AI and Architecture Innovation - first outlines
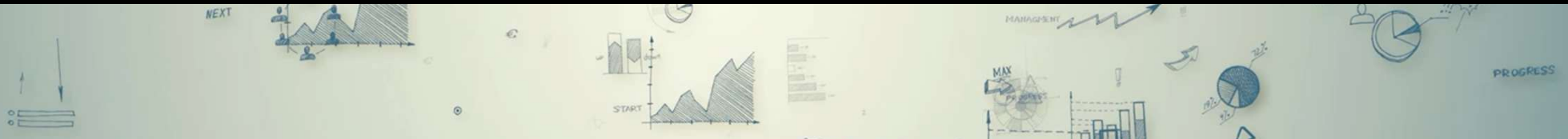
Exploring Student Research in AI and Architecture

Mariya Korolova | IPRE, TU RED WIEN | 19th ERES ES| 02.12.2023

AI and Architecture

According to AIA, "90 percent of [architecture] firms anticipate they will be using or increasing usage of AI over the next three years"

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EXPERIMENTAL RESEARCH

ON ARTIFICIAL INTELLIGENCE

RED – REAL ESTATE DEVELOPMENT AND PROJECT MANAGEMENT TU WIEN
IPRE – INSTITUTE OF REAL ESTATE DEVELOPMENT
MOFIDIAN RECHTSANWALTSKANZLEI

http://red.tuwien.ac.at

Key AI-related insights in architectural education & practices

AI

experimentation & research

ARCHI TECTURE

>concept image production

>renderings

>concepts in different architectural styles

Key AI-related insights in architectural education & practices

Areas:

concept stage

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Urban planning

on
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Key AI-related insights in architectural education & practices

Areas:

concept stage	Co-operative design	& o ent
Urban planning	Real estate development	on

Key AI-related insights in architectural education & practices

Areas:

concept stage	Co-operative design	Rendering production& enhancement
Urban planning	Real estate development	Structural engineering

Key AI-related insights in architectural education & practices

concept stage	Co-operative design	Rendering production& enhancement	Restauration
Urban planning	Real estate development	Structural engineering	Competition production

Areas:

# Key AI-related insights in architectural education & practices

Areas:

concept stage	Co-operative design	Rendering production& enhancement	Restauration	Floorplan design
Urban planning	Real estate development	Structural engineering	Competition production	Redesign

Key AI-related insights in architectural education & practices

• Seminar's focus on AI's impact in architectural education:

- finding out and learning about existing tools
- outlining weak, missing or underdeveloped fields
- designing research and conducting experiments
- creating a research paper with discussion and conclusion for further usage

- developing and steering intellectual property, ethics & biases with AI tools

Studied Objectives:

- Can AI genarate by its own Stabilty structure of Buildings (Popa Razvan-Florin)

- Is an AI enhanced Archviz process with stable diffusion efficient? (Hintermeier Markus)

- Possibilities of AI creating better concepts on urban planning projects than urban designers/architects (Marchan Guadalupe Joyce Dafne)

- Using Stable Diffusion in conceptual phase of architectural project: reviewing stable diffusion's text to image and image to image generators' ability to translate architectural concepts. (Bugno Karolina)

- Evaluating the Impact of Artificial Intelligence on Architectural Design (Suman Bana)

- How can AI enhance graphic capabilities in the post-rendering phase? (Goga Samuel)

- Possibilities of AI enhanced floorplan design in residential projects (Wolf Roland)

- digital reconstruction: The restoration of damaged buildings through generative AI (Rehfisch Anna-Lena)

- whether artificial intelligence will take over the architectural profession in the future (Kapan Deniz)

- Stable diffusion in architecture application (Robin Bohdansky)

- Emotion Recognition in Textual Communication: AI vs. Human Interpretation (Ovsepian Ruzana)

- How do the gender biases observed in AI-generated images relate to the perceptions of individuals? (Ansari Shahrezaei Shana)

- How can Ai help us with Music Mixing and demixing. (Ortner Alexander Zeno)

- Can AI gather general information about a person based on their humour? (Radoi Carmen Ioana)

- How can AI be used to reduce the impact of stress on individuals with health conditions like Endometriosis during their education? (Wagt Laura)

- To what extent can the integration of chatbot technologies, using HAMD, contribute to the early detection of depressive symptoms? (Lokaj Arijeta)

