Beyond Disruption: Digital Intelligence and Human Intuition in Architectural Practice

Adam Kiryk[1]

Introduction: Framing the One-Year AI Research Project

For centuries, architects have advanced by adopting new design tools: From ink sketches on vellum to digital sketching tablets, from hand-drafted layouts on drawing boards to modern CAD systems, from manual spreadsheets in Excel to BIM-driven coordination, or from classical hand-drawn perspective renderings to hyper-realistic VR-based visualizations. Each shift subtly reshapes the creative process, bridging tradition with technology. Now, AI emerges as the latest step in this continuum, offering the potential not to disrupt or replace the profession, but once again to enhance the traditional skills that define it. By revisiting workflows once deemed obsolete and pairing them with digital precision, AI can reinvigorate the practice, ultimately striking a balance between time-tested methods and new efficiencies.

In early 2024, the Managing Board of architectural and construction design office Penzel Valier identified AI as a strategic focus for our Digital Technology Competence Team, alongside Digital Twins, 3D Scanning, and Modularization. The newly outlined strategy aimed to explore AI's potential in ar-

1 Author's note: This article was written with strong support from ChatGPT-4o, primarily for text editing and structural refinement. The GPT-o1 model was used for deeper analysis and critical review to identify gaps in coherence and ensure logical flow. This process allowed me to focus primarily on content development, while AI-assisted editing helped maintain a concise and consistent style. Given my multilingual thought process—shifting between Polish, English, and German—AI played a key role in unifying the text into one cohesive narrative. The writing process became a moderated dialogue between AI and an experienced architect (but amateur writer), creating a continuous learning experience in structuring and refining ideas while working with LLMs.

chitectural design and construction while aligning with both short-term efficiency goals and long-term innovation strategies.

To lead this effort, the Board established a dedicated AI Unit, tasked with conducting an open-ended one-year research project. The objective was to evaluate AI's practical applications, identify key workflows where it could enhance efficiency, and build a roadmap for gradual implementation.

This initiative aligned closely with my research at ETH Zurich, where, since 2017, I have been teaching courses on digital technologies and design processes. My involvement with various research units at the university—such as the ETH AI Center, the Media & Game Technology Center, and the Center for Augmented Computational Design in Architecture, Engineering, and Construction (Design++)—provided a strong foundation for exploring AI's transformative role in creative industries, bridging theoretical research with practical applications in architectural design.

At Hybrid Reality Research, a unit I led under the Chair of Digital Building Technology supervised by Prof. Dillenburger, we organized a "Guest Input" lecture series within our elective courses, giving us and our students the opportunity to exchange ideas with experts such as Michael Mieskes (ZHAW), who explored AI's role in design theory, George Guida (Harvard GSD), who focused on AI in architectural education, and Dr. Sergey Prokudin (ETH), who researched NeRF (neural radiance field) 3D scanning methods. On the industry side, discussions with Keir Regan Alexander (Arka.Works), Bas van de Poel (Modem Works), and Michael Drobnik and Martin Schulte (Herzog & De Meuron) provided practical insights into AI and XR (Extended Reality) applications in architecture. These dialogues helped shape our research direction at Penzel Valier, blending theoretical exploration with hands-on implementation.

Beyond academia, we analyzed case studies from leading architectural firms such as MVRDV, BIG, and Herzog & de Meuron, which had already integrated AI into their design pipelines. These insights—combined with an extensive literature review and industry reports—allowed us to position Penzel Valier's AI strategy within the broader technological shift taking place in architecture.

Digital Transformation & Readiness for AI

Penzel Valier's existing digital infrastructure provided an ideal environment for AI experimentation. Several years ago, the office's IT setup was restructured

to allow employees to work seamlessly across physical and virtual spaces, fostering a culture of hybrid collaboration and tool integration. This digital-first approach created a robust foundation for testing new technologies and exploring how AI could complement established workflows.

In designing the initiative, we drew on the technology-adoption lifecycle—a framework describing how innovations gradually spread from early adopters to the broader mainstream—focusing on identifying high-impact workflows where AI could offer the greatest efficiency gains. To begin, we engaged employees who were most curious about AI in small pilot tests. Through weekly feedback loops and structured evaluations, we mapped out AI's potential in key operational areas, ensuring that our approach remained grounded in practical, real-world scenarios. Ultimately, we created four test groups to explore AI's role across different office functions:

a) Project Development & Competitions Visualization, floor plan generation, material studies, feasibility analyses
b) Office Admin & Communication Text structuring, email automation, document analysis, social media content
c) HR & Finance AI-assisted accounting, resource planning, legal document processing
d) Construction & Site Management AI-driven cost estimation, BIM integration, construction tracking, XR applications

After three months, we compiled fifty-six use cases spanning multiple domains, each with a problem statement, proposed AI solution, and effectiveness assessment. These ranged from text-based automation and document analysis to more advanced AI applications in design visualization and BIM integration. By adopting a bottom-up, iterative approach, we ensured that AI was tested in real-world settings, with direct input from employees who would eventually use these tools.

