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# HAUS Horizons in Architecture and Urban Studies Journal

**Horizons in Architecture and Urban Studies Journal** is dedicated to innovative research in the field of architecture and urbanism by providing a platform for high-quality, peer-reviewed research in architecture, urban studies, and interdisciplinary domains. The journal welcomes contributions that address Architectural and Urbanism research in the following areas:

1. **Design and Theory:** Theoretical explorations and critical analyses of the built environment and design methodologies.

2. **Educational Approaches:** Innovations in education theories and practices and pedagogical strategies.

3. **History and Conservation:** Historical studies of architecture, preservation, and conservation of heritage.

4. **Sustainability:** Research on sustainable design principles and practices, economic, social, and environmental sustainability, and green building technologies.

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# Stop Pretending AI is a Choice: The New Reality of Digital Memory

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PRESPECTIVE PAPER

## Abstract:

The cultural heritage sector, and especially the field of memory studies, is currently stuck in a cycle of denial. Artificial intelligence fundamentally changes the reality of how art and history are produced and saved. At the same time, the most common response from scholars and curators has been fear and outrage. Walk into the fine arts department or flip through the latest issue of the Cultural Memory Journal, and you will find people obsessed with drafting essays against tech companies. We hold tightly to the outdated idea of human purity.

**Keywords:** AI Denialism, AI Skepticism, AI Ethics.

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The cultural heritage sector, and especially the field of memory studies, is currently stuck in a cycle of denial (Spennemann, 2024). Artificial intelligence fundamentally changes the reality of how art and history are produced and saved, as AI can now generate hyper-realistic but entirely fabricated historical artifacts and documents. Walk into the fine arts department or flip through the latest issues of some academic journals, and you will find many papers against tech companies or at least skeptical of AI output and impacts (Flenady & Sparrow,2026). We hold tightly to the outdated idea of human purity.

This institutional resistance is framed as a noble defense of human creativity and historical truth, as a position of moral superiority. On the other hand, it risks becoming a potential barrier to further advances in the field.

Let us start with clearing up the main illusion of AI denialists. There is a belief that we can choose not to participate. Memory scholars often treat AI as a negative trend or an untrustworthy assistant, fearing that algorithmic generation threatens authentic human governance of the past (Schuh, 2024), so we can politely refuse to use it. But AI is not a passing fad. It is a permanent shift in how the world operates. The integration of AI into art creation and archiving is not a debate waiting to be settled. It is an economic and technological reality that is already here / that is here to stay.

Look at the everyday reality of modern archives. We are currently drowning in data. A cultural institution is sitting on a mountain of unsorted digital files and a deteriorating hard drive. The money required to pay a human archivist to manually sort and save all these items does not exist. Decades of severe budget cuts have ensured that most museums and historical societies are barely surviving.

When a journal or museum refuses to use a machine learning tool to sort and save a collection out of fear of algorithmic bias, what is the actual result? That collection sits in a dark room, inaccessible and completely forgotten. Total invisibility is a far worse bias than a machine making a small sorting error. Gatekeepers in our field would rather let collections rot in the name of human-only purity than save them with a computer. A decaying, uncatalogued historic photograph is no more authentic just because AI has not touched it. It is simply dead.

Hypocrisy within memory study is especially frustrating. Scholars in this field built their careers on the idea that human memory is not a perfect recording. It is an active process that constantly changes and reshapes the past. Yet the moment machines help us with this process, these same scholars panic. Looking at the history of the field as a media theorist, Wendy Hui Kyong Chun pointed out in her book Discriminating Data that our digital archive is not just a passive storage box (2021). Rather, it is an active digital process. Cultural memory is already deeply tied to the computer. Denying this reality and stubbornly demanding that memory must only involve the unassisted human mind is to willfully ignore the digital world we actually live in.

The biggest danger of this denial is not only that artists look old-fashioned or that archives stay disorganized. The true danger is that through boycotting AI, the cultural sector gives up its voice. Silicon Valley loves our boycott. When historians and artists refuse to engage with AI, big tech companies breathe a sigh of relief so that they do not have to listen to us. If the cultural sector steps out of the room, tools that will inevitably organize and save cultural memory will be built entirely through a software engineer who thinks curation just means compiling a Spotify playlist and that memory is just a hard drive.

This brings us to the core of what responsible use actually means. We cannot create a special framework for responsible AI while claiming that an ethical amount of AI is zero. Abstinence-only education does not work for teenagers, and it is a terrible approach to technology policy.

If we want AI to respect historical facts and archival rules, archivists must help train an alternative model. We need to explore how AI can bring complex digital artwork back to life for new audiences. This is not just about talking about it theoretically, but actually working with software and testing limits.

What is at stake here is not just about protecting the pride of the creative artists and the academic class. It is about who gets to build the future of human memory. AI is not a neutral tool, but refusing to use it is not neutral either. Current gatekeeping practice is silently handing over the keys of digital heritage to a profit-driven tech monopoly simply because we find technology uncomfortable.

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It is time for the community of memory studies and the broader art sector to drop the pure-and-perfect act, to stop waiting for technology to go away, to stop pretending that a boycott is a substitute for strategy. The algorithm is already inside the archives. The only question left is whether we are going to let Silicon Valley dictate how it operates or whether we are finally going to roll up our sleeves and take control.

## References:

Chun, Wendy Hui Kyong , and Alex Barnett. 2021. Discriminating Data: Correlation, Neighborhoods, and the New Politics of Recognition. MIT Press. https://doi.org/10.7551/mitpress/14050.001.0001.

Flenady, Gene, and Robert Sparrow. 2025. "Cut the Bullshit: Why GenAI Systems Are Neither Collaborators nor Tutors." Teaching in Higher Education 31 (1): 163–72 . https://doi.org/10.1080/13562517.2025.2497263.

Schuh, Julien. 2024. "AI As Artificial Memory: A Global Reconfiguration of Our Collective Memory Practices?." Memory Studies Review 1 (3): 1–25. https://doi.org/10.1163/29498902-202400012.

Spennemann, Dirk H. R. 2024. "Will Artificial Intelligence Affect How Cultural Heritage Will Be Managed in the Future? Responses Generated by Four genAI Models." Heritage 7 (3): 1453–71. https://doi.org/10.3390/heritage7030070.

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# Adapting in Situ: Observational Insights from a Field Workshop on a Continuously Inhabited Nubian Island, Aswan

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## Abstract:

Heisa Island is a small Nubian settlement in the Nile near Aswan that, unlike most of Nubia, was never relocated when the Aswan High Dams reshaped the river. Rather than being displaced, its community adapted in place — moving to higher ground and reorganizing settlement, livelihood, and daily life around a heavily regulated river. This paper draws on a one-day observation-first field workshop held on the island as part of the River Cities Network (RCN) "Rivers in Transition" meeting. Working across three thematic lenses — living heritage and local economy, the Nile edge and ecology, and everyday spatial systems and access — an international group of researchers documented how resilience on Heisa emerges through incremental, community-driven adaptation rather than formal planning. The findings position Heisa as a case of vertical adaptation in situ and argue that long-term socio-cultural adaptation to river change is frequently invisible to conventional planning frameworks. We conclude with transferable insights for other river cities confronting living heritage, governance gaps, and regenerative futures.

**Keywords:** Rivers in Transition, Nubian heritage, in-situ adaptation, Heisa Island, Community Resilience, Participatory Observation, Aswan.

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## 1. Introduction

Rivers worldwide are undergoing rapid transitions driven by human interventions and intensifying climate change. These transitions are not only hydrological and ecological; they are also deeply social and cultural, reshaping how communities live with the water that sustains them. The River Cities Network (RCN), established at the International Institute for Asian Studies (IIAS), Leiden University, advances ecologically and socially inclusive regeneration of rivers and the neighborhoods that co-exist with them. Its second face-to-face meeting, "Rivers in Transition," was convened in Aswan in 2026 with the Arab Academy for Science, Technology and Maritime Transport (AASTMT) as local partner.

This paper reports on one component of that meeting: A field workshop on Heisa Island. Heisa offers a rare and instructive case. The transformation of Nubia unfolded across successive stages of river engineering. The Aswan Low Dam, first built between 1898 and 1902 and later raised in 1912 and again in 1933, progressively submerged cultivable Nubian land and, over that thirty-five-year period, displaced fifteen villages upstream. Decades later, the Aswan High Dam, completed in the 1960s, submerged much of the remaining Nubian heartland. The reservoir created by the High Dam required the relocation of at least 100,000 Nubians, with 48,000 Egyptian Nubians resettled between October 1963 and June 1964 (T. Scudder 2016). The staged submergence of Nubia is documented in detail (Abubakr 2021). The residents of Heisa remained, adjusting their settlement upward and inward rather than abandoning it. The island, therefore, allows us to observe what river transition looks like when a community stays, adapts, and persists over generations. Our central question is simple: what does Heisa teach us about long-term adaptation to river change that formal planning often misses?

## 2. Heisa Island: Location and context

Heisa is a small Nubian island roughly two kilometers long, lying in the Nile between the Philae Temple complex and the Aswan Dam in the Aswan Governorate of southern Egypt. It is home to a Nubian community of approximately 2,000 residents and is one of the very few Nubian settlements that remained continuously inhabited through twentieth-century river engineering (Soto 2026).

While large areas of Nubia were submerged and entire communities relocated, the residents of Heisa chose to adapt *in situ* by moving to higher ground on the island. This decision preserved a continuous relationship with their land, river, and cultural practices, making Heisa a rare example of vertical adaptation rather than displacement within a heavily regulated river system (Bakry 2015). Vertical adaptation, here, refers to the process through which communities modify the vertical organization of buildings and everyday activities to accommodate changing environmental conditions—particularly fluctuating water levels and flood risk—allowing continued occupation while reducing exposure to hazards. Such adaptations may include raising floor levels, constructing additional upper floors, relocating key domestic functions to higher elevations, or altering the relationship between buildings and the ground (Atmodiwirjo et al. 2025).

### 2.1. River transition and historical change

River management has historically been dominated by technical and engineering-based approaches, with river restoration and flood management projects tending to prioritize hard infrastructure and hydrological control over social and cultural dimensions of river-community relationships (Cook and Spray 2012; Rahaman and Varis 2005).

Table 1: Selected case studies of displacement and adaptation in river management contexts.

| Case | Context | Key Finding |
|---|---|---|
| **Tokwe-Mukosi flood resettlement, Zimbabwe** | Forced resettlement following the 2014 dam-related flooding | State power exercised through local government and security institutions shaped resettlement outcomes, often furthering political and economic agendas over community welfare (Mucherera and Spiegel 2022) |
| **Char (riverine island) communities, Bangladesh** | Communities repeatedly displaced by riverbank erosion and flooding | Displaced households face severe livelihood disruption (food shortage, unemployment, housing loss); local adaptation strategies are constrained by lack of land tenure and financial resources (Hossain et al. 2022) |
| **Vanuatu at-risk coastal households** | Community preferences regarding climate-related relocation vs. adaptation | The majority of households prefer in-situ adaptation, viewing resettlement that preserves cultural and livelihood practices (Perumal 2018) |
| **Tisza River Basin, Hungary** | Flood management and participatory governance | Demonstrates application of adaptive management and participatory modeling to bridge science, policy, and local community knowledge in river governance (Halbe et al. 2013) |

The case studies summarized in Table 1 largely reinforce this displacement-centered emphasis: much of the empirical record documents communities that were relocated, or that cycle repeatedly between displacement and return, rather than ones that adapt continuously in place. The Vanuatu case is a partial exception, showing a documented preference for in-situ adaptation, but even their resettlement remains the analytical endpoint against which adaptation is measured.

The transformation of Heisa is inseparable from the broader hydrological and territorial restructuring of the Nile. Dam construction altered water levels, sediment flows, agricultural productivity, and mobility (Abd-El Monsef et al. 2015). Productive farmland was lost, traditional river-based livelihoods were disrupted, and the island's ecological balance shifted permanently (Abd-El Monsef et al. 2015; Fahīm 2013). Unlike the communities relocated to planned resettlement villages, Heisa remained inhabited within the Nile system. Over time, residents adapted their homes, settlement patterns, and everyday practices in response to environmental change and limited land availability. These adaptations appear to have been largely incremental, drawing on local knowledge, kinship networks, and community initiative rather than comprehensive formal planning (Fahmy 2004; T. Scudder 2016).

