Glovento Journal of Integrated Studies (GJIS) | ISSN: 3117-3314
Volume 1 (2025) | Article 41

An Experimental Re-evaluation of a Prototype System for Enhancing Reading Experience through Page-Turning Actions

[1]Yulana Watanabe, [2]Yutaro Ikuto, [3]Eiichi Yubune

[1,2,3]Graduate School of Information Sciences and Arts, Toyo University, Kawagoe, Saitama, Japan,
Email: [1]s4b102000049@toyo.jp, [2]s3b102500043@toyo.jp, [3]yubune@toyo.jp,
*Corresponding Author: Yulana Watanabe, (s4b102000049@toyo.jp)

Abstract- This study examines how the physical act of turning pages in printed books influences the reading experience and whether this act can be replicated in a digital environment. Printed books provide a continuous tactile process that supports comprehension, immersion, and emotional comfort, whereas electronic books offer convenience but often lack the physical qualities that support a stable reading flow. To explore this issue, a prototype system was developed using an ultra-thin material designed to produce a tactile sensation similar to turning paper pages. An experiment was conducted with thirty-one participants who read short stories by Osamu Dazai using printed books, electronic books, and the prototype system. After each session, participants completed a questionnaire assessing 12 items across four categories—reading quality, physical comfort, medium features, and post-reading impressions—and provided free descriptions. The results showed apparent differences among the three media. Printed books received the highest ratings in comprehension, immersion, emotional comfort, and overall satisfaction. Electronic books were positively evaluated for convenience, but were often associated with eye fatigue and reduced immersion. The prototype system produced mixed responses. Quantitative results indicated that comprehension, immersion, and a sense of uniqueness were strongly associated with satisfaction, whereas qualitative comments suggested that tactile sensations facilitated a sense of progress during reading. However, unfamiliar operations reduced usability for some participants. These findings suggest that tactile page-turning provides experiential value absent from conventional electronic reading, demonstrating the potential of integrating physical interaction into digital reading environments.

Keywords: Reading experience, Page-turning interaction, Tactile interaction, Bodily engagement, Printed books, Electronic books.

I. INTRODUCTION

This study focuses on the experiential value of books rather than their informational value and aims to clarify how this value changes with digitization. Although digital books have increased the informational value of books through portability and preservation, printed books continue to maintain a stable level of popularity. Furthermore, many studies report that printed books provide higher levels of understanding and immersion. This suggests that digitization improves the efficiency of information distribution but may not fully maintain the experiential value of printed books.

In considering this issue, this study focuses on the physical operation of “page-turning,” which is unique to paper books. The thickness and texture of pages allow readers to perceive them as objects that can be turned, and they function as environmental conditions that enable readers to grasp the progress of reading through physical sensations. Tomono (2025), referring to Gibson’s (1979) concept of affordance, states that the possibility of action emerges from the relationship between the environment and the agent, and pages can likewise be regarded as elements that invite the action of turning. In contrast, page operations in digital books consist solely of visual changes triggered by actions such as swiping or tapping, and they lack the physical qualities of a page that can be turned. This may create a sense of discomfort akin to a stopped escalator, in which visual appearance and physical expectation do not align, and it may disrupt the continuity between perception and action.

To address this issue, we developed a prototype system that uses tactile feedback through an ultra-thin material and examined the feasibility of a reading experience that lies between printed books and digital books. This paper presents a new experiment on novel reading and examines, with greater precision, how page turning in printed books influences the reading experience. This paper reports the methods and results of this new experiment and aims to clarify the influence of page turning on the reading experience and the design of reading interfaces.

II. METHOD

2.1. Material:

In this study, an experiment on novel reading was conducted by comparing three media—printed books, digital books, and the prototype system—based on the findings of Watanabe &Yubune (2025). Watanabe &Yubune (2025) included the commercial device "e-OneBook," which resembles the prototype system, as a comparison target and therefore used comics as the reading material; however, comics rely heavily on visual elements, and their page navigation and reading process differ substantially from those of novels. In addition, the prototype system was designed for continuous text-based reading and thus did not correspond to the page-turning characteristics of comics. As a result, it was suggested that the effectiveness of tactile feedback might not be fully evaluated. Therefore, this study standardized the three-comparison media as printed books, digital books, and the prototype system, and conducted a new examination using novels as the sole reading material. The aim was to measure the characteristics of the prototype system under conditions in which page operations more directly affect the reading experience.

