Digital Health – Connected Healthcare
Hasso Plattner Institute (HPI) · University of Potsdam
In cooperation with IMPP – Institut für medizinische und pharmazeutische Prüfungsfragen

Hasso Plattner Institut
Digital Engineering · Universität Potsdam

MASTER THESIS OFFER · Potsdam, April 2026

AI-Simulated Patients in Clinical Training

Developing and Evaluating LLM-Powered Avatar Systems for Psychotherapy Licensing Examinations

MOTIVATION

In Germany, psychotherapy trainees must pass a practical licensing examination (Approbationsprüfung) that currently relies on human actors playing the role of patients. This approach is costly, difficult to standardise, and limits the diversity of patient profiles — particularly for children and adolescents, who are systematically underrepresented.

Recent advances in large language models (LLMs) open the possibility of replacing these human simulated patients with an AI-powered avatar chatbot. The system must authentically portray ICD-10 mental disorder phenomenology — including emotional, social, and age-appropriate cognitive responses — in real-time 10-minute conversations, while meeting EU AI Act requirements for high-risk clinical AI.

BACKGROUND

This thesis offer arises from two active, complementary projects:

KOMPASS is a project of the IMPP investigating the replacement of human simulated patients in the German psychotherapy licensing examination with an AI avatar. Its core challenge is ensuring clinically faithful, real-time patient simulation across a broad range of disorder profiles and demographics, including children and adolescents.

SCALE (Strategic Clinical AI Language Evaluation, April–July 2026) is a funded pilot with the HPI AI Service Center evaluating which LLMs best power the KOMPASS avatar, balancing clinical fidelity and interaction latency. Thesis topics will be defined collaboratively based on SCALE results and candidate interests.

GOAL

Thesis topics are flexible and will be shaped in dialogue with candidates. Possible areas include:

- Clinical fidelity evaluation of small and efficient LLMs for patient dialogue
- Fine-tuning (LoRA/PEFT) for disorder-specific, role-consistent conversational behaviour
- Affective state machine design for longitudinal consistency within a conversation
- Development of reliable and clinically meaningful evaluation instruments
- Retrieval-augmented generation (RAG) to improve specificity and consistency of simulated responses

Specific research questions emerging from the project include:

- How can LLMs be guided to produce clinically accurate and role-consistent patient behaviour in simulated psychotherapy conversations?
- How can internal state representations (e.g., informed by the Berlin Global Rating Scale) improve longitudinal consistency in LLM-based patient simulations?
- Does explicit Chain-of-Thought prompting — forcing the model to generate a clinical "inner monologue" — improve the clinical validity and diagnostic consistency of generated dialogue?

- How can difficult conversational situations (e.g., resistance, silence) be reliably induced and resolved through therapist interventions?
- How can the quality of simulated patient behaviour be measured in a reliable and clinically meaningful way?

ABOUT YOU

- You are interested in working at the intersection of clinical psychology, AI, and human-computer interaction
- You have Python programming experience; familiarity with R or statistical analysis is a plus
- NLP, LLMs, or machine learning excite you — prior coursework or projects are welcome but not required
- You enjoy interdisciplinary work and are motivated by real-world clinical challenges
- We are looking for up to two Master's students to join the project

---

CONTACT

Do you have questions or would like to apply? Send a brief statement of interest and your CV to:

Dr. Vincent Beermann
Postdoctoral Researcher
Interim Chair of Design Thinking & Innovation Research, HPI
Affiliated Researcher, MIT Media Lab
vincent.beermann@hpi.de

Holly McKee
PhD Student
Chair of Digital Health (Prof. Dr. Bert Arnrich), HPI
Expertise: NLP, Human-Centered Design, Digital Health
holly.mckee@hpi.de

Theses are hosted by the Connected Healthcare Chair (Prof. Dr. Bert Arnrich), HPI.