CyberFrame: AI-Supported Hybrid Comics for Cybersecurity Awareness

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Figure 1: Three panels from a hybrid comic created by *CyberFrame*: While a user leaves his laptop unlocked when going for a coffee, a malicious actor seizes the opportunity to access private data and cause harm.

Abstract

We present *CyberFrame*, an AI-supported generator for hybrid comics about cybersecurity education, combining static comic panels with short animated transitions to support attention and understanding. Our solution is designed to make cybersecurity approachable by addressing the problem that many people lack everyday security and privacy awareness, increasing their vulnerability to digital threats. We evaluated the aesthetics and perceived usefulness of the generated hybrid comics in an online survey with $n = 20$ end-users, as they are the primary audience for awareness materials. Since the software is intended for expert use, we plan expert interviews as future work to assess usability and content quality. Our results suggest that hybrid comics are perceived as an engaging and appropriate medium for cybersecurity education, particularly when compared to traditional text-based approaches.

CCS Concepts

• **Security and privacy** → **Usability in security and privacy**; • **Human-centered computing** → **Interactive systems and tools**; • **Applied computing** → *Interactive learning environments*; • **Information systems** → **Multimedia content creation**.

Keywords

Cybersecurity, Education, Comics, Generative AI, User Experience

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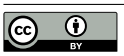
1 Introduction

Cybersecurity incidents affect everyday users, yet many people lack the awareness needed to recognize and respond to common digital threats. While technical safeguards continue to improve, human behavior remains a critical factor in many security breaches. Cybersecurity awareness training is widely used to mitigate those risks [10]. However, existing training materials can be perceived as boring or disengaging, which limits their effectiveness and user motivation [9]. From an HCI perspective, this raises questions about how security information can be communicated in ways that align with users' knowledge, attention spans, and everyday contexts. Prior research highlights the importance of engagement, narrative, and visual design in supporting learning and behavior change, particularly for non-expert audiences [1, 8, 10].



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In this work, we explore hybrid comics as an alternative medium for cybersecurity education that leverages visual storytelling and short animated transitions to convey security concepts in a more accessible, engaging way [2, 5, 7].

Our approach has two intended target groups: end-users who are supported in their cybersecurity literacy by generated hybrid comics, and cybersecurity experts and educators who can use the tool to generate content. In this poster, we approach the first target group and assess end-user perception of the concept and sample hybrid comics. We plan to interview experts in future work to assess usability and content quality.

Contribution Statement: This work introduces AI-generated hybrid comics as a novel format for cybersecurity awareness, combining static panels with short animated transitions. We present *CyberFrame*, an AI-supported generator for scalable content creation, and report findings from an online survey of perceived aesthetics and usefulness. Our results suggest the feasibility of hybrid comics for cybersecurity education.

2 Related Work

2.1 Visual Storytelling and Comics in Education

Media preferences depend on users' expertise: experts tend to prefer text-based materials, whereas novices benefit more from media-rich content, reporting higher usability and comprehension [8]. Hybrid comic films that integrate visuals, narrative, and audiovisual elements can facilitate deeper understanding and engagement than text or static comics alone, and may rival video-only formats when interactive and multimodal features are employed [6].

Hybrid comics are defined as media that embed static comic artwork within animated or digital environments using limited motion, cinematic techniques, and sound [5]. By bridging comics, animation, and interactivity, they expand engagement and learning potential. Still, producing hybrid or motion comics remains challenging for amateurs due to complex tools and workflows. Recent work shows that AI-assisted authoring can reduce cognitive load, streamline creation, and preserve narrative clarity through structured workflows and reusable animation patterns [3].

2.2 Comics for Cybersecurity Education

Comics and visual digital storytelling are effective for conveying complex cybersecurity concepts and supporting actionable cybersecurity awareness and collaborative learning [1]. A systematic review of 119 multimedia cybersecurity education tools highlights the diversity of media-based approaches and emphasizes the importance of designing for non-expert end-users [10]. Complementing this, interactive cybersecurity comics have outperformed text-only materials in comprehension, engagement, and retention by applying instructional design principles such as personalization, segmenting, signaling, and close text-visual integration [11].