The selection criteria for the reading materials were: (1) availability in both printed and digital formats, (2) the ability to select three works by the same author with similar length for comparison across the three media, and (3) suitability for use in hardcover book form in accordance with the design concept of the prototype system. To satisfy these conditions, Dazai Osamu's "Hazakura to Mateki (The Falling Leaves and the Magic Flute)" and "Kahei (Money)," included in Ayah Ihara's edited collections A Selection of Women's Novels by Dazai Osamu: Unknown to Anyone and Dazai Osamu Short Stories for Ten Minutes of Reading, were selected. Furthermore, "Tourou (Lantern)" was added as a work with a comparable number of pages and page-turns, bringing the total to three selected works. Shorter works were also considered. However, evaluations from a pilot study indicated that their small number of pages would reduce data reliability and that narrative immersion would be challenging to achieve; thus, they were excluded.

2.2. Questionnaire:

In this study, the questionnaire was redesigned based on the 12 items used by Watanabe &Yubune(2025), classified into four groups: quality of reading experience, physical effects, features of media, and impressions after reading. As the first modification, the item "the reading time felt short," which did not capture differences among media, was removed because it was included in expressions related to immersion and concentration in open-ended responses, and the items "concentration" and "immersion" were combined. In addition, "memory retention" was reclassified from impressions after reading to the quality of the reading experience. Furthermore, referring to the UX Questionnaire Beta Version by Matsumoto and Zenpou (2017), the framework of usability, usefulness, and empathy was applied to the reading experience. However, items unsuitable for digital books or the prototype system were excluded, and new elements, such as clarity and layout, and tactile enjoyment, were added based on open-ended responses. For post-reading impressions, an item on "a sense of security and attachment" was added, based on prior studies of these constructs. Through these revisions, a questionnaire integrating the theoretical basis of UX evaluation and findings from reading studies was constructed, and a total of twelve items, organized into four categories of three items each, were adopted for the comparative experiment involving printed books, digital books, and the prototype system.

Table 1: List of Questions.

1. Quality of the Reading Experience	
1	It is easy to understand the content when reading with this medium.
2	I was able to concentrate and become immersed in the story when reading with this medium.
3	I can clearly remember what I read.
2. Physical Effects	
4	I felt that the size of the text and the layout of this medium were comfortable and easy to read.
5	I did not feel much eye strain or physical fatigue when reading with this medium.
6	I felt that I could continue reading with this medium for a long time without difficulty.
3. Features of the Medium	
7	I felt that the design and appearance of the medium were suitable for reading.
8	Page turning or scrolling operations felt natural when using this medium.
9	Through its operations and tactile qualities, this medium provided a unique sense of enjoyment in reading.
4. Impressions After Reading	
10	I felt a sense of security and attachment when reading with this medium.
11	I would like to recommend reading with this medium to others.
12	I was generally satisfied with the reading experience provided by this medium.

In this study, an additional survey was administered to assess participants' reading tendencies, including reading frequency, media use, and typical reading situations; these responses were used as supplementary information on their reading experiences. The experiment involved 31 participants aged 18 to 29, all of whom were native Japanese speakers and had no visual or speech impairments (16 males and 15 females; mean age = 23.77, SD = 3.93). The sample size was determined through a power analysis using G*Power 3.1.9.7. Under the conditions of effect size F = 0.4, power = 0.9, and α = .05, the required number of participants for a one-way repeated-measures ANOVA was calculated as fifteen, but thirty-one participants were included to allow for possible attrition. This study was approved by the Ethics Review Committee of Toyo University (Approval Numbers: 2025-10, 2025-28, 2025-31), and all participants provided informed consent after receiving oral and written explanations of the purpose and procedures.
In the experiment, participants read a novel using three media—a printed book, a digital book, and a prototype system — and completed a questionnaire after each reading. Participants were not asked to speak during the task, and natural reading was respected. The experiment was conducted in a quiet environment with controlled lighting, posture, and reading distance, and no time limit was imposed, allowing participants to read at their own pace.

III. RESULT

3.1. Results of the Correlation Analysis:

Table 2: Correlation Between Satisfaction and Each Item of "Quality of Reading Experience".

