Review of the Application for Habilitation entitled

A Multi-layered Systems Approach to Modelling User and Player Experience in Interactive Digital Environments

of Dr. Tibor Guzsvinecz

This review was prepared based on the Doctoral and Habilitation Regulations of the University of Pannonia, the operating regulations of the Doctoral School of Informatics Sciences (ITDI), and the requirements of the Informatics Sciences Habilitation Committee for habilitation valid from March 2, 2026.

I. Background and Overall Assessment

Dr. Tibor Guzsvinecz is an associate professor at the Department of Informatics Systems and Applications of the Faculty of Engineering and Informatics of the University of Pannonia. He obtained his PhD degree in Informatics Sciences in 2021. He applied for his habilitation procedure in the discipline of Digital Reality within the discipline of Informatics Sciences within the discipline of Engineering Sciences at the University of Pannonia this year.

The candidate's research domain lies at the intersection of human–computer interaction, virtual and immersive environments, digital games, and user/player experience research. His scientific work focuses on how perceptual and cognitive processes, physiological constraints, accessibility, interaction structures, and game-design paradigms jointly shape user behaviour and experience. The distinctive feature of the research is the integration of controlled experimental studies with large-scale analyses of player-generated data, including sentiment, emotion, engagement, and review patterns. The candidate investigates the digital environment as layered interactive systems in which technology, human characteristics, participation conditions, and design structures collectively determine experience and behaviour.

II. Compliance with Formal Requirements

According to the requirements set by the Informatics Science Habilitation Committee, the minimum requirements for initiating the habilitation procedure regarding the performance indicators of teaching, lecturing and scientific research execution during one's career are as follows:

a) At least 8 semesters of higher education, educational activities included in the curriculum and held in a domestic or foreign higher education institution.

Fulfilment: Yes, as the number of affected years exceeds 10.

b) Developing the curriculum and topics for at least one subject.

Fulfilment: Yes, since the number of subjects developed is four (1. Programming Languages - Unity - based Development; 2. Data Automation; 3. Digital Reality: Game Mechanics and Intelligent Systems in Digital Game Development; 4. Digital Reality: LLM-based Interactions in XR Environments).

c) Supervision of the work of at least one graduate PhD student (including co-supervision), or ongoing supervision.

Fulfilment: Yes, as he coordinates three PhD students as co-supervisor (1. Ichsan Mohammed Hannats Hanafi since 2023; 2. Namrouti Hanan MA since 2023; 3. Száva Antal Levente since 2025).

d) Achieving at least 120 points in the points system specified in Annex 1 of the ITDI Operating Regulations.

Fulfilment: Yes, the applicant's total score is 165, since his higher education activity is 60 points. and his scientific activity is 75 points. This is 137.5% of the 120 points required for habilitation support. In the ten years before submitting the application, the number of contact hours in Hungarian was 2200, of which 1000 were lecture hours. He led 58 theses and TDK topics, and he was responsible for two mandatory and four optional subjects, and participated in the development of seven subjects and three notes. The Hungarian Academy of Sciences' (MTA) Q and I scientometric numbers are 630% and 11 times, respectively. He is currently the partial coordinator of three PhD students. He has participated in nine research and development projects and has led eleven institutional applications. He is a member, vice-president and section organiser in national and international scientific organisations and conferences (IEEE, VEAB, ZEK, MTA public body, NJSZT, DOSZ, etc.). All these facts exceed the requirements for habilitation.

III. Scientific Results and Contribution

The candidate summarised his most important scientific results and their significance in theses in Hungarian and English. His results contribute well to the development of the scientific field, as evidenced by his higher-than-expected scientometric numbers.

The theses present a coherent computer science perspective on user experience and player experience as emergent outcomes of layered human–system interaction (HCI). The proposed model links perceptual processing, physiological tolerance, accessibility, genre structure, engagement modes and design paradigms, and combines controlled experimental evidence with large-scale player-generated data. This integration is the principal scientific strength: heterogeneous phenomena are treated as interacting conditions shaping participation, evaluation and emotional digital expression environments. The research is methodologically diverse and relevant to HCI, virtual reality, game studies and accessible system design. The model is primarily explanatory rather than causal, and several cross-layer relationships remain to be tested directly. Nevertheless, the theses define a credible research program and provide a structured framework that may be extended beyond entertainment games to serious games, simulations and educational systems.

Thesis Group 1 – Perceptual – Cognitive Layer

The first thesis group provides a coherent and methodological, well-founded examination of perceptual and cognitive processes in virtual environments. Its main scientific merit lies in treating immersion not as a uniformly beneficial technological property, but as a factor that modifies spatial and auditory information processing in interaction with user characteristics. The distance-estimation studies combine controlled virtual environments, relatively large participant samples, regression-based modelling, and explicit treatment of moderating variables. The finding that immersive presentation may shorten response time while reducing exocentric estimation accuracy is particularly relevant, because it challenges simplified assumptions about the relationship between immersion and performance.