2.3 Lessons Learned and Research Approach

Prior work shows that (hybrid) comics are a viable tool to foster cybersecurity literacy [1, 11]. Creating such comics is difficult but can be supported with AI workflows [3]. This has not yet been applied in cybersecurity, and it remains unclear how users would perceive the output and whether the topic can be conveyed properly.

With this work, we take a step towards addressing this gap by developing an AI-supported tool for hybrid comic creation and conducting a preliminary exploration with end-users. We do not yet engage the perspective of experts creating such hybrid comics with our tool, but look forward to discuss their needs and wishes in the poster session at CHI 2026.

3 System Architecture: Hybrid Comic Generator

We developed *CyberFrame* as an AI-supported generator for hybrid comics that integrates static comic panels with text and short animated transitions. Creators may generate a complete hybrid comic at once, or guide the creation process step by step by specifying and refining every detail. Each step is prompt-based, and prompts (e.g, for the characters or segments) are either generated automatically or provided by the human in the loop (see Figure 3b).

3.1 Design Goals

We aim to create an educational medium for low-threshold cybersecurity education. Hybrid comics can break complex topics into easy-to-understand chunks, while generative AI enables scalable, efficient production of such content.

3.2 Hybrid Comic Concept

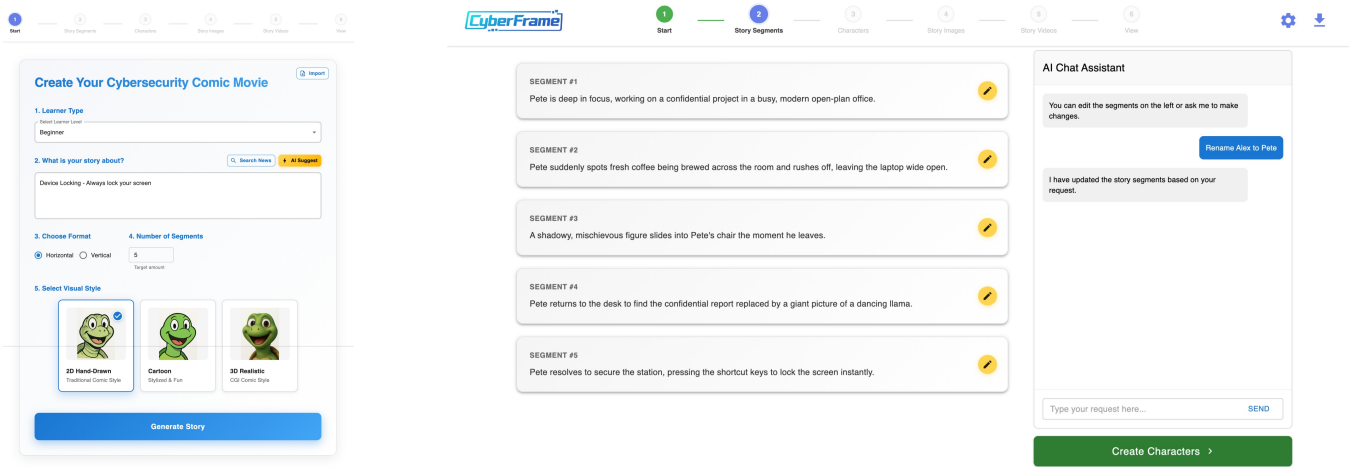
We represent each educational narrative as a hybrid comic combining static panels with short animated transitions. A hybrid comic created with *CyberFrame* consists of an ordered sequence of segments and transitions. Segments correspond to traditional comic panels and include narrative text, captions, and AI-generated images. They may feature recurring characters to support narrative continuity, and creators can refine individual segments by editing the underlying prompts. Transitions connect adjacent segments and are rendered as short video clips based on textual descriptions. Characters are defined independently and reused across segments and transitions to ensure visual consistency. Characters can be generated via prompts or customized using user-uploaded images.