Item	1. Printed Book	2. E-book	3.Prototype System
Understanding → Satisfaction	r = .461 (p< .01)	r = .559 (p< .01)	r = .721 (p< .001)
Immersion→ Satisfaction	r = .503 (p< .01)	r = .827 (p< .001)	r = .804 (p < .001)
Memory→ Satisfaction	r = .383 (p< .05)	r = .487 (p< .01)	r = .442 (p< .05)

In the first perspective, "Quality of Reading Experience," three indicators were examined: "Understanding (Item 1)," "Immersion (Item 2)," and "Memory (Item 3)." For printed books, significant positive correlations were found for "Understanding (r = .461, p < .01)," "Immersion (r = .503, p < .01)," and "Memory (r = .383, p < .05)." For e-books, significant correlations were observed for "Understanding (r = .559, p < .01)," "Immersion (r = .827, p < .001)," and "Memory (r = .487, p < .01)." In particular, the correlation for immersion was remarkably strong. For the prototype system, significant correlations were also confirmed for all three items: "Understanding (r = .721, p < .001)," "Immersion (r = .804, p < .001)," and "Memory (r = .442, p < .05)." Strong associations were observed, especially for understanding and immersion.

Table 3: Correlation Between Satisfaction and Each Item of "Physical Effects".

Item	1. Printed Book	2. E-book	3.Prototype System
Ease of Viewing→ Satisfaction	r = .476 (p< .01)	r = .281 (n.s.)	r = .488 (p< .01)
Fatigue→ Satisfaction	r = .521 (p< .01)	r = .563 (p< .001)	r = .479 (p< .01)
Long-Time Reading → Satisfaction	r = .267 (n.s.)	r = .218 (n.s.)	r = .512 (p< .01)

In the second perspective, "Physical Effects," three indicators were examined: "Ease of Viewing (Item 4)," "Fatigue (Item 5)," and "Ease of Long-Time Reading (Item 6)." For printed books, significant positive correlations were found for "Ease of Viewing (r = .476, p < .01)" and "Fatigue (r = .521, p < .01)," while no significant relationship was observed for "Long-Time Reading (r = .267, n.s.)." For e-books, a significant correlation was found for "Fatigue (r = .563, p < .001)," while neither "Ease of Viewing (r = .281, n.s.)" nor "Long-Time Reading (r = .218, n.s.)" showed significant correlations. For the prototype system, significant positive correlations were confirmed for all items: "Ease of Viewing (r = .488, p < .01)," "Fatigue (r = .479, p < .01)," and "Long-Time Reading (r = .512, p < .01)."

Table 4: Correlation Between Satisfaction and Each Item of "Features of the Medium".

Item	1. Printed Book	2. E-book	3.Prototype System
Design→ Satisfaction	r = .510(p< .01)	r = .412 (p< .05)	r = .533 (p< .01)
Operability→ Satisfaction	r = .560 (p< .01)	r = .063 (n.s.)	r = .710(p< .001)
Uniqueness→ Satisfaction	r = .520 (p< .01)	r = .303 (p = .098)	r = .817 (p< .001)

In the third perspective, "Features of the Medium," three indicators were examined: "Design (Item 7)," "Operability (Item 8)," and "Uniqueness (Item 9)." For printed books, significant positive correlations were found for all items: "Design (r = .510, p < .01)," "Operability (r = .560, p < .01)," and "Uniqueness (r = .520, p < .01)." For e-books, a significant correlation was observed for "Design (r = .412, p < .05)," while "Uniqueness (r = .303, p = .098)" showed a marginal trend and "Operability (r = .063, n.s.)" did not show a significant relationship. For the prototype system, significant positive correlations were confirmed for all items: "Design (r = .533, p < .01)," "Operability (r = .710, p < .001)," and "Uniqueness (r = .817, p < .001)." Strong associations were observed, especially for operability and uniqueness.

Table 5: Correlation Between Satisfaction and Each Item of "Impressions after Reading".

Item	1. Printed Book	2. E-book	3.Prototype System
Security and Attachment→ Satisfaction	*r* = .394 (*p*< .05)	*r* = .404 (*p*< .05)	*r* = .771 (*p*< .001)
Recommendation → Satisfaction	*r* = .670 (*p*< .001)	*r* = .639 (*p*< .001)	*r* = .792 (*p*< .001)

In the fourth perspective, "Impressions after Reading," two indicators were examined: "Sense of Security and Attachment (Item 10)," and "Willingness to Recommend (Item 11)." For printed books, significant positive correlations were found for both "Sense of Security and Attachment (r = .394, p < .05)" and "Willingness to Recommend (r = .670, p < .001)." For e-books, significant correlations were also observed for both "Sense of Security and Attachment (r = .404, p < .05)" and "Willingness to Recommend (r = .639, p < .001)." For the prototype system, very strong positive correlations were observed for both "Sense of Security and Attachment (r = .771, p < .001)" and "Willingness to Recommend (r = .792, p < .001)."