The sound localisation thesis extends this argument by showing that overall accuracy is explained primarily by human characteristics, while immersion changes the spatial structure of errors rather than

producing a simple improvement or deterioration. The parallel formalisation of both theses strengthens their conceptual unity. A limitation is that the experiments use specific display devices, participant populations and task settings, which constrains direct generalisation to newer immersive technologies. Nevertheless, the thesis group makes a clear contribution to HCI and immersive computer science by demonstrating that perceptual performance is an emergent property of the interaction between system conditions and user characteristics.

Thesis Group 2 – Constraint and Inclusivity Layer

The second thesis group addresses participation conditions and accessibility through two closely related lines of investigation. One focuses on cybersickness not merely as a physiological side effect, but as a factor limiting sustained participation in immersive virtual environments. The scientific value of this approach lies in the analysis of a corpus of real-world Steam reviews and in the combined use of topic modelling, sentiment analysis, and statistical testing. The results show that references to cybersickness are more frequent in negative reviews and are associated with shorter playtime and more detailed accounts of user experience. At the same time, several observed relationships have only small effect sizes, which appropriately limits causal interpretation and supports a cautious, non-deterministic reading of the findings.

The second line of investigation examines the distribution of accessibility features in 260 commercial PC games, covering sensory, motor, and cognitive dimensions. The statistical analyses indicate that the occurrence of such features is not random: top-level genre and, to a lesser extent, game mode act as significant structural factors. An especially relevant finding is that release year alone does not explain the number of accessibility features, challenging the assumption that newer games are necessarily more accessible.

A major strength of the thesis group is the integration of physiological constraints and design-oriented accessibility measures within a coherent HCI framework. A limitation is that the proposed relationship between a larger number of accessibility features and broader, sustained participation was not measured directly in the dataset. It is therefore better regarded as a well-motivated model assumption than as an empirically demonstrated conclusion. This thesis group is scientifically sound, methodologically current, and contributes independent results to the study of user experience and digital accessibility.

Thesis Group 3 – Structural – Affective Layer

The third thesis group examines how structural properties of digital games shape the affective expression of player experience at three interconnected levels: top-level genre, player interaction mode, and specific design paradigms. Its strength is the use of large Steam-review corpora, combined with sentiment analysis, emotion-category profiling, temporal sentiment curves, topic modelling, and inferential statistics. The genre-level results demonstrate systematic differences in review length, playtime at review, emotional valence, and emotion composition, supporting the interpretation of genre as an affective macrostructure rather than merely a classificatory label.

The analysis of interaction modes extends this framework by showing that single-player, cooperative, and multiplayer configurations are associated with distinct patterns of review length, timing, and emotional expression. This provides a meaningful intermediate structural layer between broad genre and specific game design. However, given the extremely large sample sizes, statistical

significance alone should not be regarded as evidence of substantial practical effects; the magnitude and interpretability of differences remain important.

The design-paradigm analysis integrates robust findings on Soulslike, virtual-reality, liminal-space, and competitive e-sport games. The recurring emotional and textual patterns provide plausible evidence that design logic influences how challenge, space, discomfort, competition, and mastery are experienced and communicated. A limitation is that these results originate from several independently conducted datasets and methodological approaches, so the proposed unified micro-structural layer functions partly as a synthesis rather than as a single directly tested model. Overall, the thesis group is scientifically substantial, methodologically diverse, and offers an original multilevel interpretation of the relationship between game structure and affective player discourse.

IV. Conclusions

Dr. Tibor Guzsvinecz demonstrates substantial and developing scientific impact in human–computer interaction, virtual and augmented reality, digital games, user experience, and accessibility. His research combines experimental HCI methods with large-scale data analysis, natural language processing, sentiment analysis, and statistical modelling, linking perceptual, physiological, structural, and affective dimensions of interaction in digital environments. The habilitation dossier documents a broad publication record and a significant, increasing citation profile. Several works have appeared in internationally recognised Q1–Q2 journals and have attracted notable independent attention.

Particularly relevant are his contributions to spatial perception in VR, cybersickness, accessibility in commercial games, and large-scale player discourse. His scientific influence is reinforced by participation in national and international research projects, editorial activity, conference organisation, and collaboration across disciplinary and institutional boundaries. The coherent integration of these activities shows that his work extends beyond isolated studies and contributes to a broader research agenda in user-centred digital systems. Overall, his scientific output demonstrates originality, international visibility, methodological diversity, and measurable impact, supporting the conclusion that he has established an independent and recognisable research profile in contemporary informatics.

The candidate has significant publication and citation indicators, extensive project activity, supervision of more than fifty graduate students and experience as a doctoral co-supervisor. His professional recognition at home and abroad is significant.

V. Overall Recommendations

Based on the presented scientific results and contributions, the current research program, the strong scientometric indicators, and the high-quality university educational activity, I consider the candidate to be professionally qualified for the title of habilitated doctor. I support the procedure to enter the public phase. After a successful public phase, I recommend that Dr. Tibor Guzsvinecz be awarded the title of habilitated doctor.

Debrecen, August 15, 2026.

Prof. Dr. Zoltán Gal
Department of Information Systems and Networks
Faculty of Informatics, University of Debrecen