3.3 AI-Supported Generation Pipeline

The generation process starts with a setup screen where creators provide basic inputs such as learner level (beginner, intermediate, advanced), topic, number of segments, and visual style (Figure 2a). Learner levels assume familiarity with cybersecurity topics, where a beginner level results in content that reflects basic cybersecurity concepts, while higher levels cover more complex or niche topics. The system then constructs an initial prompt to generate the hybrid comic. Creators may alternatively request an AI-suggested topic, in which case the prompt is adapted to the selected difficulty level. Text and image generation are handled via Replicate[1], while animated transitions are generated using Vidu[2]. Next, creators review and refine the generated narrative at the segment level (Figure 2b) through a chat-based AI assistant to match their intent.

The system then proposes a set of characters represented by images and textual descriptions (see Figure 5a). Creators can regenerate characters, refine character prompts, or upload custom

[1] https://replicate.com/
[2] https://platform.vidu.com/



(a) Setup Screen **(b) Story Segment Editor**

Figure 2: Narrative creation in *CyberFrame*: (a) Creators can either generate a complete story from minimal input or guide the creation process step by step by specifying learner type, topic, visual style, and narrative structure. (b) As a next step, creators can review and edit individual narrative segments of a hybrid comic, either manually or by interacting with an AI chat assistant that supports iterative refinement of the storyline.

images to personalize their appearance. Following character definition, creators configure the static story images for each segment (see Figure 3a). They can edit the featured characters, caption, story text, and image prompt, regenerate visuals, or upload custom images (see Figure 3b).

Creators can configure and adjust the animated transitions between segments in the story video view (see Figure 5b). The final screen presents the completed hybrid comic for viewing (see Figure 5c). Throughout the process, creators may return to earlier steps and iteratively refine any component.

3.4 Example Use Case

The Figures throughout this paper show the creation process of an example video on a beginner's level. The story consists of an office worker, Alex, who is writing a highly confidential report. When Alex left his workplace without locking his screen, a malicious intruder entered the scene and replaced the confidential report with a dancing llama. The final screen shows a simple yet effective countermeasure against these types of attacks: locking the screen.

4 Evaluation

Here, we summarize the methodology of a preliminary online survey conducted to evaluate the end-user acceptance of our hybrid comics.

4.1 Participants

We recruited 20 participants (11 identified as male, eight as female, and one did not specify). 13 participants were between 25–34 years old. Three participants were aged 18–24, one 35–44, one 45–54, and two were 55 or older. Participants' technical affinity was assessed using the Affinity for Technology Interaction (ATI) scale [4] (*Mean*: 4.12 on a one to six scale), indicating relatively high affinity.

Participants' education included high school degrees ($n = 5$), intermediate secondary school ($n = 2$), Bachelor's degrees ($n = 7$), Master's degrees ($n = 5$), and one doctoral degree. Disciplinary backgrounds included computer science ($n = 7$), humanities or social sciences ($n = 4$), natural sciences ($n = 2$), and six others.

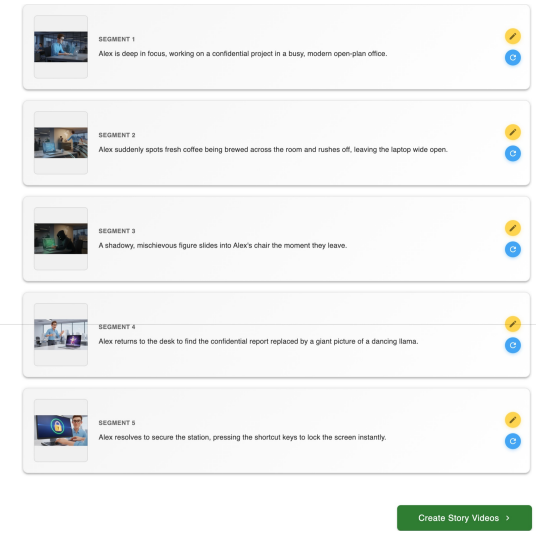
We asked participants to rate their general proficiency in cybersecurity on a three-point scale, aligned with the three levels of expertise offered in the prototype. Eight participants reported limited knowledge, eight reported medium knowledge, and four reported extensive knowledge. Participants further rated their knowledge in five different cybersecurity subfields on five-point Likert scales. They estimated their abilities in all categories slightly above average, ranging between three and five, except for their exposure to cybersecurity topics, which was rated with a mean of 2.25.