### 2.2. Living heritage and social fabric

Heisa retains a strong Nubian cultural identity reflected in its vernacular architecture, decorative traditions, language, and enduring social practices. As in many Nubian communities, built forms and public spaces continue to support kinship-based social interaction and the expression of cultural identity (Bayoumi 2018; Y. Shedid and I. Hassan 2019). Houses are often vividly painted, and social life remains tied to extended family networks and collective practice.

In recent decades, this heritage has itself increasingly become a source of livelihood. Many households have adapted parts of their homes for guest accommodation or offer river-based and cultural tourism experiences (field observations, 2026). While tourism has diversified local incomes, it has also increased dependence on a highly seasonal and externally sensitive sector, raising questions about cultural commodification, infrastructure capacity, and the long-term sustainability of heritage-based development (Ma et al. 2021; Zhang et al. 2024).

## 3. The field workshop: Approach and method

The Heisa workshop was deliberately designed around an observation-first approach rather than intervention or prescription. Participants, an international group of RCN researchers and practitioners, were asked to read the island as a living river landscape: to notice how space is used, how the river helps or harms daily life, and how residents adapt informally. Ethical engagement guidelines framed the day, emphasizing respect for a resident community that is not a museum exhibit but a home.

The program moved from collective observation to focused analysis. After a short boat arrival and an opening briefing, all participants walked one

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zone of the island together, observing paths, public spaces, and river edges. A period of individual reflection followed, in which participants marked observations on base maps and formulated key questions. Participants then split into three thematic groups, each producing a short brief and a mapping workshop board, before presenting to the plenary and reflecting collectively on transferable lessons.

Each group observed, focused, and analyzed the island through one thematic lens, organized around a single guiding question. Group 1 (Living Heritage, Livelihoods & Local Economy) asked how Nubian cultural practices and local livelihoods co-evolve to sustain identity and economic survival under river transition. Group 2 (Nile Edge, Ecology & Environmental Resilience) examined how the relationship between community and river is being reshaped, and how ecological resilience might be strengthened. Group 3 (Everyday Spatial Systems & Access) explored how spatial conditions and mobility shape daily life, access to services, and social interaction.

**Figure 1: Photos of the groups while working on the boards at the Aro Kato Nubian Guest House.**

**Figure 2: Plenary presentation at the Aro Kato Nubian Guest House: a thematic group shares its annotated findings during the closing session of the Heisa workshop.**

## 4. Findings: Reading the island

Across the three lenses, a consistent picture emerged of a community adapting continuously and resourcefully, often filling gaps left by formal systems. The observations below synthesize the groups' field notes and outputs.

### 4.1. Living heritage and local economy

The first lens found culture and economy tightly interwoven. Houses are adapted to the landscape, and tourism has produced a new building type (the guest-house dwelling) alongside modified internal layouts. Crucially, the local people are themselves the investors: regeneration on Heisa is largely self-financed and self-directed rather than externally imposed. Heritage here is mostly lived rather than performed, although the line between authentic daily practice and cultural product is increasingly negotiated as tourism grows. Artisan women sellers and small-scale hospitality were identified as emerging economic actors, while traditional livelihoods such as agriculture and fishing appear more fragile.

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The group flagged a central tension: the same heritage that sustains identity is becoming an economic resource, raising questions of commodification and of whose aspirations, especially among youth, will shape the island's future.

In Figure 3, the participants made this collaborative workshop board, which explores the concept of living heritage by identifying cultural practices that are adapting, disappearing, or remaining stable within the community. Participants organized ideas using color-coded sticky notes, highlighting themes such as traditional building techniques, natural crafts, language preservation, tourism, resilience, and sustainable livelihoods. The board also outlines future research questions, emphasizing the relationship between heritage conservation, local development, and community resilience.


**Figure 3: Participants collaboratively mapped elements of living heritage, identifying cultural practices that are adapting, disappearing, or remaining stable (Enhanced and edited by authors).**

## 4.2. Nile edge, ecology and environmental resilience

The second lens reads the interface between land and water. Observers noted considerable greening along the riverbanks but limited green space within the settlement, and a microclimate shaped by intense heat; thick-walled houses, open roofs, and a daily rhythm in which activity drops during the hottest hours. The island functions, in places, almost like the margin of a lake rather than a flowing river, a direct legacy of upstream regulation.

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Waste management surfaced repeatedly as the dominant environmental constraint: plastic waste is visible, sanitation infrastructure is limited, and collection depends largely on boats and tuk-tuks. Yet residents also demonstrate environmental care; controlled waste practices in many areas, improvised protection of young plants and small farms, a strong cultural connection to the palm tree, and even the practice of welcoming migrating birds with food. The group concluded that ecological resilience on Heisa is real but informal, low-tech, and unevenly distributed.

In Figure 4, the participants made this workshop board, which presents a participatory mapping focused on the High Dam, river ecosystems, and surrounding communities. Using drawings and multilingual sticky notes (English and Arabic), participants identified environmental concerns, agricultural practices, endemic plant species, tourism opportunities, waste management, and water-level changes. The visual map illustrates the interconnected nature of ecological, cultural, and economic systems while encouraging community-driven solutions for sustainable river management.


**Figure 4: A participatory mapping by group 2, illustrating community perspectives on the High Dam and river environment (Enhanced and edited by authors).**

## 4.3. Everyday spatial systems and access

The third group mapped movement and access. Space use is differentiated: men are associated with boats and the river, women and less-mobile residents with the immediate domestic and semi-public realm, and children with the journey to school. Movement and social life overlap at specific nodes: the docking point, weddings, and the playground-soccer field-community center.

The group identified clear bottlenecks: unpaved pathways, the absence of a secondary school on the island, and a lack of shading devices along routes. Mobility is hard for the elderly across the island's hilly, scattered fabric, and dependence on river transport links every trip off the island to weather and boat availability. The informal solutions already in place are revealing: the tuk-tuk has become the key internal mobility technology, ferry shelters mark gradual infrastructure improvement, and donkeys, boats, and walking remain in everyday use. The board also captured the social ecosystem that sustains the island; the interdependence of government, tourism, service provision, and community, and the visible role of artisan women sellers.

In Figure 5, the participants made this participatory workshop board that examines mobility, public space, and community life through the lens of tuk-tuk transportation. Participants explored different spaces, where social interactions occur, and the barriers affecting accessibility, including unpaved pathways, limited facilities, and inadequate infrastructure. The accompanying hand-drawn map highlights key community landmarks, transport routes, and potential interventions such as improving tuk-tuk safety, supporting local artisans, and fostering collaboration between government, tourism, and local communities.

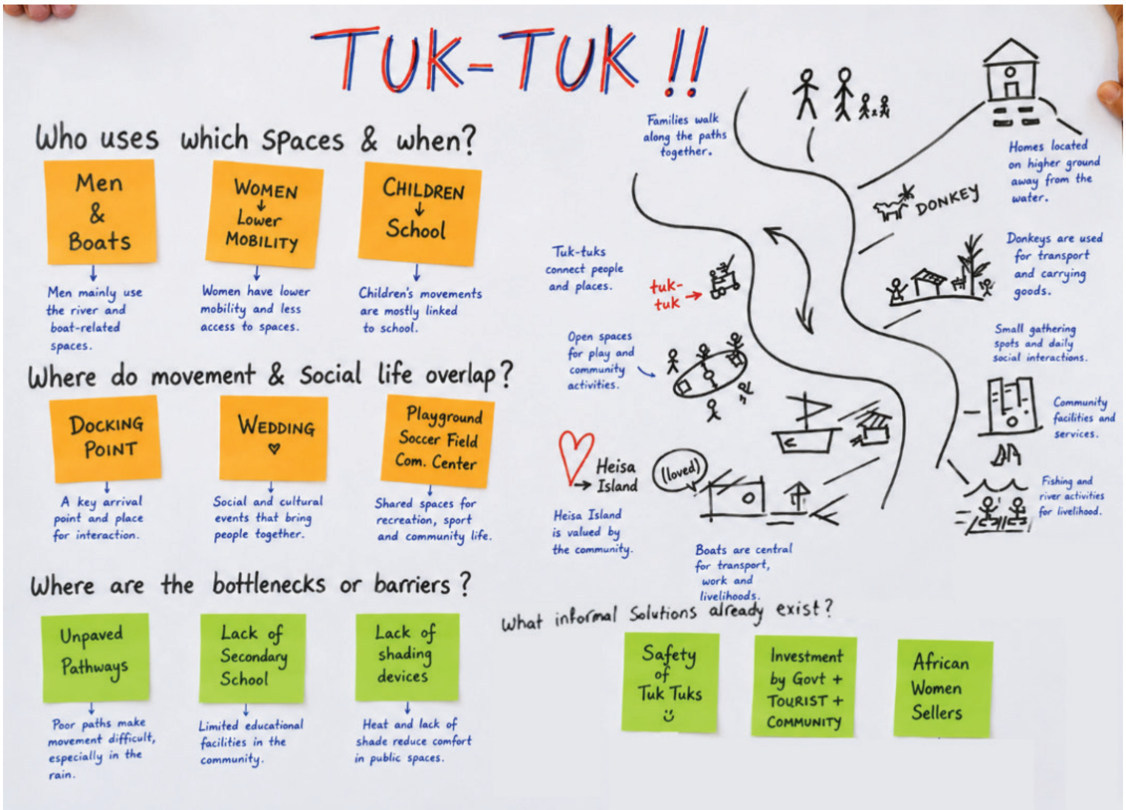


**Figure 5: Output board from Group 3 (Everyday Spatial Systems & Access), titled "Tuk-Tuk!!" The annotated map and sticky-note analysis record who uses which spaces, where movement and social life overlap, the main bottlenecks (unpaved pathways, lack of secondary), and are enhanced and edited by the authors.**

## 5. Discussion: What formal planning misses

Read together, the three lenses make a single argument. Heisa's resilience is the product of everyday adaptation; a continuous, distributed, largely undocumented practice of adjusting houses, routes, livelihoods, and ecological relationships to a regulated river. This is precisely the kind of resilience that conventional planning, oriented toward formal infrastructure and master-planned intervention, tends not to see or credit. The workshop's value lies partly in making that resilience legible, but its significance sharpens when Heisa is read against the wider literature on dam-induced displacement, participatory planning, and heritage tourism, which allows a single-site observation to be tested against documented patterns elsewhere.

- **Adaptation in situ, read against the displacement record:**
  The first and most consequential finding; that Heisa adapted vertically and in place rather than relocating, aligns with a growing body of literature showing that communities facing submergence or increasing climate risk generally prefer in-situ adaptation, with planned resettlement regarded as a measure of last resort, feasible only when cultural identity, social networks, and livelihood systems can be maintained (Bower and Piggott-McKellar 2026; IPCC 2022; Jamero et al. 2019). The comparative displacement literature explains why this preference is so strong: even where

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relocation delivers improved housing or economic compensation, these benefits rarely substitute for attachment to ancestral landscapes, cultural identity, and established livelihood systems. Consequently, communities affected by dam construction or environmental change frequently seek to maintain social and cultural ties with their former homelands, even after relocation (Bower and Piggott-McKellar 2026; Cernea 2000; IPCC 2022; Jamero et al. 2019; T. T. Scudder 2012). Nubia is itself a textbook case of this rupture; the reservoirs of the Low and High Dams displaced well over 100,000 people and severed communities from ancestral land (Abubakr 2021; T. Scudder 2016). Against that backdrop, a recent comparative study is particularly telling, where resettled Nubians had to rebuild livelihoods through tourism, government employment, and overseas labor amid the erosion of their social ties. The residents of Heisa Island, instead, drew on intact social cohesion and cultural tourism to sustain both economic stability and identity. Against this backdrop, a recent comparative study provides particularly compelling evidence. Comparing households resettled in Nasr El Nuba with residents of Heisa Island, the study found that displaced Nubians reconstructed their livelihoods through tourism, public-sector employment, and overseas labor following the loss of agricultural land and fishing rights. However, these adaptations were accompanied by weakened social networks and increasing dependence on external income sources. In contrast, Heisa residents relied on strong social cohesion, cultural continuity, and community-based tourism to sustain both economic stability and cultural identity, demonstrating the resilience afforded by remaining in place (Abdelaziz et al. 2025). Heisa, in other words, is not an anecdote but a demonstration case for a proposition the resettlement literature has long implied: cultural continuity is itself a form of resilience, and staying can preserve what relocation dismantles.

