Decolonizing Computer Science: Holograms in Holborn

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Abstract

This paper describes "Holograms in Holborn": a speculative design of an interactive holographic experience to engage people in reflection on decolonization in their everyday life. Specifically, the goal is to produce a speculative design which encourages people to apply foresight in considering colonial biases whilst going about their everyday activity on campus, at the University of the Arts London in High Holborn. The design uses 3D holograms, gesture-controlled maps, voice navigation, and 360-degree movement for immersive learning. It also draws inspiration from depictions of holograms from film. An iterative process was followed balancing the design goals to i) create an engaging experience, ii) encourage foresight in everyday experience and not just one time reflections, and iii) be inclusive in its interaction design. The paper explores possibilities for creating inclusive, community-driven digital experiences that challenge colonial legacies.

CCS Concepts

• **Human-centered computing → Human computer interaction (HCI)**; • **Applied computing → Arts and humanities**.

Keywords

speculative design, decolonization, colonisation, interactive art, design fiction, reflection

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1 Introduction

Colonialism is a historical and ongoing process through which powerful nations and cultures impose their dominance over others, often leading to significant economic, social, and cultural changes [2]. Computer Science has been characterised as a colonial system [1], often designing technology for specific cultural and social contexts, without regard for local needs or conditions in other parts of the world.

In this paper, we explore how colonialism has influenced computer science through the speculative design [3, 5] of an interactive system. Our idea was to create an immersive and engaging experience using hologram technology to encourage users to critically reflect on their everyday use of technology around the office campus in High Holborn, London. We worked with three key design criteria:

- **D1 (Engagement):** To create an interactive design where visitors will want to engage with it.
- **D2 (Everyday Foresight):** We want people to consider issues of colonialism for technology in their everyday activities, not just spark their one-time reflection or simply raise awareness.
- **D3 (Inclusivity):** To consider inclusivity and diversity in its interaction design.

Over several weeks we proposed and adapted our designs, following a design crit format [9], responding to feedback from our lecturers, expert guests, and our peers. Below we document our key findings from the iterations (Sections 2 to 5) before reflecting on our final speculative design (Section 6).

2 Iteration 1: Initial Ideas

Our initial inspiration was drawn from films which depicted futuristic and interactive holographic interfaces, helping to shape our vision of an installation that would not only inform but also captivate users through visually striking and engaging elements. Minority Report [15] and I, Robot [13] influenced our decision to use holograms for gesture-based interactivity. Blade Runner 2049 [16], Avatar [4], and Jurassic Park [14] also showcased how lifelike visuals could be used to educate and immerse audiences cf. D1 (Engagement).

Given this, we initially designed some key technological components for our immersive experience: i) 3D holograms to showcase

cultural and historical content, ii) a responsive map controlled by hand gestures for exploring decolonial histories, iii) voice control and eyetracker for navigation and interaction, iv) and 360° movement where users could walk around and engage dynamically. The key idea was that users could navigate around the **responsive map** and select areas of the map to then show **digestible information** related to issues of colonialism in computer science. This collection of ideas can be shown in Figure 1.