4.2 Procedure

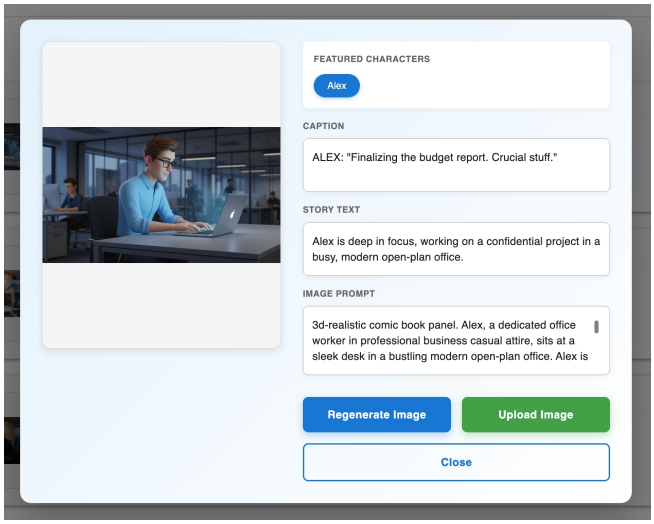
After providing informed consent, participants first completed a questionnaire assessing their proficiency with cybersecurity topics. They then completed the ATI scale, along with questions on their self-perceived cybersecurity awareness across different domains. Next, participants were shown three generated hybrid comics (one for each learner level). Afterwards, they rated perceived difficulty progression, the suitability for conveying cybersecurity content, interest in additional content in this style, and preferences compared to traditional text- and video-based learning materials.

4.3 Study Limitations

The study relied on a small, self-selected sample and focused on self-reported perceptions rather than objective learning outcomes. Future work will include controlled studies to assess knowledge gains and behavioral impact, as well as interviews with cybersecurity educators to evaluate suitability for real-world education.



(a) Story Image View



(b) Story Image Editing Dialog

Figure 3: Hybrid Comic Creation in *CyberFrame* after a narrative is established (see Figure 2): (a) Each story segment is paired with a corresponding AI-generated comic panel, allowing creators to review visual continuity and iteratively refine individual images before generating video transitions. (b) Creators can inspect and adjust individual comic panels by modifying captions, story text, and image prompts, or regenerate visuals to better match the intended narrative and educational context.

5 Results

As shown in Figure 4, participants generally evaluated the hybrid comics positively across all assessed dimensions (five-point Likert scales, 1=lowest, 5=highest, one participant provided no ratings). Participants agreed that hybrid comics are suitable for conveying cybersecurity content (*Mean*: 4.474, *SE*: 0.192) and preferred this format over traditional text-based materials (*Mean*: 4.368, *SE*: 0.244). Preference over traditional video-based materials was also positive, though slightly lower (*Mean*: 3.789, *SE*: 0.311). Participants reported that the three videos differed meaningfully in perceived difficulty (*Mean*: 4.368, *SE*: 0.205) and indicated interest in viewing further learning content in this style (*Mean*: 4.210, *SE*: 0.271), pointing to sustained engagement beyond the presented examples.

To assess whether responses differed across the five questions, we conducted a Friedman test, which indicated a significant overall difference among the statements ($p = .038$). Subsequent pairwise comparisons using Wilcoxon signed-rank tests with continuity correction revealed no significant differences.