- **The community as investor and planner:** Our second finding — that regeneration on Heisa is largely self-financed and self-directed — reinforces a well-established critique of technocratic, top-down planning. Research on informal settlements and riverine communities consistently demonstrates that planning approaches centered on land use, zoning, and physical infrastructure often overlook the social relations, informal institutions, cultural practices, and everyday mobilities through which these places function (Padawangi 2018; Watson 2009). Consequently, analyses based solely on remotely sensed data or spatial mapping are insufficient to capture the complexity of lived experiences and local adaptive practices without incorporating community knowledge and participatory approaches (Corburn 2003; Dunn 2007). The lesson drawn across this literature is consistent: where communities are already organizing their own upgrading, external actors are most effective as enablers rather than directors, while context-sensitive participatory approaches that integrate local knowledge produce more sustainable, resilient, and better-maintained outcomes than conventional top-down interventions (Ono and Adrien 2024; Terdoo 2024; Wainaina and Truffer 2024). Whereas Mamsha Ahl Misr in Cairo delivered a designed riverfront through centralized, state-led investment (Abdel-Moneim 2025), Heisa shows regeneration emerging without a master plan or external capital — two contrasting models of Nile riverfront transition. Heisa extends this argument to a setting rarely studied in these terms — a continuously inhabited Nubian island — and confirms that the community's own agency is the primary planning resource, not a supplement to it.

- **Modest, low-tech gaps rather than master plans:** The third finding follows the island's most pressing needs directly: a secondary school, shaded and paved circulation, dependable waste collection, and reliable river access. These are modest, low-tech, and identifiable through observation. They do not call for a master plan so much as targeted, community-compatible support. This is consistent with evidence from participatory planning showing that co-produced maps and improved spatial literacy enable residents to identify and communicate socially significant needs more effectively than remote technical surveys alone (Corburn 2010; Healey 2006; Innes and Booher 2010). It also reframes the planner's role from designing wholesale transformation to facilitating locally identified priorities and closing a small number of well-understood gaps. This interpretation is consistent with policy perspectives that view planning as a collaborative process in which government facilitates stakeholder cooperation and enables locally identified priorities rather than imposing predetermined solutions (El-Faramawy 2025).

- **Local knowledge as planning expertise:**
Perhaps the most significant methodological contribution of the workshop is its treatment of local knowledge as a form of planning expertise rather than raw input to be processed by professionals. Residents hold detailed understandings of seasonal environmental change, cultural value, movement patterns, and community priorities that are difficult to obtain through remote analysis or technical surveys. Participatory mapping made this knowledge visible and, in doing so, repositioned community members from consultees to active contributors. This reflects a growing body of participatory planning research that recognizes local communities as co-producers of planning knowledge rather than passive recipients of expert decisions (Brown et al. 2018; Corburn 2010). The participatory mapping literature frames this as the integration of two distinct knowledge types: the cognitive-technical knowledge of experts and the experiential knowledge of residents, with the strongest decisions emerging where the two are combined (Abdel-Moneim 2025; Abdel-Moneim and El Seddawy 2021; Özesmi and Özesmi 2004)"source":"DOI.org (Crossref. Heisa's hand-drawn boards—a river sketched with its docking points, tuk-tuk routes, and social nodes—are a concrete instance of experiential knowledge being rendered in a form that planning can use.

- **Heritage as lived practice versus heritage as product:**
Finally, Heisa exposes a tension common to river settlements in transition: the same cultural heritage that sustains community identity is increasingly becoming an economic resource, making tourism both a source of livelihood and a potential threat. This dynamic is not unique to Heisa but has been documented across Nubian settlements in Aswan. Research on Nubian cultural tourism demonstrates that, once heritage is interpreted for visitors, cultural narratives and practices may become selectively presented—partially celebrated, partially simplified, and partially omitted—to meet tourists' expectations (Elcheikh 2015). Likewise, studies of Gharb Soheil show that while tourism has created important economic opportunities, it has also generated concerns about the commercialization of Nubian culture and the gradual erosion of authenticity, highlighting the need to balance economic development with cultural preservation (Elcheikh 2018) on which they developed several outstanding civilizations, going back 5000 years (Emberling 2011: 6. Heisa currently occupies an earlier stage of this trajectory than the heavily visited West Bank villages. Its cultural heritage continues to function primarily as a lived social practice rather than a staged tourism product, making it a valuable example of regenerative development rooted in community life. Preserving this balance will require regeneration strategies that strengthen community-led enterprises, including artisan production, locally managed hospitality, and everyday cultural practice, while ensuring that tourism supports, rather than commodifies, the community's cultural identity.

Taken together, these comparisons reposition the single-day workshop within a broader evidentiary field. The Heisa observations do not stand alone; they corroborate, and are corroborated by, documented patterns in displacement studies, participatory planning, and heritage-tourism research. What Heisa adds is a rare, continuously inhabited counter-case to the Nubian displacement narrative; evidence that where a community is able to stay, adapt, and remain the author of its own transition, resilience emerges through everyday practice rather than planned intervention.

## 6. Conclusion & Transferable insights

Heisa Island offers a powerful case for understanding rivers in transition as long-term socio-cultural processes, not only environmental or infrastructural transformations. It shows how communities negotiate identity, livelihood, and place under sustained river regulation, and how resilience can emerge through everyday adaptation rather than planned intervention.

For the wider River Cities Network and for other river cities, several insights transfer:

- **Observe before intervening:** Much of what sustains a river community is informal and invisible to standard surveys; observation-first methods surface it.

- **Recognize in-situ adaptation:** Staying and adapting can preserve heritage that relocation destroys; planning should value continuity, not only relocation or renewal.

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- **Support the community agency:** Where residents are already the investors and stewards, the role of external partners is to enable, not to author.

- **Target modest, low-tech gaps:** Shaded paths, a local school, dependable waste collection, and reliable transport can matter more than large infrastructure.

- **Hold heritage and economy in balance:** Tourism can sustain or erode living heritage; the difference lies in protecting lived practice from commodification.

Placed alongside other RCN sites, from Bang Krachao in Bangkok to the Danube, the Kapuas, the Mekong, and the Ngong, Heisa contributes a distinctive Nile perspective: that of a community which met profound river transition not by leaving, but by staying, rising, and adapting in place.

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## References:

Abd-El Monsef, Hesham, Scot E. Smith, and Kamal Darwish. 2015. "Impacts of the Aswan High Dam After 50 Years." *Water Resources Management* 29 (6): 1873–85. https://doi.org/10.1007/s11269-015-0916-z.

Abdel-Moneim, Nancy M. 2025. Review of *Mamsha Ahl Misr: A Blueprint for Sustainable Urban Revitalisation Along the Nile River in Cairo. Blue-Green Rehabilitation*, June, 75–94. https://doi.org/10.1079/9781800625297.0005.

Abdel-Moneim, Nancy M., and Ahmed I. El Seddawy. 2021. "Towards a Better Urban Design in Respect to Environmental Behavior Using Knowledge Discovery." *Journal of Southwest Jiaotong University* 56 (3): 619–38. https://doi.org/10.35741/issn.0258-2724.56.3.50.

Abdelaziz, Shimaa, Xiao Han, Edris Alam, and Shi Guoqing. 2025. "Livelihood Transformation and Social Networks in Nubian Displacement: Lessons from the Aswan High Dam." *Research Square (Research Square)*, August. https://doi.org/10.21203/rs.3.rs-6587514/v1.

Abubakr, Bayan . 2021. *The Contradictions of Afro-Arab Solidarity(Ies): The Aswan High Dam and the Erasure of the Global Black Experience.* Racial Formations in Africa and the Middle East: Project on Middle East Political Science (POMEPS).

Atmodiwirjo, Paramita, Arnis Rochma Harani, Adjie Pamungkas, Kristanti Dewi Paramita, and Yandi Andri Yatmo. 2025. "Vertical Adaptation Narratives of Urban Kampung Facing Recurrent Tidal Floods." *Civil Engineering and Architecture* 13 (4): 3366–79. https://doi.org/10.13189/cea.2025.130437.

Bakry, Ahmed Osama AbdElhamid . 2015. "Integrating Local Ethnic Groups in the Process of Regional Planning: The Case of the Nubian Village of Kostol-Kom Ombo, Egypt." Dual Master of Science (M.Sc.) in Integrated Urbanism and Sustainable Design (IUSD), Ain Shams University (Egypt) and University of Stuttgart (Germany).

Bayoumi, Ola Ali Mahmoud . 2018. "Nubian Vernacular Architecture & Contemporary Aswan Buildings' Enhancement." *Alexandria Engineering Journal* 57 (2): 875–83. https://doi.org/10.1016/j.aej.2016.01.002.

Bower, Erica R., and Annah Piggott-McKellar. 2026. "Unpacking 'Success' in Climate-Related Planned Relocation: A New Research Agenda for Assessing and Measuring Outcomes." *Cell Reports Sustainability* 3 (5): 100657. https://doi.org/10.1016/j.crsus.2026.100657.

Brown, Greg, Sara Sanders, and Pat Reed. 2018. Review of *Using Public Participatory Mapping to Inform General Land Use Planning and Zoning. Landscape and Urban Planning* 177 (September): 64–74. https://doi.org/10.1016/j.landurbplan.2018.04.011.

Cernea, Michael M. . 2000. "Impoverishment Risks, Risk Management, and Reconstruction: A Model for Population Displacement and Resettlement." *Economic and Political Weekly* 35 (41): 3659–78. https://doi.org/https://doi.org/10.2307/4409836.

Cook, Brian R., and Christopher J. Spray. 2012. Review of *Ecosystem Services and Integrated Water Resource Management: Different Paths to the Same End?Journal of Environmental Management* 109 (October): 93–100. https://doi.org/10.1016/j.jenvman.2012.05.016.

Corburn, Jason. 2003. "Bringing Local Knowledge into Environmental Decision Making." *Journal of Planning Education and Research* 22 (4): 420–33. https://doi.org/10.1177/0739456x03022004008.

Corburn, Jason . 2005. *Street Science: Community Knowledge and Environmental Health Justice.* Cambridge, Massachusetts: Urban and Industrial Environments. MIT Press.

Dunn, Christine E. 2007. "Participatory GIS — a People's GIS?." *Progress in Human Geography* 31 (5): 616–37. https://doi.org/10.1177/0309132507081493.

El-Faramawy, Ali. 2025. "Inducing Urban Policy from Urban Development in Egypt." *Horizons in Architecture and Urban Studies* 1 (1): 1–9. https://apc.aast.edu/ojs/index.php/haus/article/view/haus.2025.01.1.1726.

Elcheikh, Zeina . 2015. "Interpretation in Cultural Tourism: Nubian Culture in Southern Egypt." *Furnace: Furnace Journal for Conservation and Cultural Heritage* 1 (1).

Elcheikh, Zeina. 2018. "Cultural Tourism between Identity and Income. The Case of the Nubian Village of Gharb Soheil.." *Grafiati.Com*, June, 155–72. https://doi.org/https://doi.org/10.31377/chr.v33i0.98.

Fahim, Hussein M. . 2013. *Dams, People and Development: The Aswan High Dam Case.* Revised edition . Elsevier.

Fahmy, Ninette. 2004. "A Culture of Poverty or the Poverty of a Culture? Informal Settlements and the Debate over the State-Society Relationship in Egypt." *The Middle East Journal* 58 (4): 1.4–15. https://doi.org/10.3751/194034604783997042.