- How Can I Earn Money on Social Media Using AI? (Donaire Luis Enrique)

- How can AI express its understanding of human emotions through abstract art and how does it overlap with human emotional experience? (Bojic Lucia)

- How the implementation of AI can aid tailored personal finance planning (Komatina Jana)

- The Role of AI in Enhancing Character Development in the Film industry (Ptushkina Oleksandra)

Stable Diffusion for architects (Robin Bohdansky):

1. Inquiry: to what extend stable diffusion can be used in architectural practice on different stages of the work and what are the possibilities to influence and control desired output
2. Considerations: learning in-depth of the stable diffusion as it is a base model for most of the trained models for architecture commonly used applications
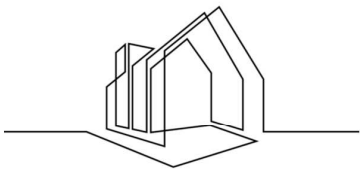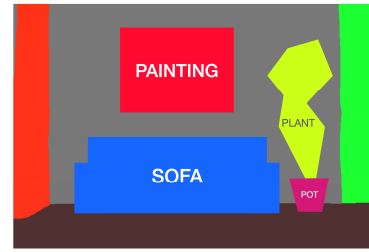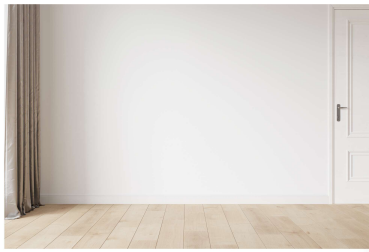

Recognition of outline
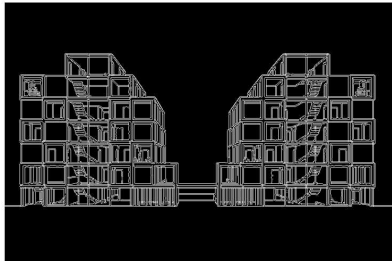

Style references

Segmentation and object recognition

Upscaling and editing

Stable Diffusion for architects (Robin Bohdansky):

Reference

Input

Prompt:
bright, interior, couch, huge plant, wooden floor, white cassette door, bright grey curtains, modern couch, modern painting, white wall, flooded with light, room door

Prompt:
Architecture, urban, house, wooden

Negative Prompt:
lowres, normal quality, worst quality, cropped, blurry, drawing, painting

Prompt:
modern architecture style, photo realistic, hyper detailed photo, human perspective, daylight, city, lights, cinematic, trees, urban background, streetlights, bushes, warm light, wooden facade, black steel frame

Negative Prompt:
lowres, normal quality, worst quality, cropped, blurry, drawing, painting,

AI-Generated Stability Structures for Buildings (Popa Razvan-Florin):

1. AI & structural engineering use:

   - Structural analysis and design
   - Material optimisation
   - Construction automation
   - Predictive maintenance

2. Challenges and limitations:

   - AI algorithms need large, high-quality datasets to learn, but acquiring such data can be difficult, especially for specialized or unconventional projects
   - AI algorithms can be like black boxes - they produce accurate results, but it's difficult to understand how they got there. This lack of interpretability can be a problem when making critical decisions based on AI-generated outputs
   - As AI becomes more sophisticated, ethical concerns regarding responsibility, accountability, bias, and human oversight arise

AI-Generated Stability Structures for Buildings (Popa Razvan-Florin):

- **STRUX**: This software platform uses AI to optimize structural designs for performance and cost.
- **Bentley Systems**: This software company offers a variety of AI-powered tools for structural engineering, including STAAD.Pro and SACS

Autodesk Generative Design: This software uses AI to generate a variety of design options for buildings based on specific constraints, such as budget, materials, and site conditions. This can help architects to find innovative and efficient solutions to design challenges

Bentley Systems' C4.5: This software uses AI to analyze the structural integrity of buildings and identify potential design flaws. It can also be used to optimize building materials and construction methods

IBM's Watson Build: This platform uses AI to connect construction professionals with the information and resources they need to build better buildings. It also provides a number of tools for managing construction projects and tracking progress.

- **SkyCiv**: This software platform uses AI to generate and analyze structural designs.

