Visual Literacy in 3D Printing Slicer Interfaces: A Design-Led Study

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Abstract

3D printing has become an integral tool within contemporary design practice, enabling designers, makers, and students to translate digital concepts into physical artifacts. Slicer software interfaces play a critical role in this process by mediating between digital models and fabrication through visual representations of layers, toolpaths, material behavior, and print parameters. As slicer workflows grow more complex, users are increasingly required to interpret dense visual information in order to make timely and accurate fabrication decisions. Many users face persistent challenges in reading and understanding slicer visualizations, particularly when navigating layer previews, infill structures, support systems, and parameter adjustments. These challenges often slow down workflow, increase trial-and-error printing, and contribute to material waste. The issue is not solely technical, but visual: current interfaces frequently rely on abstract or poorly structured visual cues that exceed users' levels of visual literacy, limiting efficient interpretation of fabrication data. This study adopts a design-led approach to examine how slicer interfaces communicate fabrication information and where breakdowns in visual comprehension occur. Through qualitative analysis of widely used open-source slicer software and UX-focused evaluation of key visual elements, the research identifies recurring issues such as weak visual hierarchy, insufficient contextual feedback, and unclear relationships between settings and their physical outcomes. The paper proposes integrating adaptive, AI-driven systems to improve visual communication, guide user attention, and accelerate decision-making within slicer workflows. By enhancing visual interpretation rather than replacing user agency, slicer software is reframed as a visual communication system within UI/UX design, digital fabrication, and emerging computational practices

Index Terms

Additive Manufacturing; 3D Printing Slicer Interfaces; Artificial Intelligence; Visual Literacy; Human–AI Interaction; User Experience Design