Halbe, J., C. Pahl-Wostl, J. Sendzimir, and J. Adamowski. 2013. "Towards Adaptive and Integrated Management Paradigms to Meet the Challenges of Water Governance." *Water Science and Technology* 67 (11): 2651–60. https://doi.org/10.2166/wst.2013.146.

Healey, Patsy . 2006. *Collaborative Planning: Shaping Places in Fragmented Societies.* Second edition. Planning, Environment, Cities: Palgrave Macmillan.

Hossain, Babul, Guoqing Shi, Chen Ajiang, Md. Nazirul Islam Sarker, Md. Salman Sohel, Zhonggen Sun, and Qi Yang. 2022. Review of *Climate Change Induced Human Displacement in Bangladesh: Implications on the Livelihood of Displaced Riverine Island Dwellers and Their Adaptation Strategies. Frontiers in Psychology* 13 (October). https://doi.org/10.3389/fpsyg.2022.964648.

Innes, Judith E., and David E. Booher. 2010. *Planning with Complexity.* Routledge. https://doi.org/10.4324/9780203864302.

IPCC. 2022. "Climate Change 2022: Impacts, Adaptation and Vulnerability Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change." *IPCC* 1 (1). https://doi.org/10.1017/9781009325844.

http://dx.doi.org/10.21622/HAUS.2026.02.1.2294

Jamero, Ma. Laurice, Motoharu Onuki, Miguel Esteban, Christopher Chadwick, Nicholson Tan, Ven Paolo Valenzuela, Richard Crichton, and John Erick Avelino. 2019. Review of *In-Situ Adaptation against Climate Change Can Enable Relocation of Impoverished Small Islands. Marine Policy* 108 (October): 103614. https://doi.org/10.1016/j.marpol.2019.103614.

Ma, Xiaolong, Rong Wang, Meiling Dai, and Yanghong Ou. 2020. "The Influence of Culture on the Sustainable Livelihoods of Households in Rural Tourism Destinations." *Journal of Sustainable Tourism* 29 (8): 1–18. https://doi.org/10.1080/09669582.2020.1826497.

Mucherera, Blessing, and Samuel Spiegel. 2021. "Forced Displacement: Critical Lessons in the Protracted Aftermath of a Flood Disaster." *GeoJournal* 87 (5). https://doi.org/10.1007/s10708-021-10471-w.

Ono, Haruka, and Uwamahoro Adrien. 2024. Review of *Community-Driven Informal Settlement Upgrading as an Everyday Practice: The Role of Urban and Governance Policies. Land Use Policy* 146 (August): 107318–18. https://doi.org/10.1016/j.landusepol.2024.107318.

Padawangi, Rita, ed. 2018. *Routledge Handbook of Urbanization in Southeast Asia.* Abingdon, Oxon ; New York, NY : Routledge, 2019.: Routledge. https://doi.org/10.4324/9781315562889.

Perumal, Nikita. 2018. "'The Place Where I Live Is Where I Belong': Community Perspectives on Climate Change and Climate-Related Migration in the Pacific Island Nation of Vanuatu." *Island Studies Journal* 13 (1): 45–64. https://doi.org/10.24043/isj.50.

Rahaman, Muhammad Mizanur, and Olli Varis. 2005. "Integrated Water Resources Management: Evolution, Prospects and Future Challenges." *Sustainability: Science, Practice and Policy* 1 (1): 15–21. https://doi.org/10.1080/15487733.2005.11907961.

Scudder, Thayer. 2016. *Aswan High Dam Resettlement of Egyptian Nubians. SpringerBriefs on Case Studies of Sustainable Development.* Singapore: Springer Singapore. https://doi.org/10.1007/978-981-10-1935-7.

Scudder, Thayer Ted. 2012. *The Future of Large Dams.* Routledge. https://doi.org/10.4324/9781849773904.

Soto. 2019. "Two Communities Show Nubians' Past, a Version of the Future – Aruba Today." Arubatoday.Com. May 14, 2019. https://www.arubatoday.com/two-communities-show-nubians-past-a-version-of-the-future/.

Terdoo, Fanen. 2024. "Assessing the Role of Participatory Planning Approach in Enhancing Informal Settlements Upgrading in Low Income Regions." *Discover Global Society* 2 (1). https://doi.org/10.1007/s44282-024-00117-w.

Wainaina, George Kiambuthi , and Bernhard Truffer. 2024. "The Missing Link for Effective Informal Settlement Upgrading: Appropriation Shaping the Outcome of New Infrastructure." *Urban Studies* 61 (12). https://doi.org/10.1177/00420980241236077.

Watson, Vanessa. 2009. "Seeing from the South: Refocusing Urban Planning on the Globe's Central Urban Issues." *Urban Studies* 46 (11): 2259–75. https://doi.org/10.1177/0042098009342598.

Y. Shedid, Mona, and Gehan I. Hassan. 2019. Review of Architectural and Urban Expression in Nubian Village Origins and Transformation with Special Reference to Displacement Villages. Advances in Science, Technology &Amp; Innovation, 277–95. https://doi.org/10.1007/978-3-030-10871-7_21.

Zhang, Shiyao, Faziawati Abdul Aziz, and Nor Azlina Abu Bakar. 2024. "A Review on the Impact of Cultural Tourism on the Sustainability of Residents' Livelihood." *International Journal of Academic Research in Business and Social Sciences* 14 (11): 2998–3014. https://doi.org/10.6007/ijarbss/v14-i11/23591.

Özesmi, Uygar, and Stacy L. Özesmi. 2004. "Ecological Models Based on People's Knowledge: A Multi-Step Fuzzy Cognitive Mapping Approach." *Ecological Modelling* 176 (1–2): 43–64. https://doi.org/10.1016/j.ecolmodel.2003.10.027.

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# Pixels, Prompts, and Precision: A Comparative Analysis of AI-Assisted and Traditional Architectural Visualization across Diverse Interior Design Styles

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## Abstract:

This study examines the practical and perceptual differences between two architectural visualization workflows: Autodesk 3ds Max with Corona Renderer, a physics-based traditional rendering engine, and Fabrie AI combined with Photoshop postproduction, an emerging AI-assisted approach. Both workflows were applied to the same interior reception space, rendered across six distinct design styles under identical spatial geometry, lighting, and camera conditions — isolating the rendering tool as the sole variable under investigation.

Evaluation drew on two complementary evidence streams. Objectively measured performance metrics — including render time, output resolution, and file size — provided a quantitative baseline for workflow comparison. These were paired with structured expert assessments gathered from a panel of architects, interior designers, and client representatives, who evaluated each render against five perceptual dimensions: visual Realism, design communication, creator skill, client approval, and overall quality. Inferential statistical tests — paired-samples t-tests, a chi-square goodness-of-fit test, and a one-way ANOVA — were applied to assess the significance and consistency of observed differences, with Cohen's d and $\eta^2$ reported as effect sizes throughout.

The findings reveal a nuanced picture that resists simple conclusions. While 3ds Max maintains a meaningful advantage in photorealistic fidelity — particularly for organic, texture-rich aesthetics such as Wabi Sabi and Mid Century styles — the two tools produce output of statistically indistinguishable overall quality across the full style set. For geometrically structured styles, including Bauhaus, Neoclassical, and Industrial interiors, AI-generated renders match or exceed 3ds Max on both quality scores and client approval. These findings challenge the common framing of AI as either a wholesale replacement for or an inadequate substitute for traditional rendering, and instead point toward a strategically hybrid workflow model: one in which each technology is deployed according to the aesthetic demands of the project and the intended purpose of the deliverable.

Beyond its immediate empirical contribution, this research offers the field a replicable mixed-methods evaluation framework, a style-conditioned decision matrix for practitioners navigating tool selection, and a preliminary evidence base for the thoughtful integration of AI visualization tools in both professional practice and architectural education curricula. These conclusions are necessarily tied to the current generation of AI visualization tools; given the rapid pace of development in this field, the relative performance gap documented here should be read as a snapshot rather than a fixed verdict, and may narrow or shift as the underlying models continue to improve.

**Keywords:** Architectural Visualization, Artificial Intelligence, Rendering Comparison, 3ds Max, Fabrie AI, Design Workflow, Mixed Methods, Interior Design Styles, Visual Fidelity, Hybrid Workflow.

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## 1. Research problem statement

Architectural visualization practitioners today operate under a persistent tension: clients and project timelines demand faster turnaround, while design quality and communicative precision remain non-negotiable. The emergence of AI-assisted rendering tools has intensified this tension by introducing a new class of solutions that promise dramatic speed gains — but whose actual quality, reliability, and contextual suitability have not been rigorously evaluated in controlled, multi-style studies.

This research directly addresses that gap. By comparing Autodesk 3ds Max and Fabrie AI across three critical performance dimensions — Render Quality (visual fidelity and photorealistic accuracy), Workflow Efficiency (time, iteration, and resource utilization), and Design Authenticity (spatial accuracy and fidelity to stylistic intent) — the study aims to replace assumption-driven tool selection with evidence-based guidance. The central question is not whether AI can replace traditional rendering, but rather under what conditions, and for which aesthetic contexts, each approach is most appropriately deployed. This distinction is deliberate and is the central concern of the study: rather than adjudicating a binary replacement question, the research is oriented toward mapping the specific design contexts in which each rendering approach is most appropriate, a framing carried through the objectives, analysis, and conclusions below.

## 2. Research goal

This study aims to establish clear, empirically grounded criteria for integrating AI visualization tools into architectural practice by systematically comparing them against the established standard of traditional photorealistic rendering. Rather than evaluating tools in the abstract, the research grounds its comparisons in a controlled experimental setting — one base model, multiple design styles, identical conditions — so that observed differences can be confidently attributed to the rendering process itself.

The ultimate goal is to move beyond the current binary debate in professional discourse and offer practitioners, educators, and researchers a framework for thinking about AI and traditional rendering as complementary rather than competing tools. Specifically, the study seeks to identify which design contexts reward the precision and material depth of 3ds Max, which benefit from AI's speed and stylistic fluency, and how a well-designed hybrid workflow might combine both to enhance creative outcomes and client communication without compromising visualization standards. A primary contribution of this paper — emphasized throughout the sections that follow — is precisely the identification of the design contexts that continue to reward the precision, control, and material realism offered by 3ds Max over AI-generated rendering, alongside those contexts where this advantage narrows or disappears.

## 3. Research question

How do architectural interior renders produced using 3ds Max with Corona Renderer differ from those generated through Fabrie AI with Photoshop postproduction — in terms of visual quality, perceived Realism, and effectiveness for client communication — when applied to the same spatial model across a range of interior design styles?

## 4. Hypotheses

**H1:** AI-generated renders are perceived as less visually detailed and realistic than 3ds Max renders, particularly in design styles characterized by organic form, natural material complexity, or tonal subtlety.

**H2:** AI-assisted workflow produces perceived quality levels comparable to traditional rendering for design styles with bold, legible geometric or formal character, which can compete in overall quality rendering.

## 5. Objectives

1. A comparative study of 3ds Max/Corona rendered images and Fabrie AI-generated images of an interior space, presented in six different design styles. An attempt to find out what the added value of AI-generated images is and where the traditional rendering process and the Fabrie AI process are inferior.

2. **Workflow Analysis:** This research also intends to develop and test key indicators that will allow for measuring and evaluating the processes required to produce visualizations with the help of the two different methods. For this purpose, the required time, the needed skills, and the required hardware will be quantified and presented with the aid of baselines for efficient workflows for architectural visualization.

3. **Quality Benchmarking:** Develop a 12-point quality assessment framework that can be applied in a systematic and qualitative manner to assess key technical, perceptual, and Design quality-related criteria in the resulting visualization(s) for the same interior space in different design styles.

4. The Study will provide practical evidence for the implementation of AI visualization in architectural workflows based on production efficiency and quality of outcome.