3.2. Results of analysis of variance:

Table 6: One-Way ANOVA of "Quality of Reading Experience".

Item	Medium	Mean	SD	F-value	p-value	Effect Size (f)
1.Understanding	Printed Book	5	0.95	6.70	*p* < .01	0.47
	E-book	4.13	0.91			
	Prototype System	4.39	1.13			
2. Immersion	Printed Book	5.1	0.96	6.36	*p* < .01	0.46
	E-book	4.03	1.18			
	Prototype System	4.32	1.3			
3. Memory	Printed Book	4.77	0.83	0.59	n.s.	0.14
	E-book	4.58	1.26			
	Prototype System	4.81	0.86			

First, clear differences were observed across the media for each quality dimension of the reading experience. For "Understanding" (Item 1), printed books (mean = 5.00) received the highest score, and significant differences were found compared with e-books (4.13) and the prototype system (4.39) (F(2, 58) = 6.70, p < .01). The post-hoc test showed that printed books scored higher than both e-books and the prototype system, while no significant difference was found between e-books and the prototype system. For "Immersion" (Item 2), printed books (mean = 5.10) again received the highest score, and significant differences were observed compared with e-books (4.03) and the prototype system (4.32) (F(2, 58) = 6.36, p < .01). The post-hoc test indicated that printed books were rated higher than the other two media, while there was no difference between e-books and the prototype system. In contrast, for "Memory" (Item 3), no significant difference was found (F(2, 58) = 0.59, n.s.). These results suggest that printed books are rated highest for understanding and immersion, indicating that traditional reading media still provide advantages in grasping content and engaging with the narrative.

Table 7: One-Way ANOVA of "Physical Effects".

Item	Medium	Mean	SD	F-value	p-value	Effect Size (f)
4. Ease of Viewing	Printed Book	5.06	1.05	2.08	n.s.	0.26
	E-book	5.26	0.84			
	Prototype System	4.77	1.10			
5. Fatigue	Printed Book	5.10	0.93	26.06	*p* < .01	1.42
	E-book	3.06	1.19			

	Prototype System	4.00	1.22			
6. Long-Time Reading	Printed Book	4.77	1.21	13.99	$p < .01$	0.68
	E-book	3.03	1.28			
	Prototype System	3.61	1.38			

For items related to physical effects, significant differences were observed across media for "Fatigue" (Item 5) and "Ease of Long-Time Reading" (Item 6). In contrast, no significant difference was found for "Ease of Viewing" (Item 4) ($F(2, 58) = 2.08$, n.s.). First, for "Fatigue" (Item 5), a significant difference was observed ($F(2, 58) = 26.06$, $p < .01$), and the post-hoc test showed that printed books (mean = 5.10) were rated significantly higher than e-books (3.06) and the prototype system (4.00). The prototype system was also rated significantly higher than e-books. Next, a significant difference was also found for "Ease of Long Reading" (Item 6) ($F(2, 58) = 13.99$, $p < .01$). Printed books (4.77) scored significantly higher than e-books (3.03) and the prototype system (3.61), while the latter two did not differ significantly. These results indicate that printed books still provide advantages in physical comfort, as they cause less physical strain and fatigue during long reading. Meanwhile, the prototype system was rated as causing less fatigue than e-books, showing some positive effects in reducing physical strain during reading.

Table 8: One-Way ANOVA of "Features of the Medium".

