MUNI

COMMENTARY TO HABILITATION THESIS[1]

[text of the commentary]

[1][2] Šašinka, Č., Stachoň, Z., Čeněk, J., Šašinková, A., Popelka, S., Ugwitz, P., & Lacko, D. (2021). A Comparison of the Performance on Extrinsic and Intrinsic Cartographic Visualizations through Correctness, Response Time and Cognitive Processing. *PLoS ONE*, *16*(4). https://doi.org/10.1371/journal.pone.0250164
(WoS JIF QUARTILE: Q2)

The study builds on the author's previous work (Šašinka et al., 2019), in which bivariate visualizations were investigated in the context of avalanche hazard. This study modifies the research design in such a way that the effect of visualization can be studied in relative isolation without the influence of domain knowledge. The author's methodological approach, the so-called extensive-intensive research design, which combines measures of behavioral performance and eye gaze tracking, or combines confirmatory and exploratory procedures, was reused. However, this publication is a pilot study as it was designed as a re-design for follow-up cross-cultural research. The full-scale follow-up study already includes datasets from several countries, including Ghana, Philippines, Taiwan, Germany, Turkey, Armenia, etc. The author participated in the activities listed in the manuscript (Conceptualization, Formal analysis, Funding acquisition, Methodology, Resources, Supervision, Writing - original draft, Writing - review & editing)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
80	80	50	80

[2] Juřík, V., Herman, L., Snopková, D., Galang, A. J., Stachoň, Z., Chmelík, J., Kubíček, P., & Šašinka, Č. (2020). The 3D hype: Evaluating the potential of real 3D visualization in geo-related applications. PLoS ONE, 15(5). https://doi.org/10.1371/journal.pone.0233353
(WoS JIF QUARTILE: Q2)

This study is part of a broader line of research developed by the author in collaboration with colleagues from the Institute of Geography and the Department of Visual Informatics, which aimed to investigate the effect of media (REAL 3D, or PSEUDO 3D). The topic was developed in the GAMU project "The influence of cartographic visualization methods on the success of solving practical and educational spatial tasks" and under supervision, among others, his graduate students' theses were created and later published (Špriňarová et al., 2015, Juřík et al., 2017). This study also uses the outputs of a previous study (Kubicek et al., 2019; see point 4) and is part of a larger battery published in Herman et al., 2021. The studies as a whole, all of which were supervised by the author, examine the influence of the medium in various aspects and conclude that REAL 3D does not offer a significant advantage over PSEUDO 3D. The author participated in the activities listed in the manuscript (Methodology, Resources, Supervision, Writing - review & editing).

[1] The commentary must correspond to standard expectations in the field and must include a brief characteristic of the investigated matter, objectives of the work, employed methodologies, obtained results and, in case of co-authored works, a passage characterising the applicant's contribution in terms of both quality and content.
[2] Bibliographic record of a published scientific result, which is part of the habilitation thesis.

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	40	5	40

[3] Kubíček, P., Šašinka, Č., Stachoň, Z., Štěrba, Z., Apeltauer, J., & Urbánek, T. (2017). Cartographic Design and Usability of Visual Variables for Linear Features. *Cartographic Journal*, *54*(1), 91-102. https://doi.org/10.1080/00087041.2016.1168141
(WoS JIF QUARTILE: Q4)

This work was developed during the author's work at the Transport Research Centre, where the aim was to design suitable visualisations for detours. The topic was subsequently developed with regard to alternative visualization methods and the influence of individual differences (cognitive styles) on preferred visualizations. In this experiment, the author was responsible for the methodology and research design as well as for the text writing and implementation of the reception procedure, among others, in the role of correspondence author. The experimental design was based on the author's previous studies where alternative visualization was compared and concurrently used cognitive style tests. The results did not show differences in effectiveness depending on the display method, but partial relationships to preferred visualizations in terms of cognitive style were found.