## Tools & Methods

## 6. Experimental design

This study uses a mixed-methods approach (Creswell & Plano Clark, 2018) to analyze both quantitative data (expert survey) and qualitative data (experts' comments). This manuscript reports a pilot-phase study (n = 23 expert respondents, six design styles): its findings, effect sizes, and hypothesis tests below should be read as preliminary results from this first phase, ahead of the larger, fully powered follow-on study outlined under Future Study. Both the quantitative and qualitative data were collected at the same time and analyzed separately. The results of both analyses were then integrated and displayed in a joint display. In order to measure the perceptual outcomes of both tools and to find out about the reasons for possible differences between design styles and both tools, a quantitative survey was held among experts in the building industry. The qualitative part of the study provides evidence for the experts' comments on the reasons for differences between the two tools and thus for differences between design styles.

The base geometry of a single reception space was created in 3ds Max and used throughout for all variations of the six different interior design styles: Wabi Sabi, Mid Century, Coastal, Bauhaus, Industrial, and Neoclassical. All variations of the space were set up with constant camera settings, and all variations of natural lighting were set up to occur at the same time of day. The only variable that was changed between all variations of the space was the descriptive textual input that both rendering workflows received.

The experiment operates across three clearly defined variable classes:

- **Constant variables:** room layout and spatial geometry; camera position and field of view; natural lighting scenario (direction, time of day); descriptive textual input provided to both tools, matched as closely as possible.

- **The independent variable:** the rendering workflows (3ds Max/Corona or Fabrie AI visualization / Photoshop postproduction).

- **Dependent variables:** Visual Realism (% yes), Design communication (% yes), Skill required by creator (1–5 Likert-scale), Client approval for presentation (% yes), Overall quality (1–5 Likert-scale).

A further methodological improvement would be the implementation of a three-arm study design in which the raw AI output as well as the combined AI-Photoshop tool would be compared to the 3ds Max/Corona rendering process, thus isolating the effect of the postproduction step from the effects caused by the AI model. This confound was not yet addressed in the pilot study, where improvements to the quality of the images could have been caused by the post-processing steps in Photoshop, and thus could have been attributed to the AI-based rendering process in its entirety.

## 7. Quantitative strand

The quantitative strand is based on a survey of experts within the field of interior Design. Each pair of renderings is scored within 12 parameters across 5 scored dimensions. These five scored dimensions correspond to the five consolidated categories now used in the Introduction. (plus Rendering Time and Cost, reported separately): Overall Quality, User Evaluation, Design Communication, Design Satisfaction, and Photorealism & Design Authenticity. To check for significant differences between the means for each of the five evaluation dimensions across the six style pairs using paired-samples t-tests (with d.f. = 5). In this pilot round, practical significance is assessed using the reported mean differences and standard deviations in Table 5 directly; formal Cohen's d and $\eta^2$ effect-size statistics are planned for the expanded, fully powered follow-on study, where a larger number of style pairs will support their reliable estimation.

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Chi-square test (goodness-of-fit) on the binary approval of client presentations for both tools (a total of 138 'equals' for each tool, i.e., 138 cases of 'presenting plans' to clients). The null hypothesis is that the proportion of approvals is the same for both tools. Because the 138 counts per tool derive from 23 respondents rated across six styles rather than 138 independent respondents, this test is reported below as a descriptive supplementary summary rather than a formally valid inferential test; the paired-samples t-test at the style level (n = 6, df = 5, above) is the primary inferential comparison, as it correctly treats each style as the unit of repeated-measures analysis.

One-way ANOVA to test for equality of the performance difference between the two rendering tools on the five dimensions. As with Cohen's d above, the one-way ANOVA and its $\eta^2$ effect size were not run in this pilot round, given the small sample size (n = 6); both are retained here as the intended confirmatory test for the expanded follow-on study.

## 8. Qualitative strand

For the qualitative assessment, three methods will be applied in combination to analyze the obtained results: thematic analysis, visual analysis, and content analysis.

- **Thematic analysis** (Braun & Clarke, 2006) of open comments provided by the design experts who participated in the pilot study. The comments were analyzed inductively using themes that have emerged from the various categories that described the errors in object identification, spatial coherence, and material continuity that had been observed in the images generated by the AI rendering tools in the pilot study. Some of the themes that had emerged from the comments were: materiality, spatiality, design communication, mood, and AI-generated errors.

- **Visual content analysis** of the generated images against a set of criteria (authenticity rubric) established for each of the design styles from the relevant literature. Each set of paired renderings is scored by two raters using a set of criteria that define a style, for example, for Wabi Sabi: the presence of natural imperfections, a muted color palette, a variety of textures, the absence of a synthetic sheen, etc. This rubric also incorporates scale accuracy and object proportion — the consistency of object scale, spatial relationships, and furniture placement relative to the constant base geometry — as raters noted visible discrepancies in scale and placement between the AI-generated and 3ds Max renderings during review. In this pilot round, the two-rater comparisons are reported narratively, through the qualitative themes below, rather than as a scored inter-rater reliability statistic (e.g., Cohen's kappa); formal reliability reporting is planned once the rubric is applied across the larger follow-on sample.

A graphical comparison of workflow performance between the two render methods. The study will outline the amount of time for completion for each image (wall-clock time) as well as the number of iterations that were required for the system to arrive at a satisfactory result. In addition, a comparison of the licensing costs for use as well as the required levels of operator expertise between the two workflows will be detailed. This will allow for the easy comparison of both aspects of performance using a graphical comparison.

## 9. Integration & joint display

A style-by-style joint display matrix puts the numbers and themes together in one table. Mixed-methods research often uses this matrix. Each row shows a design style. Each column is an evaluation point. The matrix shows scores and theme codes side by side in each cell. This setup lets you see if the scores and feedback line up. It shows when people give the same score but say different things about why. This setup helps you spot new ideas or problems that the survey did not talk about.

## 10. Introduction

Artificial Intelligence (AI) has significantly transformed rendering technologies across various domains, enhancing efficiency and visual quality. AI-driven methods, such as Linear RepRender, utilize deep learning to simplify high-dimensional image data, achieving faster rendering speeds and improved visual accuracy (Kalidindi et al., 2024). Additionally, AI-based three-dimensional product display techniques allow for the generation of dynamic product images from user-generated content, facilitating low-cost solutions for small enterprises (Xi'en & Shanshan, 2018). In gaming, generative AI enhances texture rendering, reducing manual creation time and improving runtime performance, which contributes to a more immersive player experience (Singh, 2024). Furthermore, AI technologies are employed in cultural heritage projects, creating virtual environments that allow users to explore historical sites interactively (Chen & Cao, 2024). Lastly, the integration of big data and AI in e-learning frameworks optimizes rendering processes, improving educational experiences (Arumugam et al., 2023).

## 11. AI-Based three-dimensional product display

The application of AI in rendering extends beyond image and video processing to three-dimensional product displays. A novel method disclosed in recent research involves the use of artificial neural networks to establish three-dimensional image rendering models. This method comprises several steps: establishing a three-dimensional image rendering model through an artificial neural network, carrying out primary training on the model using a dataset, and conducting secondary training using user-shot videos or images of a product. The final step involves obtaining a three-dimensional image rendering model of the product (Xi'en & Shanshan, 2018).

This method addresses the challenge of realizing three-dimensional product displays without the need for three-dimensional CAD models. By utilizing the three-dimensional image rendering model, the method generates three-dimensional images of products under different viewpoint conditions, allowing users to view products from various angles. This solution is particularly beneficial for small and medium-sized enterprises, as it provides a convenient and low-cost three-dimensional product display solution (Xi'en & Shanshan, 2018).

## 12. Artificial Intelligence render

The artificial intelligence platforms that were used in the experiment, such as (Minimal AI, Prome AI, Fabrie imagine AI, Krea AI, Midjourney AI, Visualize AI, Reroom AI), have proven by observation to produce fast results; however, the results were not accurate.

Common mistakes observed were: inaccurate identification of the objects in the scene, a lighting fixture could be seen as part of the stairs, wallpaper could not be continuous, discontinuity of a part of the objects, such as the stairs. People were often dressed irregularly, had missing limbs or body parts, or wore irrelevant garments, where gender was often inaccurate or not clear to distinguish.

The twelve-variable framework originally presented in a previous phase of the study has now been consolidated and reorganized into the five broader categories below, plus Rendering Time and Cost, treated briefly as an already well-established metric. The scholarly grounding for each original variable is preserved by folding its citations into the relevant consolidated section rather than by keeping twelve separate subsections.

## 13. Rendering time & cost

Rendering time — the wall-clock time from the start of a render to final output, including prompt iterations and postproduction — has been a central concern in computer graphics since Turner Whitted's first ray-tracing algorithm (Whitted, 1980), because it directly affects the economics of a designer's iterative exploration time. AI generation methods such as Stable Diffusion and Fabrie AI can render scenes in seconds (Rombach et al., 2022; Ramesh et al., 2022), but must be judged across the full workflow rather than in isolation, since postproduction correction time offsets much of the raw speed gain (Brown et al., 2020; Chaillou, 2020). Licensing cost follows a similar logic: it is an established, easily quantified metric (subscription/seat cost for 3ds Max and Corona versus the AI platform's usage-based pricing) rather than one requiring extended theoretical framing, which is why it is treated briefly here rather than as a full standalone variable.

## 14. Photorealism & Design authenticity

This category combines two closely related concerns: how convincingly a render reproduces photographic reality, and how faithfully it represents the designer's actual spatial and material intentions. Photorealism is the degree to which a computer-generated image is perceptually indistinguishable from a photograph under equivalent conditions (Ferwerda, 2003), with functional equivalence — task-context indistinguishability — being most relevant to Design communication. Automated metrics such as SSIM (Wang et al., 2004; Hore & Ziou, 2010) and the blind metrics BRISQUE and NIQE

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(Mittal et al., 2012, 2013) offer candidate tools from the wider literature, though domain-specific criteria — material surface fidelity, spatial coherence of light and shadow, geometric accuracy — must supplement them in an architectural context (Dorsey et al., 2010; Reinhard et al., 2010); these automated metrics were not computed in the current pilot, which relies instead on the expert Likert-based ratings reported in the Results, and their application is planned for the expanded follow-on study.

Design authenticity, meanwhile, is the degree to which a render faithfully represents the designer's spatial and material intentions as embodied in the design model (Herbert, 1993; Mitchell, 1990), with geometric accuracy, material fidelity, and atmospheric accuracy as its key aspects (Dorsey et al., 2010); it is studied most closely in heritage visualization, where spatial accuracy is a legal and scholarly requirement (Denard, 2012; Frischer & Dakouri-Hild, 2008), and misrepresentation can create client expectations the built architecture cannot fulfil (Boeykens, 2011). Diffusion models generate images by sampling from a learned distribution of visual plausibility rather than referencing a specific design model, which can produce 'spatial drift' (Chaillou, 2020) or architectural plausibility without architectural accuracy (Huang et al., 2022). Scale accuracy and object proportion — the consistency of object scale, spatial relationships, and placement relative to the constant base geometry — are a specific, discussable component of design authenticity that emerged as a recurring point of difference between the two workflows during expert review (see Qualitative Strand and Statistical Limitations); no discrete quantitative score for it was collected in this pilot, and it is recommended as a dedicated variable in future iterations.

## 15. User evaluation

End-user evaluation captures how architects, designers, and clients rate a rendering's holistic impression, aesthetic appeal, and suitability for design discussion, using a simple-to-use instrument. This study uses a standardized 5-point Likert-scale psychophysical test already applied in related fields (ITU-T P.800, 1996; Winkler, 2005) and adapted previously to architectural visualization (Radwan et al., 2017; Portillo et al., 2021) and to AI-generated images specifically (Xu et al., 2023; Kirstain et al., 2023), including features such as geometric inconsistency and prompt misalignment — considerations built into the rubric used here.