Item	Medium	Mean	SD	F-value	p-value	Effect Size (f)
7.Design	Printed Book	5.16	0.81	13.58	$p < .01$	0.67
	E-book	4.00	1.08			
	Prototype System	4.26	1.32			
8.Operability	Printed Book	4.71	1.32	7.70	$p < .01$	0.51
	E-book	4.87	1.21			
	Prototype System	3.58	1.43			
9.Uniqueness	Printed Book	5.13	1.16	28.77	$p < .01$	0.98
	E-book	2.90	1.17			
	Prototype System	4.39	1.34			

For the items related to the "features of the medium", significant differences were found among the media for all items. For "Design" (Item 7), printed books (mean = 5.16) received the highest score, and significant differences were found compared with e-books (4.00) and the prototype system (4.26) ($F(2, 58) = 13.58$, $p < .01$). The post-hoc test showed that printed books scored significantly higher than both e-books and the prototype system, while no significant difference was found between e-books and the prototype system. Next, a significant difference was found for "Operability" (Item 8) ($F(2, 58) = 7.70$, $p < .01$). The post-hoc test showed no difference between printed books (4.71) and e-books (4.87), but both were rated significantly higher than the prototype system (3.58). A significant difference was also found for "Uniqueness" (Item 9) ($F(2, 58) = 28.77$, $p < .001$). The post hoc test showed that printed books (5.13) scored significantly higher than e-books (2.90) and the prototype system (4.39), and that the prototype system also scored significantly higher than e-books. These results suggest that printed books retain advantages in sensory and visual appeal, as they receive higher evaluations for design and uniqueness. Although the prototype system exhibited limitations in operability, it surpassed e-books in uniqueness.

Table 9: One-Way ANOVA of "Impressions after Reading".

Item	Medium	Mean	SD	F-value	p-value	Effect Size (f)
10.Security and Attachment	Printed Book	5.10	1.12	27.81	$p < .01$	0.96
	E-book	2.74	1.27			
	Prototype System	3.94	1.29			
11.Recommendation	Printed Book	4.87	1.26	8.47	$p < .01$	0.53
	E-book	3.65	0.97			
	Prototype System	4.00	1.34			
12. Satisfaction	Printed Book	5.32	0.74	15.23	$p < .01$	0.71
	E-book	3.94	1.16			
	Prototype System	4.16	1.27			

Finally, significant differences among the media were observed for all items related to impressions after reading. For "Security and Attachment" (Item 10), printed books (mean = 5.10) received the highest score, and significant differences were found compared with e-books (2.74) and the prototype system (3.94) ($F(2, 58) = 27.81$, $p < .01$). The post-hoc test showed that printed books scored significantly higher than the other two media, and the prototype system also scored significantly higher than e-books. Next, a significant difference was found for "Recommendation" (Item 11) ($F(2, 58) = 8.47$, $p < .01$). Printed books (4.87) received significantly higher evaluations than e-books (3.65) and the prototype system (4.00). No significant difference was found between e-books and the prototype system. A significant difference was also observed for "Satisfaction" (Item 12) ($F(2, 58) = 15.23$, $p < .01$). Printed books (5.32) scored the highest, and significant differences were found compared with e-books (3.94) and the prototype system (4.16). No difference was observed between e-books and the prototype system. These results suggest that printed books outperform other media across all three impression-related items, indicating advantages in psychological satisfaction and trust. Meanwhile, the prototype system received positive evaluations, including a greater sense of security and attachment than e-books.

3.3. Results of the open-ended responses:

In the analysis of the open-ended responses, it became clear that the three media—printed books, e-books, and the prototype system—formed distinct reading experiences. For printed books, many respondents referred to physical actions such as "reading," "feeling," and "turning pages," as well as material aspects such as "paper" and "pages." Positive comments primarily noted that the texture and act of turning pages supported a sense of realism, comfort, and immersion in reading, although some noted paper-specific inconveniences, such as "heavy" and "difficult to turn." For e-books, respondents appreciated the usability and portability, using words such as "light," "easy to read," and "scroll." However, many also reported visual strain from screen displays, such as "bright" and "tiring," as well as difficulty with immersion. Some also noted a diminished sense of reality in reading due to the absence of physical action. For the prototype system, words related to page turning appeared with particularly high frequency. Opinions praising its tactile operation, similar to paper, coexisted with opinions noting operational burdens such as "not familiar," "tiring," and "hard to return." While some respondents found novelty and interest in the tactile experience that conventional e-books do not provide, others suggested that awkward operations could disrupt the reading experience. These findings revealed that each medium has a distinct structure with respect to physical engagement, operability, and psychological responses.