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
80	80	80	80

[4] Kubíček, P., Šašinka, Č., Stachoň, Z., Herman, L., Juřík, V., Urbánek, T., & Chmelík, J. (2019). Identification of altitude profiles in 3D geovisualizations: the role of interaction and spatial abilities. *International Journal of Digital Earth*, *12*(2), 156-172. https://doi.org/10.1080/17538947.2017.1382581
(WoS JIF QUARTILE: Q2)

This study is part of a broader line of research developed by the author in collaboration with colleagues from the Institute of Geography and the Department of Visual Informatics, which aimed to investigate the effect of media (REAL 3D, or PSEUDO 3D). The topic was developed in the GAMU project "The influence of cartographic visualization methods on the success of solving practical and educational spatial tasks", This particular study focused not only on comparing the effect of media, but also investigated the influence of individual differences, mainly spatial abilities and gender. The author was responsible for the conceptual and methodological part, including the organization of data collection and manuscript preparation. The types of tasks used were subsequently used in a follow-up study by Juřík et al., 2020 (see point 2)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	40	30	30

[5] Šašinka, Č., Stachoň, Z., Sedlák, M., Chmelík, J., Herman, L., Kubíček, P., Strnadová, A., Doležal, M., Tejkl, H., Urbánek, T., Svatoňová, H., Ugwitz, P., & Juřík, V. (2019).

Collaborative Immersive Virtual Environments for Education in Geography. *ISPRS International Journal of Geo-Information*, *8*(1). https://doi.org/10.3390/ijgi8010003 (WoS JIF QUARTILE: Q3)

This study and this topic had its roots already in the preparation of the project (The influence of cartographic visualization methods on the success of solving practical and educational spatial tasks), where the author, among other things, prepared the topic of collaborative aspects in the interpretation of spatial data. This is a topic that qualitatively exceeds the original research scope of the author and the entire main line of the project. It crosses the boundaries of a purely individualistic view of visualization processing and a cognitivist perspective and emphasizes the social aspect of cognition. The topic and the whole study was developed in a strong interdisciplinary collaboration of the main concept developers, in which the author was responsible for the research method in addition to the cognitive and user aspects, and in which the topic was developed by Dr. Stachoň from the geography perspective and coordinated by Dr. Chmelík from the IT implementation perspective. The findings led to a qualitative change in the research line and, among others, to the profit of an applied project focused on the use of collaborative immersive virtual reality in education, which the original team (author, Dr. Stachoň, Dr. Chmelík) complemented in terms of educational and social aspects by Mgr. Šašinková. Within the framework of the present project, among others, a follow-up study Jochecová et al. (2022) was created, which has already been implemented on the new eDIVE platform and the collaborative immersive virtual environment has been used in semester-long teaching at the Faculty of Arts. The article describes the potentials and limitations of the technology and the concept of collaborative work in information processing, which is currently the main research line of the author.

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	40	10	50

[6] Čeněk, J., Tsai, J.-L., & Šašinka, Č. (2020). Cultural variations in global and local attention and eye-movement patterns during the perception of complex visual scenes: Comparison of Czech and Taiwanese university students. PLoS ONE, 15(11). https://doi.org/10.1371/journal.pone.0242501 (WoS JIF QUARTILE: Q2)

The author includes this article as an introduction to the cross-cultural line in his work. The paper introduces the concept of analytic-holistic cognitive style in a cross-cultural perspective and its impact on visual perception. In doing so, the author builds on partial theoretical discussions in his dissertation, in which he theoretically discussed just the possible influence of cultural differences on the processing of visualizations. The results of the experiment support the thesis of culturally conditioned differences in visual perception and open the way for research on cross-cultural differences in the way graphically coded data are processed. The research compared populations of Czechs and Taiwanese. The author was responsible for the implementation of the research in the Czech Republic, including the adaptation of the research (lab) settings, and his CFT test was used. He also worked on Conceptualization, Data curation, Funding acquisition, Methodology, Software, Visualization, Writing - review & editing.