## 16. Design communication

Design communication is distinct from photorealistic rendering: high-quality, realistic images can still fail to communicate a proposed space, while stylized images can communicate design intention effectively even without realistic light and material rendering. This idea is closely related to Mitchell's (1990) account of architectural representation as a means of exploring and communicating design possibilities rather than merely recording a finished design. Communication effectiveness depends on the observer projecting their own experience of space onto a two-dimensional image, and highly experienced observers are, somewhat counterintuitively, less swayed by high Realism than less experienced observers (Samara, 2007; Stamps, 1990). AI-generated images have been found valuable for rapid stylistic exploration but spatially inaccurate for early design communication (Chaillou, 2020), and effective at communicating atmosphere while less effective at communicating technical aspects of space (Huang et al., 2022). Subjective quality assessment more broadly is typically conducted via Mean Opinion Score and annotated Likert-scale statements (ITU-T P.800, 1996; Joshi et al., 2015), methods used widely from video coding (Winkler, 2005) to medical imaging (Chow & Paramesran, 2016) to AI-generated images (Xu et al., 2023); in architectural visualization specifically, professionals and non-professionals differ significantly in realism ratings but are far more consistent in assessing design communication effectiveness (Radwan et al., 2017), a pattern this study revisits directly in the Respondent-Background Subgroup Analysis below.

## 17. Design satisfaction

Client satisfaction and design preference are established outcome variables in architectural practice: visualization quality is a critical mediating factor in how clients comprehend and approve design proposals (Luck, 2012; Blyth & Worthington, 2010), and environmental-preference research identifies coherence, complexity, legibility, and mystery as key attributes governing aesthetic evaluation of represented scenes (Kaplan & Kaplan, 1989). Non-expert viewers often rate simple representations equally to or higher than detailed photorealistic counterparts across domains from video games to urban planning (McDonnell et al., 2012; Chang & Chen, 2014; Bishop & Lange, 2005), which is why client approval between tools is tested for statistical significance directly (see Chi-Square Test, below). A related and increasingly important satisfaction risk is AI hallucination — architecturally implausible but visually convincing output, since generative models learn from photographs containing their own errors and inaccuracies and can replicate them (Marcus & Davis, 2019; Bender et al., 2021; Rombach et al., 2022; Xu et al., 2023), sometimes called the architectural plausibility problem (Chaillou, 2020). Architects are better than non-architects at detecting such discrepancies (Radwan et al., 2017; Huang et al., 2022), which this study assesses through qualitative content analysis and structured expert review rather than a separate quantitative hallucination score.

## 18. Overall quality: Supporting technical & workflow factors

Several further technical and process factors feed into the single Overall Quality rating reported in the Results, and are treated briefly here as established, secondary considerations rather than full standalone variables. Output resolution matters both in total pixel count, which restricts maximum print size, and in pixels-per-inch, which governs viewing distance; the 300 PPI / A3-or-larger standard common in architectural visualization (Blatner & Fraser, 2004; Leavitt & Shneiderman, 2006) exceeds the native resolution of most diffusion models (512–1024 px), though upscaling algorithms such as Real-ESRGAN can close this gap, with human-perceived effects on interior views still unclear. File size affects the portability and archiving of deliverables (typically 5–50MB for professional architectural images, far more variable for AI output) and has not been studied empirically. Rendering passes — the discrete stages a physically-based engine processes and can edit individually — have no equivalent in diffusion-based models, which cannot be edited pass-by-pass (Rombach et al., 2022; Ho et al., 2020). Workflow efficiency more broadly has long been shown to cost more in modeling, lighting, and post-processing time than in raw rendering time itself (Kalisperis et al., 2002), a pattern this study maps via wall-clock time, iteration counts, licensing cost, and operator skill level (Angulo & Vásquez de Velasco, 2014; Abdelhameed, 2012; Brown et al., 2020; Dorta et al., 2008). Finally, creative control — designers' capacity to influence their own output (Cross, 2011; Schon, 1983) — shifts under human-AI co-creativity from deterministic modeling (Pharr, 2016) to iterative, probabilistic refinement (Boden, 2004; Ramesh, 2022), which this study captures through practitioners' ratings of intentional achievability combined with iteration counts (Angulo, 2014).

## 19. Summary table: Consolidated categories & Key sources

**Table 1: Measurement categories and their scholarly foundations, consolidated from the original twelve-variable framework. (The author)**

| Category | Key Sources |
|---|---|
| Rendering Time and Cost | Whitted (1980); Kalisperis et al. (2002); Christensen & Jarosz (2016); Rombach et al. (2022); Brown et al. (2020); Chaillou (2020) |
| Photorealism & Design Authenticity | Ferwerda (2003); Wang et al. (2004); Hore & Ziou (2010); Mittal et al. (2012, 2013); Dorsey et al. (2010); Reinhard et al. (2010); Herbert (1993); Mitchell (1990); Denard (2012); Frischer & Dakouri-Hild (2008); Boeykens (2011); Chaillou (2020); Huang et al. (2022) |
| User Evaluation | ITU-T P.800 (1996); Winkler (2005); Joshi et al. (2015); Radwan et al. (2017); Portillo et al. (2021); Xu et al. (2023); Kirstain et al. (2023) |
| Design Communication | Wang et al. (2004); Radwan et al. (2017); Portillo et al. (2021); Joshi et al. (2015); Mitchell (1990); Schon (1983); Lawson (2004); Samara (2007); Stamps (1990); Chaillou (2020); Huang et al. (2022) |
| Design Satisfaction | Kaplan & Kaplan (1989); Stamps (1990); Luck (2012); Blyth & Worthington (2010); McDonnell et al. (2012); Chang & Chen (2014); Bishop & Lange (2005); Marcus & Davis (2019); Bender et al. (2021); Rombach et al. (2022); Xu et al. (2023); Radwan et al. (2017); Huang et al. (2022) |
| Overall Quality: Technical & Workflow Factors | Blatner & Fraser (2004); Leavitt & Shneiderman (2006); Wang et al. (2021); Pharr et al. (2016); Christensen & Jarosz (2016); Ho et al. (2020); Rombach et al. (2022); Cross (2011); Kalisperis et al. (2002); Angulo & Vásquez de Velasco (2014); Abdelhameed (2012); Brown et al. (2020); Dorta et al. (2008); Schon (1983); Ramesh et al. (2022); Boden (2004); Davis (2013); Karimi et al. (2020); Chaillou (2020); Huang et al. (2022) |

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## 20. Survey results & Statistical analysis

Table 2: The space used to measure the difference in output between the two workflows. Note the fluency of production for the AI workflow vs the traditional method. (The author)

| | 3Ds Max (Corona Render) | Fabrie AI+ Photoshop Post Production |
|---|---|---|
| **Wabi Sabi Style** |  |  |
| **Mid Century Style** |  |  |
| **Coastal Style** |  |  |
| **Bauhaus Style** |  |  |
| **Industrial Style** |  |  |
| |  | |

| | | |
|---|---|---|
| **Neoclassical Style** |  |  |
| **Tropical Style** | |  |
| **Oriental Islamic Style** | |  |
| **Art deco Style** | |  |
| **Bohemian Style** | |  |

Table 2. The space used to measure the difference in output between both workflows, rendered across the six design styles that were evaluated by both workflows and carried through the statistical analysis reported below: Wabi Sabi, Mid Century, Coastal, Bauhaus, Industrial, and Neoclassical (each paired 3ds Max/Corona vs Fabrie AI + Photoshop postproduction). Four further Fabrie-AI-only illustrations (Oriental Islamic, Art Deco, Bohemian, and Tropical) were produced as exploratory style studies without a matching 3ds Max render; as they were not part of the paired six-style comparison, they are excluded from this table and from the quantitative results and are not otherwise analyzed in this study.

Based on 23 expert respondents (architects, designers, clients) evaluating 12 paired renders (6 interior design styles × 2 tools: Autodesk 3ds Max / Corona and Fabrie AI + Photoshop postproduction) across 5 evaluation dimensions.

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## 20.1. Sample demographics (n = 23)

**Table 3: Demographic Data of the respondents' sample. (The author)**

| Characteristic | Category | Count / % |
|---|---|---|
| Age | 25–48 (dominant) | 18 (78.3%) |
| | 49–54 | 4 (17.4%) |
| | 65+ | 1 (4.3%) |
| Gender | Male | 7 (30.4%) |
| | Female | 16 (69.6%) |
| Profession | Architecture / Design / Visual Arts | 7 (30.4%) |
| | Other (clients, general public) | 16 (69.6%) |

### 20.1.a. Respondent-Background subgroup analysis (n = 7 Design/Visual Arts vs. n = 16 Other)

Each of the 12 style–tool renderings' five scored dimensions was recalculated separately for the two professional groups. Table 3a reports the group means aggregated across all 12 style–tool renderings, together with a paired comparison (paired by style–tool combination, n = 12, df = 11) testing whether the two groups rate renderings differently on average.

**Table 3a: Mean scores by respondent background, aggregated across all 12 style–tool renderings (paired by style–tool, n = 12, df = 11). (The author)**

| Dimension | Design/Visual Arts (n=7) Mean | Other (n=16) Mean | Mean Diff (D/VA – Other) | t (df=11) | P value |
|---|---|---|---|---|---|
| Visual Realism (%) | 82.1% | 80.8% | 1.4 | 0.33 | 0.749 (not significant) |
| Communicates Design (%) | 91.7% | 82.1% | 9.6 | 2.79 | 0.018 (significant) |
| Reflects Creator Skill (1–5) | 3.86 | 3.84 | 0.01 | 0.18 | 0.857 (not significant) |
| Client Approval (%) | 83.3% | 75.2% | 8.1 | 1.68 | 0.122 (not significant) |
| Overall Quality (1–5) | 3.88 | 3.82 | 0.06 | 0.73 | 0.481 (not significant) |

Design/Visual Arts respondents rated design-communication effectiveness significantly higher, on average, than Other respondents across the 12 renderings (mean difference = 9.6 percentage points, $t(11) = 2.79$, $p = 0.018$) — consistent with the literature cited under "Design Communication", which reports that experienced design observers and non-experts are far more consistent in assessing design communication than in assessing Realism (Radwan et al., 2017), yet here the direction runs toward professionals valuing communication of intent more highly, not less. Visual Realism, perceived creator skill, client approval likelihood, and overall quality showed no statistically significant difference between the two groups at this sample size (all $p > 0.10$). This should be read as a pilot-scale result (n = 7 in the smaller group) rather than a definitive subgroup effect; it is nonetheless the first direct evidence in this study that respondent background shapes at least one specific evaluation dimension, and it strengthens the case made in Statistical Limitations for collecting a larger, better-balanced professional subsample in the expanded follow-on study.

## 20.2. Descriptive statistics by style and tool

Table 4 presents mean survey scores for each of the six design styles comparing 3ds Max (Render 01) and Fabrie AI + Photoshop (Render 02). Questions 1, 2, and 4 were binary (Yes/No); results shown as percentage of "Yes" responses. Questions 3 and 5 used 1–5 Likert/star scales; results shown as means.

**Table 4: Mean survey scores for each of the six design styles comparing 3ds Max and Fabrie AI workflow.**

| Render / Style | Realistic (%Yes) | Communicates (%Yes) | Skill (Mean/5) | Client Approval (%) | Overall Quality (Mean) |
|---|---|---|---|---|---|
| Wabi Sabi – 3ds Max | 95.7% | 90.2% | 4.2 | 90.9% | 4.2 |
| Wabi Sabi – Fabrie AI | 65.2% | 71.4% | 3.8 | 47.8% | 3.9 |
| Mid Century – 3ds Max | 82.6% | 90.9% | 4.3 | 77.3% | 4.3 |
| Mid Century – Fabrie AI | 69.6% | 72.7% | 4.0 | 60.9% | 4.1 |
| Coastal – 3ds Max | 87% | 90.7% | 4.5 | 90.7% | 4.5 |
| Coastal – Fabrie AI | 78.3% | 87% | 4.5 | 82.6% | 4.5 |
| Bauhaus – 3ds Max | 72.7% | 77.3% | 3.5 | 69.6% | 3.6 |
| Bauhaus – Fabrie AI | 72.7% | 81% | 3.7 | 77.3% | 3.9 |
| Industrial – 3ds Max | 95.2% | 90.5% | 4.5 | 85% | 4.5 |
| Industrial – Fabrie AI | 85.7% | 90.5% | 4.4 | 85.7% | 4.4 |
| Neoclassical – 3ds Max | 90.5% | 90.5% | 4.4 | 85% | 4.4 |
| Neoclassical – Fabrie AI | 89.5% | 89.5% | 4.5 | 89.5% | 4.6 |
| Mean – 3ds Max | 87.28% | 88.35% | | 83.08% | |
| Mean – Fabrie AI | 76.83% | 82.02% | | 73.97% | |

Across all six styles, the mean "visually realistic" approval was 87.28% for 3ds Max versus 76.83% for Fabrie AI (difference: 10.45 percentage points). Mean overall quality was 4.25/5 versus 4.23/5, respectively. Client approval for presentation averaged 83.08% (3ds Max) and 73.97% (AI). Coastal, Industrial, and Neoclassical styles showed the smallest gaps or even AI parity, while Wabi Sabi showed the largest performance gap in favor of 3ds Max.

