M U N I

Příloha č. 10 směrnice MU Habilitační řízení a řízení ke jmenování profesorem

POSUDEK OPONENTA HABILITAČNÍ PRÁCE

Masarykova univerzita	
Uchazeč	Mgr. Vojtěch Juřík, Ph.D.
Habilitační práce	*Virtual Simulations in Psychology: Evaluating Current Trends of Immersive Virtual Simulations Use in Psychological Research and Follow-up Applications*
Oponent	doc. PhDr. Slávka Démuthová, Ph.D., univ. prof.
Pracoviště oponenta, instituce	Univerzita sv. Cyrila a Metoda v Trnave Filozofická fakulta, Katedra psychológie

Formal Considerations

The habilitation thesis is structured into four principal sections. The first two chapters are the most extensive: they provide a comprehensive theoretical overview of the subject matter (Part I) and present evidence on the use of virtual simulations in psychological research (Part II). The third chapter analyzes spatiotemporal evacuation trajectories derived from agent-based models enriched with real and virtual behavioral data, demonstrating substantial divergences from default simulations. The fourth part concludes the thesis by arguing that immersive virtual simulations—particularly those integrating human-centered design and machine learning—constitute a powerful, ethically sensitive, and increasingly indispensable tool for advancing psychological research, theory, and applied practice. The final section of the presented thesis contains an extensive list of references (535 sources), attesting to the author's broad and in-depth overview of the topic.

The thesis is logically structured, with clearly delineated chapters and subchapters that facilitate navigation throughout the text. However, the page formatting unnecessarily stretches the content (most pages contain fewer than 1,800 characters—approximately one standard manuscript page), which makes the work more difficult to read. The overall length of the thesis is 363 pages (approximately 515,000 characters), which substantially exceeds the usual standard for habilitation theses. Among the competencies expected at this academic level is the ability to present essential information concisely and within an appropriate scope. For the purposes of a habilitation thesis, it is generally anticipated that the text will bring the most important findings and the conceptual essence of the chosen topic. I am convinced that the academic quality of the thesis would not diminish even if certain sections (e.g., historical overviews, etc.) were omitted. Overall, the work is conceived more as a monograph integrating comprehensive knowledge (not only “current trends” as stated in the title) on immersive virtual reality within the context of psychology.

The thesis is written in a cultivated scientific style, and I highly appreciate the excellent language editing: the text contains no typographical or grammatical errors, and all sources are cited correctly. The author has also demonstrated a conscientious approach to copyright—permissions for the use of visual materials are consistently documented, and collaboration with AI tools in the areas of language fluency and stylistic refinement is duly acknowledged.

Content considerations

The ***"Theoretical Background"*** section provides a comprehensive analysis of simulation within psychology, tracing its historical origins, conceptual foundations, and relevance for contemporary research. It defines simulation as both imitation and abstraction, presenting mental simulation as a fundamental human capacity that supports foresight, problem-solving, and adaptive behavior. Drawing on cognitive science, the text differentiates mental representations from mental models, emphasizing the latter as dynamic, manipulable structures that facilitate reasoning, prediction, and causal understanding. Mental simulation is further described as the basis for higher cognitive functions, including theory of mind, embodied cognition, and predictive processing, with predictive processing conceptualized as a biologically grounded form of simulation through which the brain anticipates sensory input. The section also highlights the limitations of mental simulation—its susceptibility to cognitive biases, heuristic shortcuts, and subjective variability—which reduce its reliability in complex or unfamiliar contexts and point to the need for complementary physical simulations. Physical simulations are presented as embodied, human-centered practices that recreate real-world conditions in controlled environments, such as driving and medical simulations, military training, assessment centers, and analog missions. Overall, the section frames mental, physical, computational, and virtual simulations as interconnected tools for understanding and shaping human behavior, with their integration—particularly within immersive virtual environments—representing a promising direction for psychological research and applied practice.

The ***"Empirical Evidence"*** section examines immersive virtual simulations (IVS) and virtual reality (VR) across psychological research, psychotherapy training, education, and engineering. It highlights VR's ability to create ecologically valid, controllable, and ethically feasible environments that support precise measurement of behavioral, cognitive, and physiological processes. Positioned within psychology's replication crisis, the text argues that standardized VR environments may enhance reproducibility. Empirical studies on exposure therapy, anxiety induction, and evacuation behavior show that VR elicits responses comparable to real-world contexts, while VR-based evacuation modeling demonstrates the need for high-quality behavioral data. An educational experiment comparing VR instruction with PowerPoint-based learning shows that immersion alone does not ensure better outcomes; individual learner characteristics remain significant. Overall, IVS is presented as a versatile interdisciplinary tool with substantial potential for science, training, and engineering applications.