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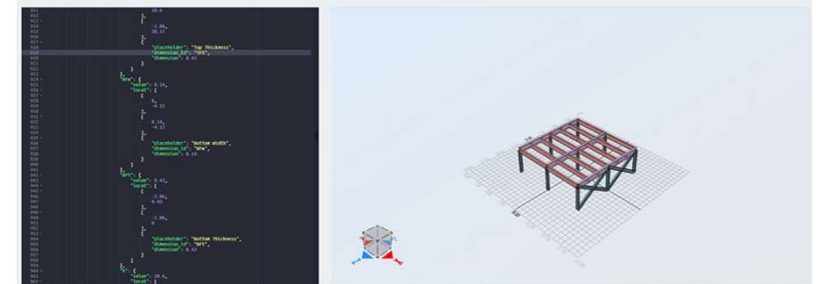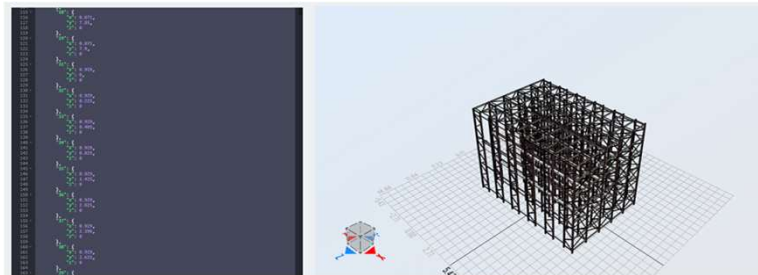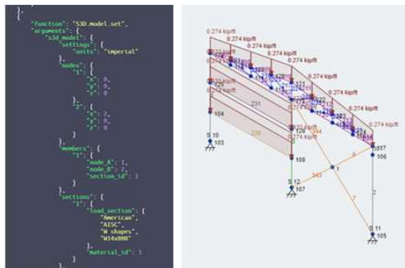
Stable Diffusion in Architectural Project Conceptualization (Bugno Karolina):

1. Examination: Using Stable Diffusion in conceptual architectural projects.
2. Analysis: AI's role in translating architectural concepts using stable diffusion in two variations – architectural and non-architectural model.

Experiment 2, concept 2

Architectural model

Non-architectural model

An university building on a modern campus, dense urban context, busy location, coexisting with the students

Experiment 3, concept 2
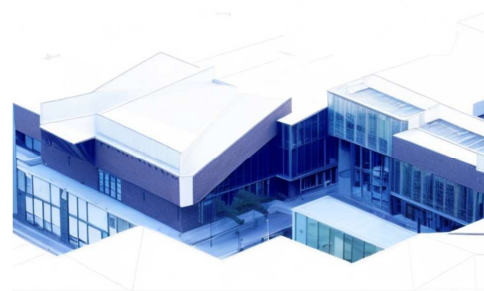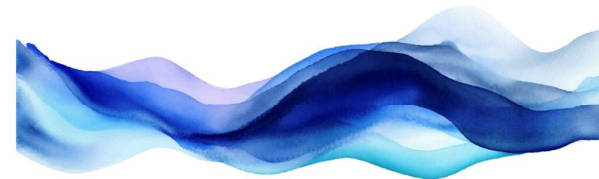
An university building on a modern campus, concrete construction, dynamic forms, medium rise building, open façade /N: high rise building, static forms

An university building on a modern campus, dense urban context, busy location, coexisting with the students

AI's Impact on Architectural Design Evaluation (Suman Bana):

1. Research Focus: How does the integration of artificial intelligence tools impact the efficiency, creativity and usability in the architectural design process, as compared to traditional methods, and to what extent does it impact the evaluation and perception of designs by experts, as compared to human-generated designs?