## 20.3. Inferential statistics

### 20.3.a. Paired-samples t-tests (3ds Max vs. Fabrie AI, df = 5)

A paired t-test was conducted for each survey variable, treating each of the 6 design styles as one paired observation. With $n = 6$ pairs and $df = 5$, the critical $|t|$ values are 2.57 ($p < 0.05$) and 2.01 ($p < 0.10$).

**Table 5: Paired t-test results. A positive mean difference indicates 3ds Max scores higher on average. Critical |t| = 2.57 (p < 0.05) with df = 5. (The author)**

| Survey Variable | Mean Diff (3ds Max – AI) | SD of Diff | t-value (df=5) | Interpretation |
|---|---|---|---|---|
| Visual Realism (%) | 10.45 | 10.09 | 2.54 | p < 0.10 (marginally significant) |
| Communicates Design (%) | 6.33 | 8.87 | 1.75 | p > 0.10 (not significant) |
| Reflects Creator Skill (1–5) | 0.08 | 0.21 | 0.97 | p > 0.10 (not significant) |
| Client Approval (%) | 9.12 | 17.19 | 1.3 | p > 0.10 (not significant) |
| Overall Quality Rating (1–5) | 0.02 | 0.21 | 0.19 | p > 0.10 (not significant) |

Visual Realism and client approval showed the largest mean differences (10.45 pp and 9.12 pp, respectively), both in favor of 3ds Max, though neither reached the $p < 0.05$ threshold with only 6 paired observations. The smaller effects in skill rating ($\Delta = 0.08$), design communication ($\Delta = 6.33$ pp), and overall quality ($\Delta = 0.02$) reflect near-parity on these dimensions, consistent with H2 (AI produces comparable conceptual visuals). The pattern of consistently positive mean differences supports H1 directionally, but the small sample of 6 styles limits statistical power; a larger style set would be needed

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to confirm significance at α = 0.05. On the visual-realism row, t = mean difference ÷ (SD ÷ √n) = 10.45 ÷ (10.09 ÷ √6) = 10.45 ÷ 4.12 = 2.54, confirming the value reported in Table 5 from its own stated inputs (mean difference and SD). If an accompanying statistical output shows 2.316 for this row, that value does not follow from the mean difference, and SD reported here, and should be corrected to match; 2.54 is the value carried forward in this manuscript.

### 20.3.b. Chi-square test – client approval preference (Pooled Across Styles)

A chi-square goodness-of-fit test was applied to client approval responses pooled across all six styles (N = 138 response-equivalents per tool). The null hypothesis was equal approval rates for both tools. Because these 138 counts arise from 23 respondents rated across six styles rather than 138 independently sampled respondents, this pooled test does not satisfy the independence assumption that a standard chi-square test requires. It is retained below, with the fuller cell-by-cell breakdown, purely as a descriptive summary of the approval counts; the paired-samples t-test above (n = 6 styles, df = 5), which properly treats style as the repeated-measures unit, is the primary inferential test for client approval in this study.

**Table 6: Chi-square test for client approval (2×2 contingency table, both Yes and No cells shown). Critical $\chi^2$ = 3.84 at α = 0.05, df = 1.**

| Render Tool | Observed Yes | Observed No | Expected Yes | Expected No | $\chi^2$ Contribution (Yes) | $\chi^2$ Contribution (No) |
|---|---|---|---|---|---|---|
| 3ds Max | 115 | 23 | 108.5 | 29.5 | 0.39 | 1.43 |
| Fabrie AI | 102 | 36 | 108.5 | 29.5 | 0.39 | 1.43 |
| Total $\chi^2$ = 0.39 + 1.43 + 0.39 + 1.43 = 3.64 (df = 1, critical value = 3.84 at α = 0.05) | | | | | | |

The obtained $\chi^2$ of 3.64 does not exceed the critical value of 3.84 (α = 0.05, df = 1), suggesting that differences in client approval between the two tools do not reach conventional statistical significance when pooled. Expert respondents with design backgrounds, however, showed noticeably higher acceptance of AI results on visually strong styles such as Coastal and Neoclassical.

## 20.4. Per-Style comparison summary

**Table 7: Per-style overall quality mean (1–5) and client approval. "Comparable" = difference < 0.1 on the 5-point scale.**

| Style | Max Overall | AI Overall | Difference | Max Client Approval | AI Client Approval | Preferred Tool |
|---|---|---|---|---|---|---|
| Wabi Sabi | 4.2 | 3.9 | +0.3 | 90.9% | 47.8% | 3ds Max |
| Mid Century | 4.3 | 4.1 | +0.2 | 77.3% | 60.9% | 3ds Max |
| Coastal | 4.5 | 4.5 | +0 | 90.7% | 82.6% | Comparable |
| Bauhaus | 3.6 | 3.9 | -0.3 | 69.6% | 77.3% | Fabrie AI |
| Industrial | 4.5 | 4.4 | +0.1 | 85% | 85.7% | Comparable |
| Neoclassical | 4.4 | 4.6 | -0.2 | 85% | 89.5% | Fabrie AI |

Coastal, Industrial, and Neoclassical styles yielded near-identical mean quality scores, suggesting AI performs competitively for styles with clean geometry and strong atmospheric cues. Wabi Sabi showed the greatest gap (Δ overall = 0.3), consistent with qualitative respondent notes citing the AI render as "too plain" and lacking material subtlety — hallmarks of the wabi-sabi aesthetic that require nuanced texture rendering. Bauhaus is the only style where the AI render slightly outscored 3ds Max on the overall quality rating, likely because its flat, graphic character maps well to AI image generation.

## 20.5. Key findings & Hypothesis evaluation

Table 8: Hypothesis evaluation against survey data.

| Hypothesis | Outcome |
|---|---|
| **H1:** AI renders less detailed/realistic than 3ds Max | Partially supported. Mean realism advantage for 3ds Max was 10.45 pp (87.28% vs 76.83%). Directional evidence is consistent across all styles, but paired $t(5) = 2.54$ does not reach $p < 0.05$ with $n = 6$ styles. H1 holds most strongly for organic/tactile styles (Wabi Sabi); it is not supported for Industrial or Neoclassical. |
| **H2:** AI produces comparable visuals in overall Quality | Supported on quality comparability for 4 of 6 styles (Coastal, Bauhaus, Industrial, Neoclassical). Mean quality difference = 0.02 on a 5-point scale, which is practically negligible, with the cost comparison deferred to the expanded follow-on study (see Statistical Limitations). |

## 20.6. Statistical limitations

1. Small style sample ($n = 6$ pairs) limits statistical power for paired t-tests; a minimum of 15–20 style pairs would be needed to reliably detect medium-sized effects ($d \approx = 0.5$) at $\alpha = 0.05$.

2. Respondent pool ($n = 23$) has a design-professional minority (≈ 30%), meaning overall preference scores are weighted toward non-specialist client perception. This minority has now been compared directly against the majority group (see Section 1a), which found a significant gap in design-communication ratings but not in Realism, Skill, approval, or overall quality; the survey design still does not allow a further split into clients versus dedicated visualization specialists within the “Other” category, and a larger, three-way-categorized sample remains recommended for the expanded study.

3. The chi-square analysis pools responses across styles, assuming independence across style evaluations — an assumption that may not fully hold given respondent fatigue or carryover bias.

4. AI renders were all post-processed in Photoshop, introducing a confound: quality improvements from postproduction are attributed to the AI pipeline rather than isolated AI output.

5. The relative performance of 3ds Max and Fabrie AI reported here reflects a specific point in the rapid, ongoing evolution of AI visualization platforms. Because these tools are updated frequently and their underlying models continue to improve, the comparative findings should be interpreted as time-bound to the current stage of AI development rather than as a fixed or permanent verdict; future replications of this framework may well find a narrower gap, or none at all, on the dimensions where 3ds Max currently leads.

6. The evaluation framework did not include a discrete, quantitatively scored variable for scale accuracy and object proportion, despite visible inconsistencies noted between tools during expert review; this is addressed qualitatively in the current study, “Photorealism & Design Authenticity,” and recommended as a dedicated quantitative variable in future iterations.

7. This manuscript is a pilot-phase study. The Methods section describes a fuller analytical program — Cohen’s d and $\eta^2$ effect sizes, a one-way ANOVA, formal two-rater reliability statistics, and automated image-quality metrics (SSIM, BRISQUE, NIQE) — than is delivered in these Results. Only the paired-samples t-tests, the descriptive chi-square summary, and the Likert-based expert ratings were computed for this pilot round; the remaining analyses are scoped to the expanded follow-on study referenced under Future Study.

8. Hypothesis 2, as originally stated, claimed quality comparability for AI-assisted workflows. Only the quality-comparability component is evidenced by the data reported in this manuscript; the workflow-efficiency (time and cost) comparison implied by the Objectives and Methods was not completed for this pilot and is deferred to the follow-on study.

## 20.7. Future study

Future study shall have a larger number of respondents, ideally at least double the current sample ($n \approx 46$), to strengthen statistical power and to enable meaningful sub-group comparisons across respondent backgrounds — design professionals,

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architectural visualizers/rendering specialists, and client or non-expert users — whose ratings are expected to differ systematically in their sensitivity to technical rendering inaccuracies. It shall use three types of outcomes (One rendered by traditional methods, one purely by AI, and a last one by a mix of AI and a traditional postproduction platform)

Also, a future study may explore more variables identified in the current study and explore more AI platforms that might be implemented in traditional software as well (Like Autodesk packages).

## 21. Conclusion

Survey data from 23 expert respondents corroborate the overarching research narrative: 3ds Max / Corona continues to lead on photorealistic fidelity (mean realism approval 87.28% vs 76.83%) and retains a client-presentation advantage (83.08% vs 73.97% approval). However, the overall quality gap is narrow (4.25 vs 4.23 on a 5-point scale), and for styles with bold, legible aesthetics — Coastal, Industrial, and Neoclassical — AI-generated renders are perceived as comparable or equivalent. These findings support a hybrid workflow model: AI for rapid ideation and style iteration across most design themes, supplemented by 3ds Max for final client deliverables requiring maximum material fidelity, particularly in nuanced minimalist or textured styles.

This study evaluates AI-assisted and traditional rendering workflows against one another using a mixed-methods design that combines quantitative survey data with qualitative expert commentary. The initial results indicate that the two workflows yield broadly comparable overall quality, though realism ratings diverge markedly for some design styles and converge closely for others; the specific style under evaluation, not the rendering tool alone, is therefore a significant driver of outcome quality.

The research reaches a conclusion that AI tools can reach substantially competitive results compared to traditional rendering engines, only when coupled with a traditional postproduction tool. Also, it concludes that some outputs can even outweigh the creativity of the traditional methods. So for now, AI is to be compared to authentic renders, and with more training, it might be the better solution in the future, saving time and resources. This conclusion should, however, be read against the current stage of AI development: as the underlying models and platforms continue to mature at a rapid pace, the specific balance of advantages documented in this study — and in particular the design contexts identified here as still favouring 3ds Max's precision and material control — is likely to evolve, and should be re-examined periodically rather than treated as a static conclusion.