6 Discussion

The results indicate a high acceptance by end-users of hybrid comics for cybersecurity education. Participants rated the format as well-suited for conveying cybersecurity content and expressed a clear preference over traditional text-based materials, with slightly lower but still positive preference compared to videos. This suggests that hybrid comics may occupy a middle ground between static and fully dynamic media, offering both accessibility and engagement.

Despite participants reporting varying levels of prior cybersecurity knowledge, the hybrid comics were generally perceived as appropriate and engaging. This suggests that the combination of short segments, visual storytelling, and security advice may support learners with limited prior knowledge, aligning with our goal of accessible cybersecurity education. The system's prompt-based design enables future personalization to different expertise levels.

We plan to conduct interview-based studies with cybersecurity educators and domain experts to assess the pedagogical and narrative quality of the generated hybrid comics. As the current tool was not designed for a specific target audience, it may be applicable across multiple user groups. We hope to discuss with attendees which other audiences (e.g., novices, professionals, or students) could benefit from similar approaches, and how our system could be adapted to these groups. Finally, we see one of the main advantages of our work in the opportunity to create personalized learning experiences. We invite discussion on how existing system features could be extended to support personalization, and how hybrid comics might be integrated into adaptive or individualized cybersecurity learning interventions.

7 Conclusion

This paper introduced *CyberFrame*, an AI-supported system for generating hybrid comics that combine static panels with short animated transitions to support cybersecurity education. By targeting everyday security and privacy awareness, *CyberFrame* aims to lower entry barriers to a complex and often intimidating topic and to reduce users' vulnerability to digital threats. Results from an initial survey with end-users indicate that the generated hybrid comics are perceived as engaging, aesthetically appealing, and well-suited for conveying cybersecurity concepts. Together, these findings suggest that AI-generated hybrid comics are a promising direction for accessible and engaging cybersecurity education.

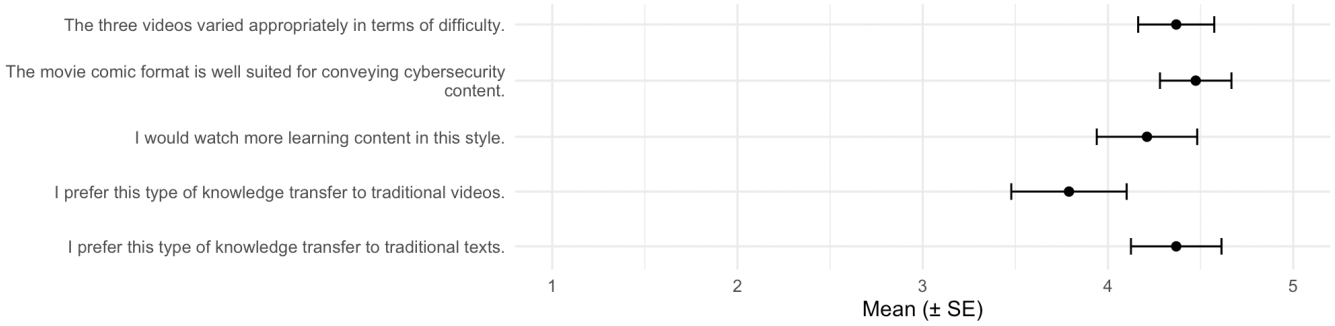


Figure 4: Mean participant ratings (± standard error) for survey statements evaluating the movie-comic video format. One participant did not rate the statements, resulting in data from 19 participants. Responses (Likert scale 1–5) indicate generally positive perceptions: participants agreed that the videos varied appropriately in difficulty, that the format is well-suited for conveying cybersecurity content, and that they would watch more learning content in this style. Preference for this format was stronger compared with traditional texts than with traditional videos, though still favorable overall.