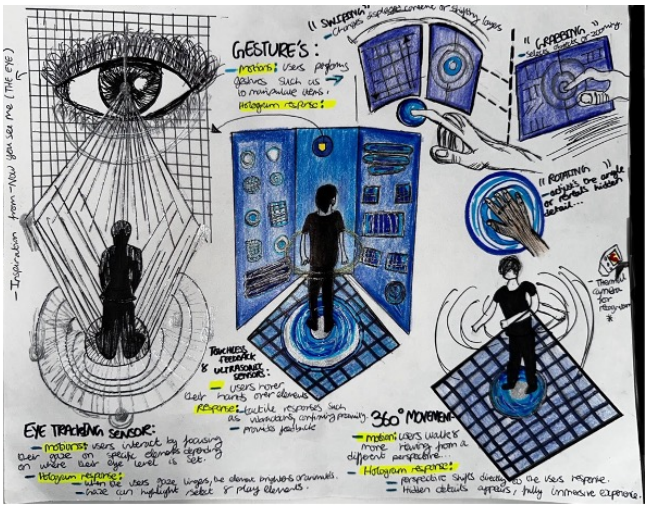

Figure 1: Sketches of the hologram prototype

A key reason for choosing holograms was their ability to support our design goal of engagement (D1). We felt that holograms were immersive and visually compelling, naturally drawing in users and making the learning process more interactive. Rather than the technology itself enabling reflection on colonialism's impact, we designed the experience to guide users in making these connections also cf. D2 (Everyday Foresight). The accessibility of holograms, in this context, lay in their intuitive, hands-free interaction and their ability to present complex historical narratives in a format that felt modern and engaging. We also felt that the opportunities to use holograms could align with the brief's goals of fostering meaningful reflection and ensuring inclusivity through customisable settings and diverse perspectives cf. D3 (Inclusivity). This made holograms seem like an ideal choice to engage a broad audience and address the intersection of colonialism and technology effectively. However, at this stage our approach was still not completely refined and was open ended – we simplify our approach in later iterations, to ensure that the final design remained feasible while still delivering an impactful educational experience.

3 Iteration 2: Usability

After receiving feedback from the first iteration, we identified key interaction design concerns that needed to be addressed. Primarily, our initial design was too focused on technology, i.e., we created a large list of technology features, without fully considering how users would actually engage with them. Additionally, we were advised to ensure that our system was seamlessly integrated into everyday activity in High Holborn, rather than requiring deliberate effort to engage with, to spark everyday reflection.

Therefore, we refined gesture-based interactions by limiting the number of movements needed. We focused on three primary actions: swiping to navigate, pushing forward to select, and rotating to adjust the view. According to research in gesture-based UX, limiting interaction options helps users execute commands more easily [11]. To further accommodate users, we thus added animated gesture icons, ensuring that they understood how to interact with the holograms without additional explanations.

Another major improvement was the removal of AR and eyetracker integration, which were initially included as additional features but were identified as scope creep that made the interaction less smooth. Instead of switching between physical and digital interfaces, we focused our design on a single, seamless interaction. We also refined haptic feedback by integrating subtle mid-air vibrations to confirm inputs. Meta [10] suggest that tactile feedback enhances user confidence, particularly in non-physical systems like holograms. By adopting a user-centred approach rather than focusing on technology, we made the interaction more natural and engaging.

4 Iteration 3: Inclusivity

The feedback from the previous iteration emphasised the need to ensure that the system was inclusive and accessible to all users, including those with disabilities. Research into accessibility and inclusivity raised concerns about our interaction features potentially excluding people who might be overwhelmed by instantaneous engagement and need more time to process their movements [7]. We decided to make this feature optional and also include a loading box to help people feel more assured in their actions – providing them with time to process the effects of their movements.

We were also challenged by our gesture-based controls creating barriers for users with limited mobility, as highlighted in a study by Yamagami et al. [17], which stated, "to combat fatigue, participants performed 51% of gestures with their hands resting on or barely coming off their armrest" when asked to design personalised gesture sets. This allowed us to identify that our gesture-based controls were centering able-bodied people and might not recognize the unique gestures of those with mobility impairments. The option to interact using the physical kiosk allows for a less physically demanding experience, with minimal need for movement. It would be specifically designed with features to accommodate those with physical impairments, as identified in a study by Lee et al. [8]. The kiosk would eliminate the need to walk around, as required with the hologram, and be adjustable by height so those in wheelchairs could comfortably interact.

5 Iteration 4: Paper Prototype

To further explore our design, we created a low-fidelity prototype. The cardboard model (Figure 2) was designed to represent an interactive holographic projection system. The model features a 3D map displaying continents—South America, Africa, and Asia—highlighted in different colours to signify their inclusion in the hologram display. Below the map, cylindrical paper "buttons" symbolise interactive features, demonstrating how users might engage with the