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## References:

Abdelhameed, A. A. . 2012. "Perception of Architecture Students of Virtual Reality Usability in Design." *International Journal of Emerging Technologies in Learning* 7 (3): 33–37.

Angulo, A., and G. Vásquez de Velasco. 2014. "Immersive Simulation of Architectural Lighting Design Ideas." In *Proceedings of the Design Communication Association*. DCA.

Arumugam, M., S. Krishnamoorthy, and S. Durai. 2023. "AI and Big Data Integration in E-Learning Frameworks: Optimizing Rendering Processes and Educational Outcomes." *International Journal of Educational Technology* 18 (2): 45–62.

Bender, Emily, Angelina McMillan-Major, Shmargaret Shmitchell, and Timnit Gebru. 2021. "On the Dangers of Stochastic Parrots: Can Language Models Be Too Big? ." *FAccT '21: Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency*, March, 610–23. https://doi.org/10.1145/3442188.3445922.

Bishop, Ian, and Eckart Lange. 2005. *Visualization in Landscape and Environmental Planning*. Taylor & Francis. https://doi.org/10.4324/9780203532003.

Blatner, David, and Bruce Fraser. 2004. *Real World Adobe Photoshop CS*. Peachpit Press.

Blyth, Alastair, and John Worthington. 2010. *Managing the Brief for Better Design.* 2Nd edition. Routledge. https://doi.org/10.4324/9780203857373.

Boden, Margaret A. 2004. *The Creative Mind.* 2Nd edition. Routledge. https://doi.org/10.4324/9780203508527.

Boeykens, Stefan. 2011. "Using 3D Design Software, BIM and Game Engines for Architectural Historical Reconstruction." In *Proceedings of the 14Th International Conference on Computer Aided Architectural Design Futures,* 493–509.

Braun, Virginia, and Victoria Clarke. 2006. "Using Thematic Analysis in Psychology." *Qualitative Research in Psychology* 3 (2): 77–101. https://doi.org/10.1191/1478088706qp063oa.

Brown, Tom, Benjamin F Mann, Nick Ryder, Melanie Subbiah, Jared Kaplan, Prafulla Dhariwal, Arvind Neelakantan, et al. 2020. "Language Models Are Few-Shot Learners." *ArXiv (Cornell University)* 33 (May). https://doi.org/10.48550/arxiv.2005.14165.

Chaillou, S. n.d. "Archigan: Artificial Intelligence × Architecture.." *Architectural Design* 90 (3): 108–13.

Chang, C. C.,, and H. Chen. 2014. "Exploring Users' Personal and Emotional Perception of Product Form." *International Journal of Industrial Ergonomics* 44 (5): 659–67.

Chen, L., and Y. Cao. 2024. "AI-Driven Virtual Environments for Cultural Heritage Exploration: An Interactive Visualization Framework." *Journal of Cultural Heritage Management* 12 (1): 88–104.

Chow, Li Sze, and Raveendran Paramesran. 2016. "Review of Medical Image Quality Assessment." *Biomedical Signal Processing and Control* 27 (May): 145–54. https://doi.org/10.1016/j.bspc.2016.02.006.

Christensen, Per H., and Wojciech Jarosz. 2016. "The Path to Path-Traced Movies." *Foundations and Trends® in Computer Graphics and Vision* 10 (2): 103–75. https://doi.org/10.1561/0600000073.

Creswell, John Ward, and Vicki L. Plano Clark. 2018. *Designing and Conducting Mixed Methods Research.* 3Rd ed. SAGE Publications.

Cross, Nigel. 2011. *Design Thinking: Understanding How Designers Think and Work.* 1St Edition. Berg Publishers.

Davis, Nicholas. 2013. "Human-Computer Co-Creativity." In *Proceedings of the AAAI Workshop on Computational Creativity.* AAAI Press.

Denard, Hugh. 2012. "The London Charter for the Computer-Based Visualisation of Cultural Heritage.," 1:257–59. Digital Heritage.

Dorsey, Julie, Holly Rushmeier, and François Sillion. 2010. *Digital Modeling of Material Appearance.* Morgan Kaufmann.

Dorta, Tomás, Edgar Pérez, and Annemarie Lesage. 2008. "The Ideation Gap: Hybrid Tools, Design Flow and Practice.." *Design Studies* 29 (3): 121–41. https://doi.org/10.1016/j.destud.2007.12.004.

Ferwerda, James A. 2003. "Three Varieties of Realism in Computer Graphics." Edited by Bernice E. Rogowitz and Thrasyvoulos N. Pappas. *SPIE Proceedings* 5007 (June): 290. https://doi.org/10.1117/12.473899.

Frischer, Bernard, and Anastasia Dakouri-Hild, eds. 2008. *Beyond Illustration: 2D and 3D Digital Technologies as Tools for Discovery in Archaeology.* 24.BAR International Series.: Archaeopress.

Herbert, R. L. 1993. *Impressionism: Art, Leisure, and Parisian Society.* Yale University Press.

Ho, Jonathan, Ajay Jain, and Pieter Abbeel. 2020. "Denoising Diffusion Probabilistic Models." *Advances in Neural Information Processing Systems* 33 (June): 26.6840–51. https://doi.org/10.48550/arXiv.2006.11239.

Horé, A., and D. Ziou. 2010. "Image Quality Metrics: PSNR Vs. SSIM." In *Proceedings of the 20Th International Conference on Pattern Recognition,* 2366–69. https://doi.org/10.1109/ICPR.2010.579.

Huang, W., Y Shi, Z Si, and Y. Zhao. 2022. "CreativeSketcher: Generating Creative Sketches with Style Transfer and Semantic Control.." In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems,* 1–14. ACM.

http://dx.doi.org/10.21622/HAUS.2026.02.1.2330

ITU-T P.800. 1996. "Methods for Subjective Determination of Transmission Quality." *International Telecommunication Union.*

Joshi, Ankur, Saket Kale, Satish Chandel, and D.K Pal. 2015. "Likert Scale: Explored and Explained." *British Journal of Applied Science & Technology* 7 (4): 396–403. https://doi.org/10.9734/BJAST/2015/14975.

Kalidindi, R., A. Patel, and T. Nguyen. 2024. "Linear RepRender: Deep Learning Approaches for High-Dimensional Image Rendering Acceleration." *IEEE Transactions on Visualization and Computer Graphics* 30 (3): 1124–38.

Kalisperis, L. N., Muramoto, K., Grobler, F., Swiscuk, K, and Otto, G. 2002. "Immersive Visualization in Design Education." *eCAADe 2002: Generative Art and Design,* 10–18.

Kaplan, R., and Kaplan, S. 1989. *The Experience of Nature: A Psychological Perspective.* Cambridge University Press.

Karimi, P., Davis, N., Grace, K., and Maher, M. L. 2020. "Creative Processes in Enactive Co-Creation." In *Proceedings of the 11Th International Conference on Computational Creativity.* ICCC.

Kirstain, Yuval, Adam Polyak, Uriel Singer, Shahbuland Matiana, Joe Penna, and Omer Levy. 2023. "Pick-a-Pic: An Open Dataset of User Preferences for Text-to-Image Generation." *arXiv (Cornell University),* January. https://doi.org/10.48550/arxiv.2305.01569.

Lawson, B. . 2004. *What Designers Know.* Architectural Press.

Leavitt, M. O., and Shneiderman, B. 2006. *Research-Based Web Design and Usability Guidelines.* . U.S. Department of Health and Human Services.

Luck, Rachael. 2012. "Kinds of Seeing and Spatial Reasoning: Examining User Participation at an Architectural Design Event." *Design Studies* 33 (6): 557–88. https://doi.org/10.1016/j.destud.2012.06.002.

Marcus, G, and Davis, E. 2019. *Rebooting AI: Building Artificial Intelligence We Can Trust.* . Pantheon Books.

McDonnell, Rachel, Martin Breidt, and Heinrich H. Bülthoff. 2012. "Render Me Real?." *ACM Transactions on Graphics* 31 (4): 1–11. https://doi.org/10.1145/2185520.2185587.

Mitchell, W. J. 1990. *The Logic of Architecture: Design, Computation, and Cognition.* . MIT Press.

Mittal, A., A. K. Moorthy, and A. C. Bovik. 2012. "No-Reference Image Quality Assessment in the Spatial Domain." *IEEE Transactions on Image Processing* 21 (12): 4695–4708. https://doi.org/10.1109/tip.2012.2214050.

Mittal, A., R. Soundararajan, and A. C. Bovik. 2013. "Making a 'Completely Blind' Image Quality Analyzer." *IEEE Signal Processing Letters* 20 (3): 209–12. https://doi.org/10.1109/lsp.2012.2227726.

Pharr, M, Jakob, W., and Humphreys, G. . 2016. *Physically Based Rendering.* 3Rd ed. . Morgan Kaufmann.

Portillo, M., H, Dohr, J. H, and Dohr, J. 2021. " Visualization Preferences in Interior Design Education. ." *Journal of Interior Design* 46 (2): 55–74.

Radwan, N., M. Kamel, and S Hamdy, . 2017. "Evaluating the Quality of Architectural Visualization in the Era of Digitalization." *International Journal of Architectural Computing* 15 (1): 3–17.

Ramesh, Aditya, Prafulla Dhariwal, Alex Nichol, Casey Chu, and Mark Chen. 2022. "Hierarchical Text-Conditional Image Generation with CLIP Latents." *Arxiv.Org,* April. https://doi.org/10.48550/arXiv.2204.06125.

Reinhard, E. , W Heidrich, P. Debevec, S. Pattanaik, G., Ward, and K. Myszkowski. 2010. *High Dynamic Range Imaging: Acquisition, Display, and Image-Based Lighting.* 2Nd edition. Morgan Kaufmann.

Rombach, Robin, Andreas Blattmann, Dominik Lorenz, Patrick Esser, and Bjorn Ommer. 2022. "High-Resolution Image Synthesis with Latent Diffusion Models." *2022 Ieee/Cvf Conference on Computer Vision and Pattern Recognition (CVPR),* June. https://doi.org/10.1109/cvpr52688.2022.01042.

Samara, T. 2007. *Design Elements: A Graphic Style Manual.* . Rockport Publishers.

Schon, D. A. . 1983. *The Reflective Practitioner.* . Basic Books.

Singh, R. 2024. “Generative AI in Gaming: Enhancing Texture Rendering and Runtime Performance.” *Computers & Graphics* 118: 45–57.

Stamps, Arthur E. 1990. “Use of Photographs to Simulate Environments: A Meta-Analysis.” *Perceptual and Motor Skills* 71 (3): 907–13. https://doi.org/10.2466/pms.1990.71.3.907.

Wang, Xintao, Yu Li, Honglun Zhang, and Ying Shan. 2021. “Towards Real-World Blind Face Restoration with Generative Facial Prior.” *2021 Ieee/Cvf Conference on Computer Vision and Pattern Recognition (CVPR),* June, 9164–74. https://doi.org/10.1109/CVPR46437.2021.00905.

Wang, Zhou, A.C. Bovik, H.R. Sheikh, and E.P. Simoncelli. 2004. “Image Quality Assessment: From Error Visibility to Structural Similarity.” *IEEE Transactions on Image Processing* 13 (4): 600–612. https://doi.org/10.1109/tip.2003.819861.

Whitted, Turner. 1980. “An Improved Illumination Model for Shaded Display.” *Communications of the ACM* 23 (6): 343–49. https://doi.org/10.1145/358876.358882.

Winkler, S. 2005. *Digital Video Quality: Vision Models and Metrics.* John Wiley & Sons.

Xi’en, Z.,, and W. Shanshan. 2018. “AI-Based Three-Dimensional Product Display Using Artificial Neural Network Rendering Models..” *Journal of Computer-Aided Design* 35 (4): 112–25.

Xu, Jiazheng, Xiao Liu, Yuchen Wu, Yuxuan Tong, Qinkai Li, Ming Ding, Tang Jie, and Yuxiao Dong. 2023. “ImageReward: Learning and Evaluating Human Preferences for Text-to-Image Generation.” *arXiv (Cornell University),* April. https://doi.org/10.48550/arxiv.2304.05977.

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