2. Observations: with a lot of experimentation Ai needs a great input and ~~still~~ ~~production~~
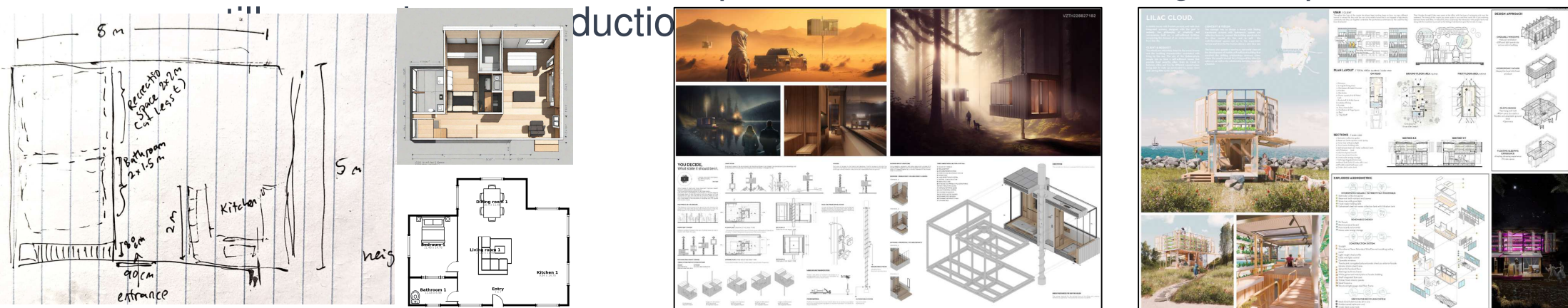
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AI-Enhanced Floorplan Design in Residential Projects (Wolf Roland):

1. Focus: Possibilities of AI-enhanced floorplan design in residential projects.
2. Insights: AI Tools can help archtects to be more eficient, but can not substitute Architects (by now), as there needs to be a certain understanding of the topic and context, to use these tools in a right manner.

	Chat GPT 3.5	maket.ai	Planner 5D	eva	PlanFinder	architechtures	spacio.ai
project development	green	grey	grey	green	grey	green	green
site based analytics	grey	grey	grey	green	grey	green	green
space allocation	grey	limited	grey	green	green	green	green
plan creation	grey	limited	green	grey	green	green	green
quantity survey (mass, costs)	grey	grey	limited	grey	grey	green	green
required knowledge	yellow	green	green	orange	orange	orange	orange

AI-Enhanced Floorplan Design in Residential Projects (Wolf Roland):
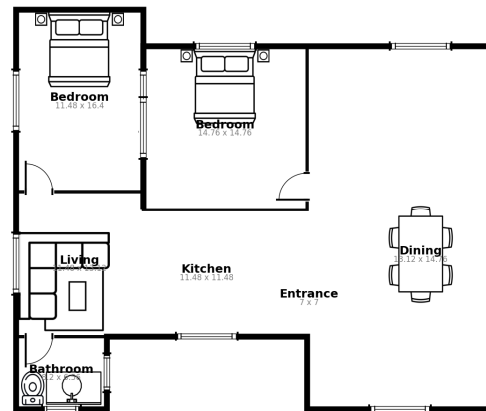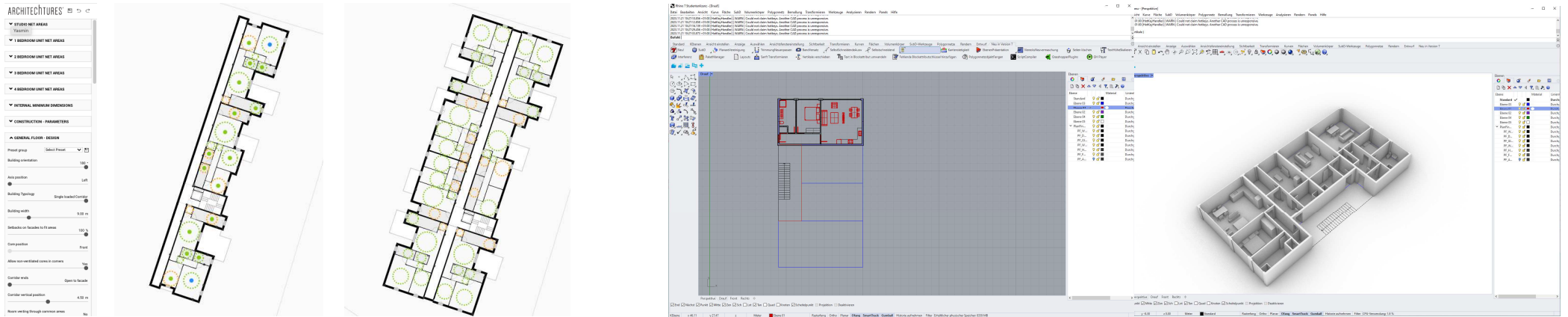
Digital Reconstruction of Damaged Buildings through AI (Rehfisch Anna-Lena):

Study: Digital reconstruction of damaged buildings using generative AI. To what extent can generative AI models in Adobe Photoshop be used to enable the visual reconstruction of damaged buildings on photographs?