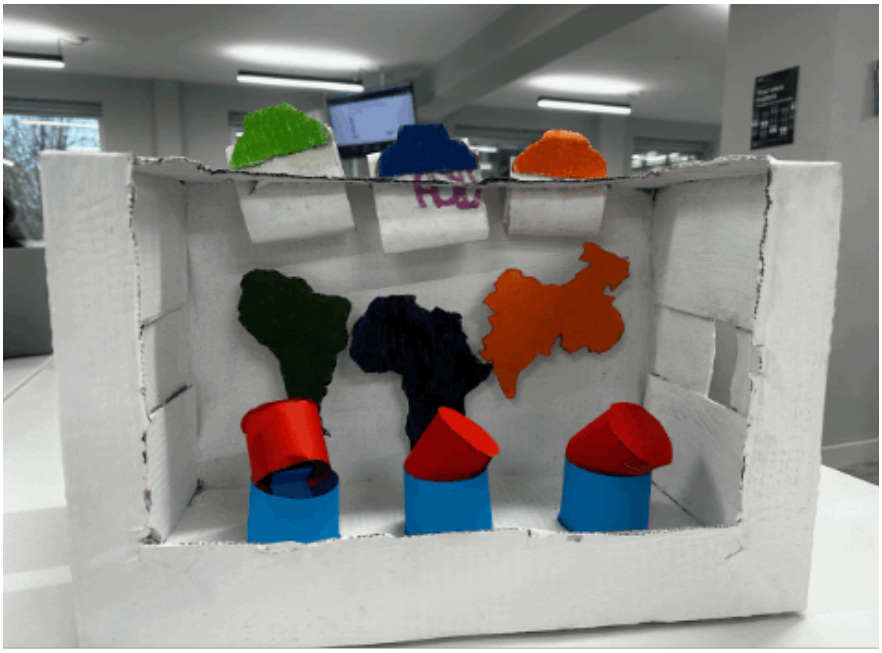

Figure 2: Paper prototype of hologram map with buttons.

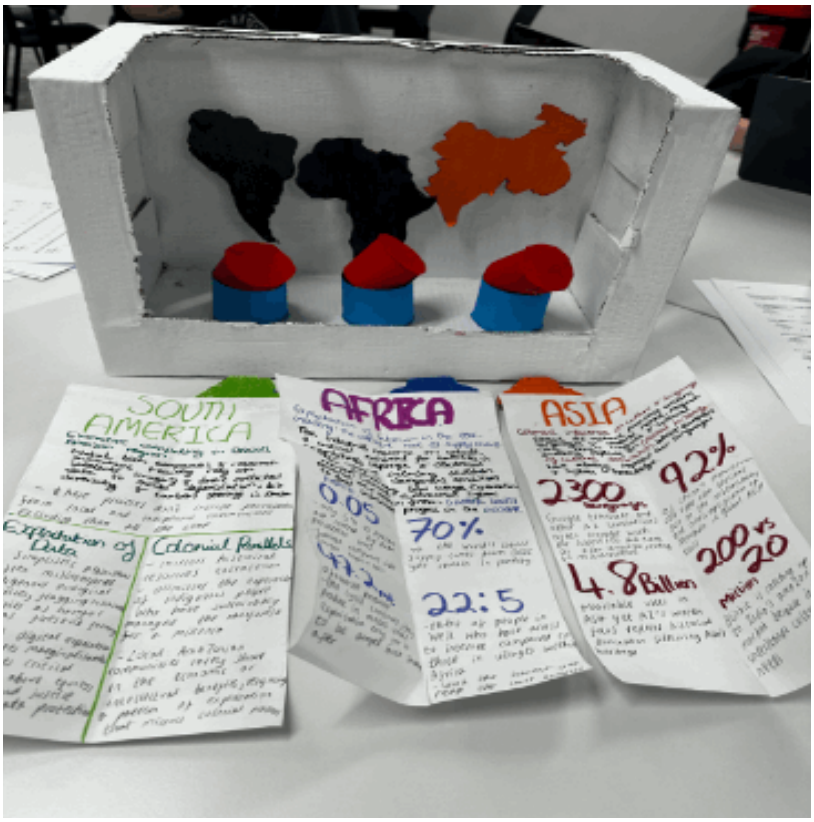

Figure 3: Paper prototype of information output from holograms.

hologram by selecting specific areas. Additionally, rolled-up sheets of paper beneath (Figure 3) the map represent information about colonialism and related themes. These emulate printed receipts, symbolising how the hologram might deliver tangible, interactive data to users, blending visual and textual storytelling about topics like data exploitation, historical narratives, and tech colonialism. This prototype emphasises user engagement with educational content through an immersive and intuitive medium.