LLMs: Accessibility, Personalization, and Automation

From the outset, we recognized that Large Language Models (LLMs) would play a central role in our AI strategy, serving as accessible, customizable tools to enhance productivity across all areas of the office. Their versatility—combined with rapid development and the continuous addition of new

features—has significantly improved efficiency in both day-to-day tasks and complex workflows.

Our core challenge in implementing LLMs was ensuring that every employee, regardless of technical expertise, could leverage AI effectively. To address this, we focused on low-threshold solutions that enable team members to customize GPTs for their specific roles and project needs.

During the initial testing phase, we created six accounts: Four for the test groups, one for IT and administration, and one for the management team. This structure helped us evaluate LLMs in different office contexts while maintaining data security and role-specific configurations. As adoption increased, we introduced personal AI accounts for employees who handle sensitive information, allowing them to benefit from AI-driven efficiencies while working securely. For instance, HR teams manage confidential employee data that must remain inaccessible to others, so they require dedicated accounts with stronger safeguards. We also caution employees against using private accounts for business purposes, since personal licenses do not offer the same level of security as our enterprise AI tools.

With this foundation in place, we then began actively training employees on configuring GPTs in ChatGPT, showing them how to personalize these tools according to the project phase, task type, and desired automation level. We also introduced Copilot Studio and MS Automate, integrated into our familiar MS 365 environment, allowing staff to easily adapt to AI-driven tools without steep technical barriers.

Almost a year after introducing ChatGPT to the entire office, roughly half of our employees use it daily or weekly, with 81 percent finding it intuitive and 94 percent reporting increased work efficiency. While many rely on it for text processing, spell-checking, and automated email drafting, its impact extends far beyond administrative tasks. LLMs have become essential for software support (CAD, BIM, and MS Excel), analytical tasks involving complex datasets, and intelligent web searches through ChatGPT and Bing Copilot.

One of the most remarkable developments has been how quickly some employees discovered its creative potential. With proper prompt engineering, certain team members have built their own GPTs to handle entire workflows—automating minutes of meetings, task assignments, and database queries. For example, we are working on our Swiss Norms databank, trained with ChatGPT, to assist employees in navigating complex building law questions with ease. In the competitions team, LLMs are used to analyze competition programs, generate spatial programs and unit mix strategies, and support cre-

ative text-based design explorations. Meanwhile, HR and finance benefit from AI-assisted Excel solutions for multilayered spreadsheet optimization and financial planning.

These solutions are not dictated from the top down but have organically evolved from the needs of different teams, supported by the AI Unit. Going forward, our vision is for every employee to be able to create and refine their own AI agents, seamlessly integrating services like Copilot Studio and MS Automate to streamline repetitive processes. The key lies in keeping the barrier to entry as low as possible, so that AI adoption remains inclusive and accessible to everyone. In this way, we see AI not as a replacement for human expertise, but as a flexible, evolving assistant—capable of enhancing workflows, accelerating operations, and unlocking new forms of creativity in architectural practice.

Generative Design Process with AI

Alongside our text-based LLM applications, we systematically tested various AI platforms for image and geometry generation to evaluate usability, creative potential, and integration within professional design workflows. Our trials included image-generation tools such as MidJourney and Stable Diffusion (Magnific AI, Prome AI, Yanus) as well as FinchAI and Architectures for floor plan creation.

One key takeaway from these tests was the significant variance in ease of use. Tools based on Stable Diffusion (e.g., Prome AI, Yanus) had lower entry thresholds, making them more accessible for quick sketch enhancements and volumetric explorations. By contrast, MidJourney excelled in producing visually striking images but struggled with the level of detail required for accurate design inputs. Its reliance on more complex prompt engineering also made it less straightforward for architects without extensive AI experience.

We also evaluated platforms specifically designed for floor plan generation (Finch AI and Architectures). While these tools can rapidly produce iterative layouts based on personalized floor plan libraries, we found that inaccuracies and unpredictable outputs often require time-consuming revisions. In many cases, the complexity of the design task—including site constraints and local building codes—exceeds the default parameters of these software solutions, necessitating substantial manual intervention to correct the generated output. Despite these drawbacks, both FinchAI and Architectures show promise

as early-stage conceptual design aids, where speed and variety can spark new spatial ideas before moving into more rigorous workflows.

When compared to our architects' expertise in Photoshop sketching, collaging, CAD modelling, and rendering engines, AI-based tools still serve more as supplementary resources than replacements for established workflows. They show particular promise as a kind of creative dialogue partner, generating unconventional results that human designers refine and integrate into ongoing projects.

Interestingly, this has started to redefine the role of the architect—from a "creator" to a "curator" of AI-generated ideas. To advance this approach, we plan to train our own LoRA (Low-Rank Adaptation) models rooted in Penzel Valier's architectural identity, ensuring that AI outputs align with our office's design philosophy. Our forthcoming Penzel Valier monograph will offer a rich, well-curated dataset of text and images for fine-tuning these models, embedding the firm's architectural DNA into future AI-assisted text- and image-based design tasks. In doing so, we aim to move beyond generic AI outputs and create a more context-aware design tool—one that becomes an adaptive extension of our creative process, rather than an external generator of random iterations.