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)

40	10	10	30

[7] Stachoň, Z., Šašinka, Č., Čeněk, J., Angsüesser, S., Kubíček, P., Štěrba, Z., & Bilíková, M. (2018). Effect of Size, Shape and Map Background in Cartographic Visualization: Experimental Study on Czech and Chinese Populations. *ISPRS International Journal of Geo-Information*, *7*(11). https://doi.org/10.3390/ijgi7110427
(WoS JIF QUARTILE: Q3)

In the cross-cultural study utilizing the visual search paradigm, the influence of culture and the complexity of map background were investigated. The assumption that the presence of map background in the case of a more holistic and thus field-dependent Chinese culture relatively increases the search time, was not confirmed. The Chinese script was considered as another cultural phenomenon that would potentially positively affect the search speed, for example with small and harder to distinguish shapes. However, no cross-cultural effect was detected here either. Nevertheless, Czech participants solved all task types considerably faster. This finding led to the need to amend the test batteries for cross-cultural research with psychological tests (See point 11), which would capture the potential bias caused by, e.g., culturally conditioned psychomotor pace. The authors were primarily responsible for the research method as well as the theoretical grounding in terms of the psychology of visual perception.

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	30	30	30

[8] Stachoň, Z., Šašinka, Č., Čeněk, J., Štěrba, Z., Angsüesser, S., Fabrikant, S., I., Štampach, R., & Morong, K. (2019). Cross-cultural differences in figure–ground perception of cartographic stimuli. *Cartography and Geographic Information Science*, *46*(1), 82-94. https://doi.org/10.1080/15230406.2018.1470575
(WoS JIF QUARTILE: Q2)

The paper followed-up previous one (see point 7) and already worked with a complex cartographic symbol set, or rather two alternative types of legends – iconic and more schematized. The participants were asked to search for point symbols in the first subtest, and to search for background segments in the second subtest. Contrary to expectation, Chinese participants were significantly slower at locating the background. As expected, Czechs were also faster in searching for point symbols (i.e., focal objects). Over all, the obtained results of the map tasks do not correspond with the underlying theory. At the same time, even the complementary framed-line test of differences (Kityama et al., 2003), which was used by the authors specifically to demonstrate cultural variations, identified Chinese participants as relatively more analytical.

including interactive map tasks, questionnaires, dynamic scenes, videos to various types of psychological tests.The tool has proven to be essential for the possibility of conducting cross-cultural research. The author is the lead designer of the solution and draws, among other things, on experience with the previous MuTEP system. The author of the proprietary code is Ing. Morong, the software as such was released under Open Source license. The paper presents, among other things, empirical studies that have demonstrated the functionality of the system. The platform Hypothesis has also been put into practice and mass diagnostics are underway in VN Brno.

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
60	70	70	80

[10] Popelka, S., Stachoň, Z., Šašinka, Č., & Doležalová, J. (2016). Eyetribe Tracker Data Accuracy Evaluation and Its Interconnection with Hypothesis Software for Cartographic Purposes. *Computational Intelligence and Neuroscience*, Vol. 2016, Special Issue, February, Article ID 9172506. https://doi.org/10.1155/2016/9172506
(WoS JIF QUARTILE: Q3)

The article contains two relatively separate topics. Comparison of the accuracy of eye tracking devices (Eye tribe and SMI). And linking the Hypothesis platform with eye tracking systems. The author's contribution lay mainly in the second part, in which he collaborated on both the technical solution and the evaluation of the solution. The paper also includes the introduction of large scale and small scale studies, as it is the Hypothesis software that allows to collect data online and in bulk. Eyetracking allows to gain deeper insight into the process of processing the given tasks. However, data collection is primarily only possible indvidiually under controlled laboratory conditions. The author is the creator of the corresponding parts of the text as well as the methods used.