IV. DISCUSSION

By integrating the quantitative and qualitative data of this study, it became clear that printed books, e-books, and the prototype system each formed distinct structures of reading experience. In the correlation analysis, printed books showed moderate associations between satisfaction and factors such as comprehension, immersion, and a sense of comfort; readability and low physical burden were associated with a stable experience. For e-books, usability and convenience influenced satisfaction, while associations with emotional aspects were weak, revealing an experience structure centered on functional features. For the prototype system, several factors such as comprehension, immersion, media specificity, and a sense of comfort were strongly linked to satisfaction, suggesting that tactile cues and page-turning actions may have played an essential role in the experience. However, this did not necessarily indicate a high absolute evaluation, and the average satisfaction score (4.16 on a six-point scale) suggests that the overall assessment was not strongly positive.

ANOVA results showed that printed books received the highest evaluations across major indicators, including comprehension, immersion, and comfort, and consistently provided a high-quality reading experience. E-books were similar to printed books in usability and visibility, but they scored lower in emotional aspects. The prototype system exceeded e-books in media specificity and a sense of comfort, but its usability was lower than that of both media, revealing a structure in which the value of physical interaction coexisted with operational difficulty.

The open-ended responses generally supported these quantitative results and helped to confirm the characteristics of each reading medium.

Regarding background factors such as reading volume, reading habits, gender, and age, no clear differences affecting media evaluation were found. Because the bias in attributes was small, the

differences among the media can be interpreted as attributable to the features of each medium rather than to reader attributes.
Based on these findings, the prototype system partially incorporated the physical and emotional value of printed books, but usability issues sometimes reduced immersion and readability. Thus, at this stage, it can be regarded as an electronic reading medium that partially restores the physicality of paper; however, refinement of page operations and interface behavior is essential to realize its potential as a stable reading experience. The findings of this study indicate the importance of understanding reading experience from several perspectives, including physical, emotional, and practical aspects, and suggest that reading interfaces involving physical interaction may provide new value to digital reading.

V. CONCLUSION

This study focused on the role of page-turning actions specific to printed books and examined the relationship between physical actions and reading interfaces through reading experiments using a prototype system. The results showed that printed books, e-books, and the prototype system yielded distinct reading experiences, and printed books received the highest evaluations across multiple indicators, including comprehension, immersion, and comfort.
In contrast, the prototype system exceeded e-books in media specificity, suggesting that tactile page-turning may provide experiential value not present in e-books. The study also indicated that tactile feedback may help reduce reading fatigue, including by lowering perceived tiredness. Based on the study's findings, the prototype system did not fully replicate the experience of printed books, but tactile page-turning demonstrated the potential to create a unique reading experience distinct from that of e-books.
This study highlighted the importance of designing reading interfaces based on the physical aspects of reading and suggested the possibility of media that go beyond the dichotomy between paper and digital formats. It also suggested the need for further analysis that considers factors such as reading habits and genre, as well as the optimization of tactile feedback.

VI. LIMITATIONS

This study has several limitations. First, the participants were concentrated within a limited age range, and caution is required when generalizing the findings. Second, the prototype system had limited functionality, which may have influenced evaluations of its ability to reproduce the reading experience of printed books. Third, the study relied only on subjective evaluations of reading load and usability. Without objective data such as eye-tracking or log analysis, detailed reading behaviors could not be quantified. In addition, because the study used short stories under limited conditions, it remains unclear whether similar effects would appear in different genres or long-form reading. Long-term observational studies are also needed to examine how tactile interaction becomes established in the reading experience and how it influences reading over time. Furthermore, the experiments were conducted in relatively quiet environments that did not fully replicate everyday reading conditions, such as lighting and surroundings. To examine changes in experience during commuting or waiting time, broader experimental designs are required.

VII. DATA AVAILABILITY

The quantitative data supporting the study's findings (used for correlation and analysis of variance) are summarized in the manuscript. The original datasets, including questionnaire responses and qualitative free-text comments, are not publicly available due to ethical considerations and privacy concerns related to human participants, but are available from the corresponding author upon reasonable request.

REFERENCES

Reference to a journal publication:

[1] Matsumoto, K., &Yoshikata, Z. (2017). A questionnaire for evaluating interactive systems based on user experience (UX). Japanese Journal of Ergonomics, 53(2), 46–50. doi:10.5100/jje.53.46
[2] [Author’s translation; originally published in Japanese]

[3] Tomono, T. (2025). Recommendations for affordance perception research: Start from pi-number. Ecological Psychology Research, 17(1), 97–108. doi:10.24807/jep.17.1_97
[4] Watanabe, Y., &Yubune, E. (2025). Evaluation and consideration of an e-book system with page-turning functionality. Advances in Networked-Based Information Systems, 157–167.