table 4 indicates that all experts believed that the 3D, 4D, and 5D components are understandable. Three experts believed that the 1D and 2D components are simple to comprehend, whereas two experts believed that they require further explanation.

Figure 3 shows a pie chart showing the connections and flows between the model's components. 60% of the experts agreed that it was logical, whereas 40% disagreed. However, the expert provided suggestions for improvement to justify their decisions. Regarding connections and flows, experts recommended enhancing the aesthetic value of the aesthetic of medium, which is the focus of this study.

Table 4: Validation Results of Component in Understand of Aesthetic Measure and IxD dimension

Components	It is easy to understand	Frequency (n = 5)	
		Need some explanation	Need very detail explanation
1D Words	3	2	-
2D Visual Representations	3	2	-
3D Physical Object / Space	5	-	-
4D Time	5	-	-
5D Behaviour	5	-	-

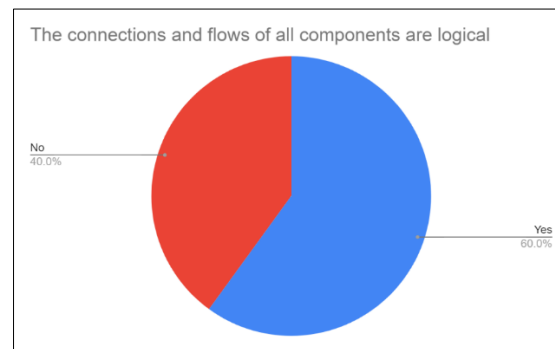


Figure 3: Expert Feedback of Connections and Flows of the Overall Model

Figure 4 is a pie chart showing the readability of proposed extended model. 80% of the experts agreed that it was readable, whereas 40% disagreed. However, the expert provided suggestions for improvement to improve the readability of the model, which is to focus the line on the aesthetic of composition only because it is more related to IxD for the DGN interface.

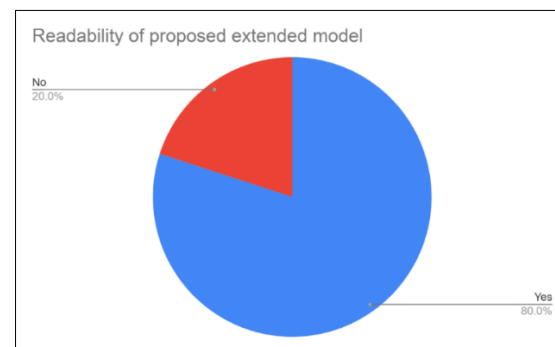


Figure 4: Expert Feedback of Model Readability

For the final section, experts were asked to make any comments or suggestions about the extended model. Expert comments and suggestions are discussed in Table 5.

Table 4: Comments and Suggestions from Experts

Element	Expert	Comments and Suggestions
Component of Model	E04	Some components need explanation, as they are hard to understand and interpret into graphical elements.
	E05	Explain the details of each component at LR
Connections and Flows of All Components	E01	Put an element of measure in the group
	E02	Focus on the aesthetic of the medium
	E03	Connection link (red colour) for aesthetic value, just focus aesthetic of the medium
	E04	Fix the group of aesthetic values based on each group
Overall Model	E02	Overall are good and interesting.
	E03	Group the aesthetic measure that focuses on IxD
	E04	Group the aesthetic measure that focuses on IxD.

It is feasible to draw the conclusion based on the experts' comments and suggestions that the majority of experts agreed with the suggested model, and that the only component that needs to be improved is the part that deals with aesthetic value. Based on expert feedback, several improvements were made to the extended IxD-based DGN model to make it clearer and easier to use. The main change was grouping aesthetic values by their related IxD elements and using different colors for each group. This color-coding helps users quickly see the differences between components and better understand how they connect. As shown in Figure 5, the revised version model is now more organized and easier to follow. The changes make it more readable and highlight important relationships between elements. It's also flexible enough to support future updates, making it a more useful tool for both researchers and practitioners.