Digital Reconstruction of Damaged Buildings through AI (Rehfisch Anna-Lena):

symposium

ARTIFICIAL + INTELLIGENCE
A+I
INNOVATION + ARCHITECTURE

our special guests:

PATRIK SCHUMACHER
Principal of ZHA

MATIAS DEL CAMPO
SPAN,
University of Michigan

PROGRAM

15:00 – 15:05 Welcome
Paul Lensing | RICS
Dietmar Wiegand | IPRE/TU Vienna

15:05 – 15:15 Introduction to AI
Mariya Korolova | TU Vienna/IPRE

15:15 – 15:55 3 Best Student Works
Research projects + Discussion

15:55 – 16:15 Coffee Break

16:15 – 16:40 Keynote by
PATRIK SCHUMACHER (online)

16:40 – 16:50 Discussion

16:50 – 17:50 Specialist Presentations:

Matias del Campo | SPAN Architecture;
Associate Professor Taubman College and
Michigan University
TECTONICS OF THE LATENT SPACE

Manuel Mofidian | Mofidian Attorney
LAW, ETHICS AND BIASES OF AI

Fabian Pitscheider | OPTIMUSE
AI AND REAL ESTATE

Dr. Ayse Glass | Digital City Science at
Hafen City University
**AI, SYNTHETIC DATA GENERATION AND
APPLICATION USE CASES FOR SMART
CITIES**

17:50 – 18:25 Panel Discussion
moderated by Mariya Korolova and Manuel
Mofidian

18:25 – 18:30 Closing Remarks by Mariya
Korolova and Manuel Mofidian

24.11
15:00-18:30

TU Vienna, **Friedrich Hartmann - HS17**
Karlsplatz 13, Staircase 7, 3.OG

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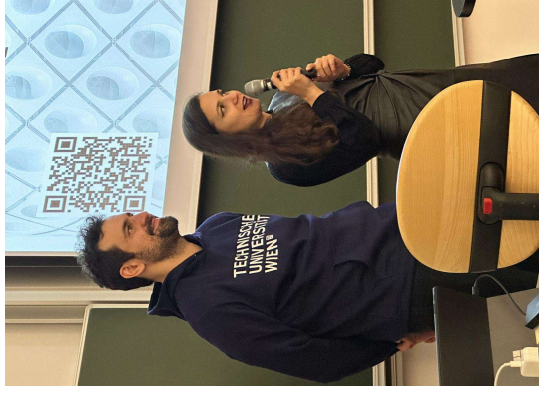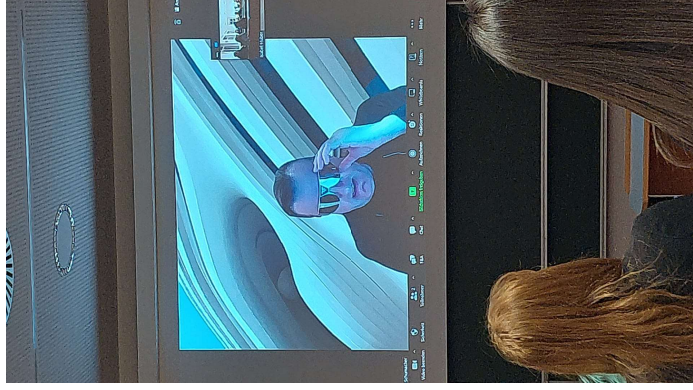
The Advantages of AI Integration in Architecture

- Faster project completion
- Extract & summarise information
- Design
- Drawing plans in 2D
- Visualisation: Creating visuals in 3D
- Sustainable & efficient building
- Smart home / building management
- Cost calculation
- Project management

Challenges & Concerns of AI Adaptation in Architectural Work

- Lack of human touch / emotion
- Superficial information during online site analysis
- Unrealistic or common designs
- Dependence on technology
- Compatibility of the programs with each other
- Accuracy of the information gathered
- Privacy & security problems (bias, ethics, copyright)
- Cost of software

- Potential job loss / requalification

THANK
YOU

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