During this crit we asked our classmates to interact with the system to mimic how its real-world use might occur, and asked them to give feedback using the reflection in creative experience questionnaire [6] cf. D2 (Everyday Foresight) and the user engagement questionnaire [12] cf. D1 (Engagement). Data collection was covered by the university ethics board.

The feedback received from our in-class surveys suggested that our project prototype performed strongly in usability (average 4.75 out of 5), while the weakest score was focused attention (average 3.25 out of 5). This made sense as we prioritised short engagement for everyday use and not longer, more focused engagement. Users could navigate the system intuitively, but the breadth of information may have made it overwhelming, potentially, making it difficult to sustain user attention. The metrics from the reflection in creative experience questionnaire all had a wide variety of responses. This suggests that while some users found the hologram to invoke deep reflection, others struggled to engage to the same extent. This disparity could come from individual differences in learning styles so to improve we would refine our information to make it more digestible to ensure accessibility for a wider range of users. Our sample size was small and it was an early examination of our hologram - so we take these findings as suggesting directions to further explore rather than as generalisable certainties.

6 Discussion

Our project centered on developing an educational holographic system to explore the intersection of colonialism and technology. Holograms, as three-dimensional visual projections, were chosen for their ability to create an engaging and immersive user experience. Over multiple iterations, we refined the design by incorporating feedback, improving key elements such as visual impact, interactivity, and accessibility while removing unnecessary complexities.

Reflecting on this process, we believe our project successfully met our initial design goals. While we started with a flexible concept and explored new technologies on the go, the positive feedback from demonstrations validated our approach. The project effectively balanced innovative ideas with educational objectives, ensuring a meaningful user experience. Indeed, the design decisions reflect a balance between addressing feedback and maintaining the project's core purpose. While we excluded many ideas to streamline the design, such as removing the eyetracker interaction, others were emphasised to enhance user engagement. The holographic system represents a thoughtful integration of technology and narrative, aimed at educating users about the historical and ongoing implications of colonialism in a compelling and interactive way.

Our initial ideas for our design seemed too "technology-first" and we considered whether alternative approaches, such as physical installations, might have been more suitable. However, the choice to prioritise technology was deliberate, as the project seeks to address colonialism through the lens of human-computer interaction. By leveraging holographic technology, we challenge traditional methods of presenting historical narratives, recontextualising them in a way that is both engaging and accessible. This aligns with our brief to explore how colonialism has shaped computer science and to propose ways of using technology to address historical inequities.

One lesson learned is the importance of grounding design within the constraints of current technological accessibility. By envisioning the project in a future technological context, we unintentionally overlooked some present-day practicalities. Next time, we should focus more on integrating technologies that are readily available, ensuring the system remains accessible and feasible for current users. This adjustment would make the design more practical while maintaining its educational impact.

In conducting research on colonialism and technology across multiple parts of the world, we assumed that presenting our findings would be straightforward. However, it was challenging to balance depth and digestibility. It was difficult not to get carried away with the vast amount of information, as we wanted to ensure factual accuracy while also identifying captivating statistics that sufficiently conveyed the weight of colonialism. Condensing our extensive research into a visually compelling and easily understood format was more difficult than anticipated. We had to mindfully simplify and structure our design to make it engaging and numerical without losing its significance.

Furthermore, the physical construction of our design was difficult. Making it visually appealing and functional required meticulous craftsmanship, particularly in cutting cardboard safely and precisely to assemble intricate features such as push buttons and information receipts that could be pulled out.

We mistakenly thought that developing an idea and bringing it together creatively would be difficult, but this process unfolded naturally over time through iterative development. Each iteration refined our concept, and as we continued iterating, the hologram idea evolved smoothly. Similarly, we expected the coding aspect to be challenging, but after exploring reference codes and YouTube videos, we found setting up the code to come innately, aside from the mapping component, which required more dedicated time. Deciding on our prototype's execution and selecting which continents to focus on also came naturally, as we gravitated towards the regions we were most passionate about. The weekly feedback process and responding to critiques helped us continuously refine our work to make necessary improvements. Initially, we were concerned that avoiding scope creep would restrict our creative flow. However, we found that having a more focused approach enhanced our creativity and increased the clarity and impact of our design without convoluting our prototype.

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