5.0 DISCUSSION AND CONCLUSIONS

The design phase is the most important part of this study because it brings together both theory and practical use. It's essential to consider both perspectives since this model adds valuable knowledge to the fields of interaction design and user interface design. The IxD-based DGN Model helps designers and researchers better understand how interaction design and aesthetic value come together in the design process. It focuses on three key IxD dimensions related to UI design: words (1D), visual representations (2D), and time (4D). This extended model also includes aesthetic value components that enhance the overall look and feel of interaction design. Unlike the 5D dimension, which is more about user behavior and the digital graphic novel archetype rather than UI design, this model focuses mainly on the aesthetic value of the 1D, 2D, and 4D dimensions. During the model verification process, a questionnaire was used as the main tool to gather expert feedback. The validation showed that the extended IxD-based model is relevant and helpful in combining aesthetic values with interaction design. Experts' input helped improve the model's clarity and usability, though further testing with real users is still needed to confirm how well it works in practice.

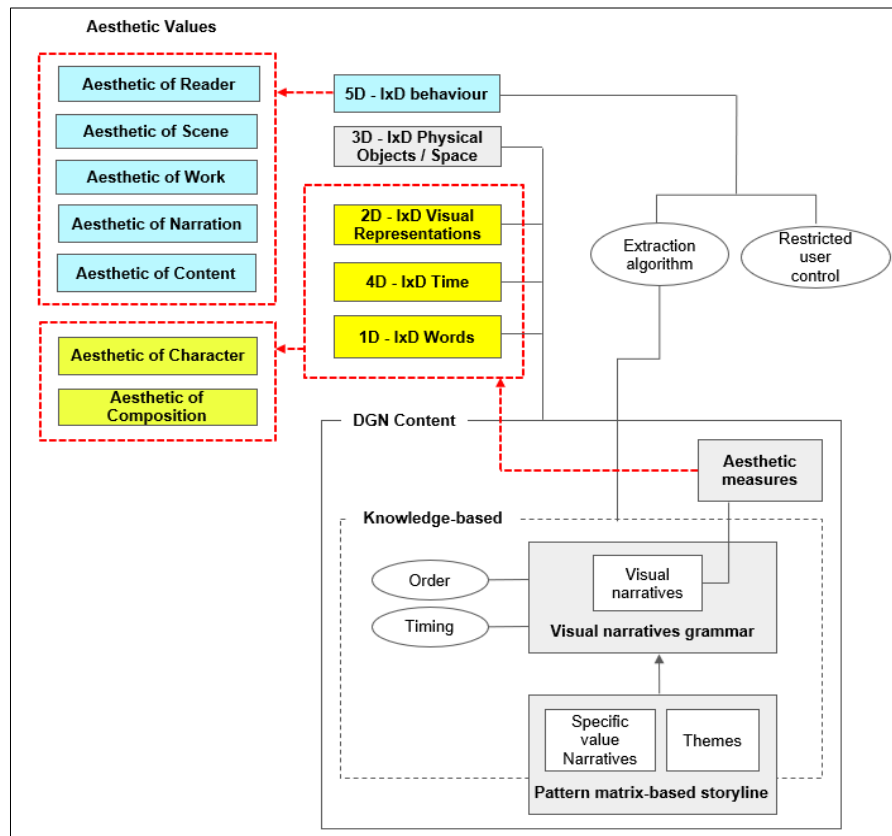


Figure 4: Revised Version of IxD-based DGN Model

This study developed and tested an improved IxD-based model that adds detailed aesthetic values to the design of Digital Graphic Novels. Experts confirmed that the model's parts are useful and relevant, and their feedback helped make the model clearer and easier to use especially by grouping related aesthetic values and adding color-coding. The extended model is a helpful guide for designers and researchers to create DGNs that are both interactive and visually engaging. Future work should include user testing and expanding the model to cover more design aspects. Overall, this study offers a practical way to include aesthetics in interactive storytelling.

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