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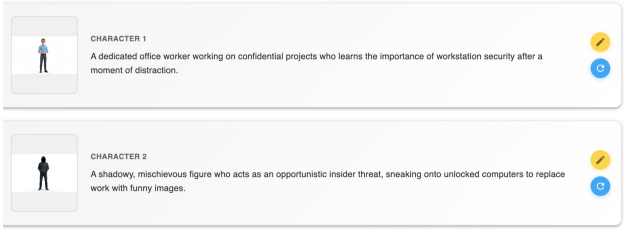
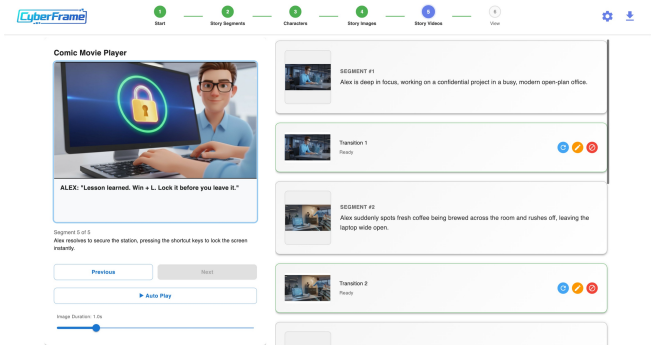
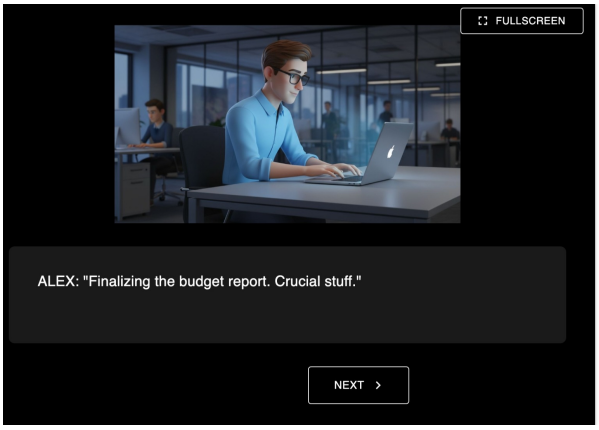


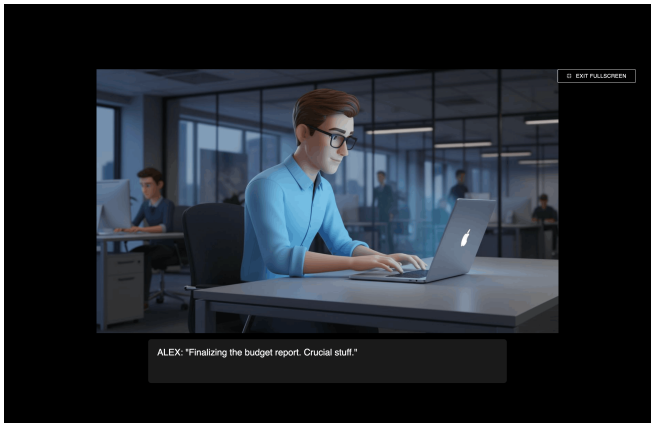
(a) Character Definition View



(b) Hybrid Comic Playback and Transition Overview



(c) Final Viewing Mode



(d) Example frame from a generated hybrid comic

Figure 5: Overview of further interface steps in *CyberFrame* not shown in the main body of the paper: (a) In the Character Definition View, users define and edit recurring characters, including their narrative roles and visual representations, which are reused across story segments and transitions to ensure visual and narrative consistency. (b) Static comic panels are combined with short animated transitions, allowing creators to preview, reorder, and adjust timing before viewing the final hybrid comic. (c) Creators experience the completed cybersecurity story as a sequence of static comic panels with captions and integrated transitions, presented in a focused, fullscreen-style player. (d) The final output consists of comic-style panels presented with an overlaid caption, illustrating how narrative text and visuals are combined during playback.