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
25	25	25	25

[11] Šašinka, Č., Lacko, D., Čeněk, J., Popelka, S., Ugwitz, P., Řádová, H., Fabianová, H., Šašinková, A., Brančík, J., Jankovská, M. (2021). ImGo: A Novel Tool for Behavioral Impulsivity Assessment Based on Go/NoGo Tasks. *Psychological Reports, 23.* https://doi.org/10.1177/00332941211040431
(WoS JIF QUARTILE: Q3)

This paper presents an evaluation of a psychological test based on the GO/noGO task principle. The paper includes three completely independent datasets and the paper and the study itself were developed over several years in three different projects in which the author was a principal investigator. Thus, the resulting article is both a testament to the necessary procedures and the costliness of creating psychometric tools. The author supervised all the sub-studies and was at the beginning of the development of the test itself, including the creation of the stimulus material and the implementation in the Hypothesis software environment. The bull research studies included, for example, also a study validating the concept on the plane of eye movement. The paper verifies, among other things, the psychometric parameters of the test and establishes the relationship with other similar concepts (which are also, among other things, established by other psychological tests of the author). The validation test was subsequently used in the basic research project "The

The study is also an elaboration of the original experiment, in which Prof. Švancara participated (Stachoň, 2013), and its roots originated within the author's internal MU project (Experimental Practicum: Design and Implementation of Interdisciplinary Research). The author was involved from the beginning in the conception, as well as research design, preparation of background material, organization of data collection, and preparation of the manuscript.

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
50	50	30	50

[8] Lacko, D., Šašinka, Č., Čeněk, J., Stachoň, Z., & Lu W.-L. (2020). Cross-Cultural Differences in Cognitive Style, Individualism/Collectivism and Map Reading between Central European and East Asian University Students. *Studia Psychologica*, *62*(1), 23-42. http://dx.doi.org/10.31577/sp.2020.01.789
(WoS JIF QUARTILE: Q4)

The last of the cross-cultural research was focused on higher cognitive processes. The design of the study called "Cross-Cultural Differences in Cognitive Style, Individualism/Collectivism and Map Reading between Central European and East Asian University Students", was inspired by the experiment of Norenzayan et al. (2002), which examined the tendency to categorize based on a one-dimensional rule (analytically), or a rule of overall similarity (holistically). Participants were asked to identify and label a continuous map area covering at least four territorial units that they considered to belong together. The visualizations were designed in a way so that either the one-dimensional or the holistic-similarity rule applied. The results imply that Czech participants exhibited significantly lower levels of collectivism than Chinese/Taiwanese participants, and similar levels of individualism. In accordance with the hypothesis, the results of the map task show that Czech participants categorized more analytically, while Chinese/Taiwanese categorized more holistically. However, the effect of this significant difference was relatively small. The experiment itself is in fact the fourth iteration of the topic started by the author and Dr. Stachoň and developed by their graduate students at both the Geography Department of the Faculty of Science and the PsÚ Faculty of Arts of MU. The actual realization of the study, data processing and main parts of the text was carried out by Mgr. Lacko, who together with both authors carried out the fifth iteration in the meantime. Actually, the study was supplemented with a new type of items and data were collected using eye tracking in several countries.

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	50	10	40

[9] Šašinka, Č., Morong, K., & Stachoň, Z. (2017). The Hypothesis Platform : An Online Tool for Experimental Research into Work with Maps and Behavior in Electronic Environments. ISPRS International Journal of Geo-Information, 6(12). https://doi.org/10.3390/ijgi6120407
(WoS JIF QUARTILE: Q3)

This paper presents a research tool that had to be developed for the needs of visualization research. The tool allows the creation and online administration of complex batteries

influence of socio-cultural factors and writing system on perception and cognition of complex visual stimuli", where the author is the principal investigator.

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
40	100	5	90

12] Ugwitz, P., Šašinková, A., Šašinka, Č., Stachoň, Z., & Juřík, V. (2021). Toggle Toolkit: A Tool for Conducting Experiments in Unity Virtual Environments. *Behavior Research Methods*, *53*(4), 1581-1591. https://doi:10.3758/s13428-020-01510-4
(WoS JIF QUARTILE: Q1)

This paper presents a tool for creating a virtual reality experiment. The main reason for the creation of the tool was the practical need to find an efficient solution for creating different types of experiments with a wide range of interactions. The author defined the structure and scope of the article to fit the profile of the target journal. At the same time, he participated in the preparation of sample experiments that demonstrated the potential of the tool for praxis and then supervised the process of creating the entire manuscript.

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	70	10	40

[redacted]