Remarks and questions:

Although VR can approximate real-world conditions, substantial research demonstrates discrepancies between virtual and physical behaviors due to sensory constraints, reduced peripheral vision, and differences in embodied perception. Also, the thesis mentions physiological measures but does not sufficiently examine how discomfort, disorientation, or motion sickness may distort cognitive or emotional responses. Finally, behavioral differences between real and virtual settings (e.g., altered risk perception, reduced social inhibition, or modified locomotion patterns) are the issues that need to be considered.

- *How do you account for methodological limitations of VR—such as cybersickness, hardware variability, and altered sensory perception—when interpreting the validity and generalizability of behavioral and physiological responses recorded in virtual simulation studies?*
- *How do you account for known behavioral differences between real and virtual settings—such as altered risk perception or reduced social inhibition?*

Chapter ***"Further Evidence"*** presents a follow-up analysis of spatiotemporal trajectories derived from agent-based evacuation simulations informed by real and virtual human behavior. Using Pathfinder ABEM data, the study compares five trajectory groups reflecting different simulation inputs and behavioral strategies, including retracing and non-retracing patterns. The findings indicate substantial divergence between default simulations and those refined through

Human-in-the-Loop data, particularly in non-retracing virtual scenarios. The results demonstrate that human-informed simulations yield more varied and ecologically realistic patterns of movement, highlighting the value of integrating real and virtual behavioral data into agent-based models for more accurate prediction of evacuation behavior and improved methodological approaches in crisis-navigation research.

Remarks and question:

The text presents a complex and technically detailed analysis of spatiotemporal trajectories derived from real, virtual, and default simulation inputs. The VE data are treated as if they provide meaningful "human-like" inputs for agent-based modeling.

- *Could you offer an empirical justification that behavior observed in the virtual environment (VE) is sufficiently representative of real-world (evacuation) behavior (RE)?*

The concluding section ***"Concluding Commentary"*** synthesizes the thesis's contributions, arguing that immersive virtual simulations (IVS) represent a transformative methodological and applied tool in psychology. It highlights the development of a theoretical framework for human-centered simulations, empirical evidence demonstrating IVR's capacity to bridge the control–validity trade-off, and advances enabled through machine-learning–integrated, human-in-the-loop systems. Applications in therapy, education, and evacuation modeling illustrate IVR's versatility. The text also addresses ethical considerations, including psychological risks and data privacy, and outlines future research directions such as adaptive simulations, longitudinal studies, and cross-cultural collaboration. Overall, it positions IVS as a promising frontier for psychological science and practice.

Remarks:

The text's concluding tone presents immersive virtual simulations as a powerful, reliable, and transformative tool for psychology, asserting that IVR bridges the control–validity tradeoff, enhances replicability, reflects real behavior, and offers ecologically valid contexts. However, these strong claims are not always accompanied by the clear acknowledgment of contradictory empirical findings, evidence quantifying the limits of IVR realism or psychological equivalence to real-world settings, critical discussion of unresolved methodological issues (e.g., behavioral distortions, sensory mismatches, validity threats), or explicit boundaries of when and for whom IVR fails to achieve its promised outcomes. From this point of view, IVR is still rather an emerging technology than a definite solution. On the other hand, these gaps open a research space for further examination.

Opponent's Questions for the Habilitation Thesis Defense

(as already stated above):

- *How do you account for well-documented methodological limitations of VR—such as cybersickness, hardware variability, and altered sensory perception—when interpreting the validity and generalizability of behavioral and physiological responses recorded in virtual simulation studies?*
- *How do you account for known behavioral differences between real and virtual settings—such as altered risk perception or reduced social inhibition?*
- *Could you offer an empirical justification that behavior observed in the virtual environment (VE) is sufficiently representative of real-world (evacuation) behavior (RE)?*

Conclusion

I consider the presented habilitation thesis to be a highly valuable scholarly contribution to the rapidly developing field of VR technologies in psychology. By virtue of its comprehensiveness, scientific rigor, and textual structure, the work constitutes a fully developed monograph, and I strongly encourage the author to pursue its publication. The thesis provides an integrative synthesis of current knowledge in the area of immersive virtual reality, and I am convinced that it will serve not only as a source of inspiration but, above all, as a repository of up-to-date

insights for many professionals. Despite the aforementioned remarks and questions, I regard the application of IVR in therapy and other domains of psychological practice as highly promising, and in this context, I sincerely hope that the author will continue his scientific activities in this area.

The habilitation thesis of Mgr. Vojtěch Juřík, Ph.D., *"Virtual Simulations in Psychology: Evaluating Current Trends of Immersive Virtual Simulations Use in Psychological Research and Follow-up Applications"*

meets – ~~does not meet~~

the requirements standard for habilitation theses in the field of psychology.

Trnava

December 19th, 2025

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