AI as an Evolution, not a Disruption

After a year of structured experimentation, our approach to AI at Penzel Valier demonstrates that meaningful technology adoption is not about disruption but strategic evolution. From the outset, we focused on AI tools that align with our design principles, workflow logic, and creative values, rather than adopting technology for its own sake.

We did not seek to replace existing expertise, but to enhance and refine established processes. Testing AI in visualization, data processing, and automation revealed clear advantages in efficiency and rapid iteration, yet also reinforced the necessity of human oversight—especially in architectural design, where control over the process remains paramount. Tools like FinchAI and MidJourney offered exciting possibilities but fell short in architectural quality and process control, requiring significant manual intervention to produce viable results.

More important than the tools themselves was the mindset shift—both in how we evaluate AI's role in design and how we restructure workflows to inte-

grate it effectively. Rather than viewing AI as an autonomous decision-maker, we embraced it as a collaborative agent, capable of structuring information, assisting in creative discussions, and streamlining repetitive tasks. This perspective supports a controlled, non-disruptive transition, ensuring that AI augments rather than undermines the architect's role.

Like past technological shifts—from CAD to BIM, from 3D visualization to parametric design—AI will need time to find its natural place within architectural practice. Despite rapid advancements, full integration is an ongoing process requiring continued refinement, training, and adaptation. While some creative industries have fully embraced AI-driven workflows, architecture remains a profession where technical precision, material knowledge, and spatial understanding cannot be fully automated.

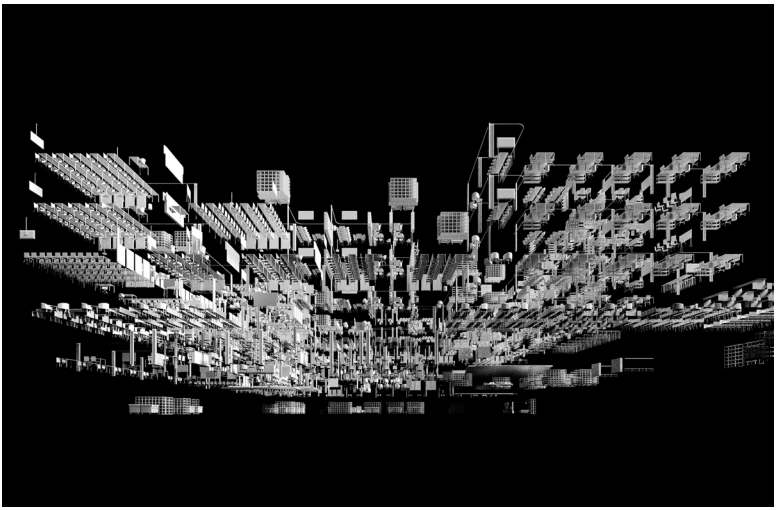
A major insight from our research is that AI's true potential lies less in stand-alone tools and more in integrated ecosystems. We have already seen that cross-platform solutions—particularly when LLMs are combined with automation frameworks like Copilot Studio and MS Automate—have the greatest potential for long-term implementation. The ability to create custom AI assistants tailored to specific office roles provides a personalized and scalable approach to AI adoption.

Beyond Disruption: Digital Intelligence and Human Intuition in Architectural Practice

Throughout this process, we have underlined that successful AI adoption is not about mastering a single tool but about cultivating a workplace culture that values experimentation, structured learning, and adaptability. Many technologies that seemed revolutionary just a few years ago—3D scanning, 3D printing, VR/AR—are now commonplace. AI will likely follow a similar trajectory.

Ultimately, the greatest challenge for AI in architecture is not the technology itself but the profession's ability to harness its possibilities while maintaining the core values of design integrity, creative authorship, human judgment, and intuition. By balancing structured implementation with openness to innovation, we can ensure that AI is not a disruptive force but a natural extension of our evolving design practice.

Fig. 36: The figure presents a rendering of 45'844 3D furniture objects extracted from a BIM model of a designed building, capturing the essence of digital transformation and the challenges of harnessing extensive datasets to achieve AI-enhanced efficiency in contemporary architectural practice.



Key Findings and Next Steps

As we reflect on the experiences of the past year and look ahead to future developments, several key points stand out:

1. AI Introduction as Evolution
   A structured, incremental approach proves more sustainable than purely disruptive change. The architect's creative control remains at the center, with AI serving as an efficiency booster rather than a replacement.

2. LLMs as Universal Aids
   LLMs like ChatGPT have emerged as accessible, flexible base technologies, applicable to everything from text processing to complex data analytics. Personalized AI accounts and prompt strategies enable all employees to benefit.

3. Generative Design as Ideation Partner
   Image and geometry generation tools still complement, rather than supplant, established workflows. They spark unconventional ideas that human designers refine for real projects.

4. Next Steps
   a. Training Custom LoRA Models to align AI outputs more closely with Penzel Valier's architectural identity.
   b. Expanding Partnerships with industry and academic institutions for deeper insights and shared expertise.
   c. Deeper Integration of automation platforms (Copilot Studio, MS Automate) for more sophisticated AI-based assistants.
   d. Ongoing Training and Workshops to lower barriers and build confidence across all teams.