



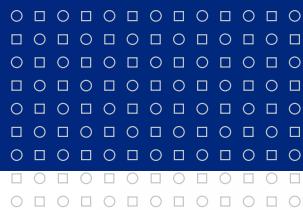
MASARYK UNIVERSITY

Je více méně?

Význam lidské chyby v
interakci s 3D VGEs

Vojtěch Juřík

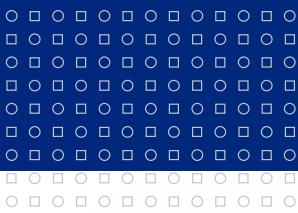
CEPCoS, Faculty of Arts, MU
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Aplikační potenciál virtuálních rozhraní

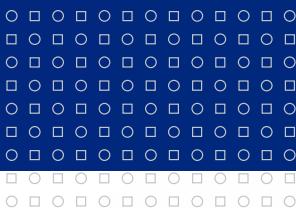
- Human-computer interaction
- Navigace
- Zábavní průmysl
- Mapy
- Krizový management
- Armáda
- Letectví



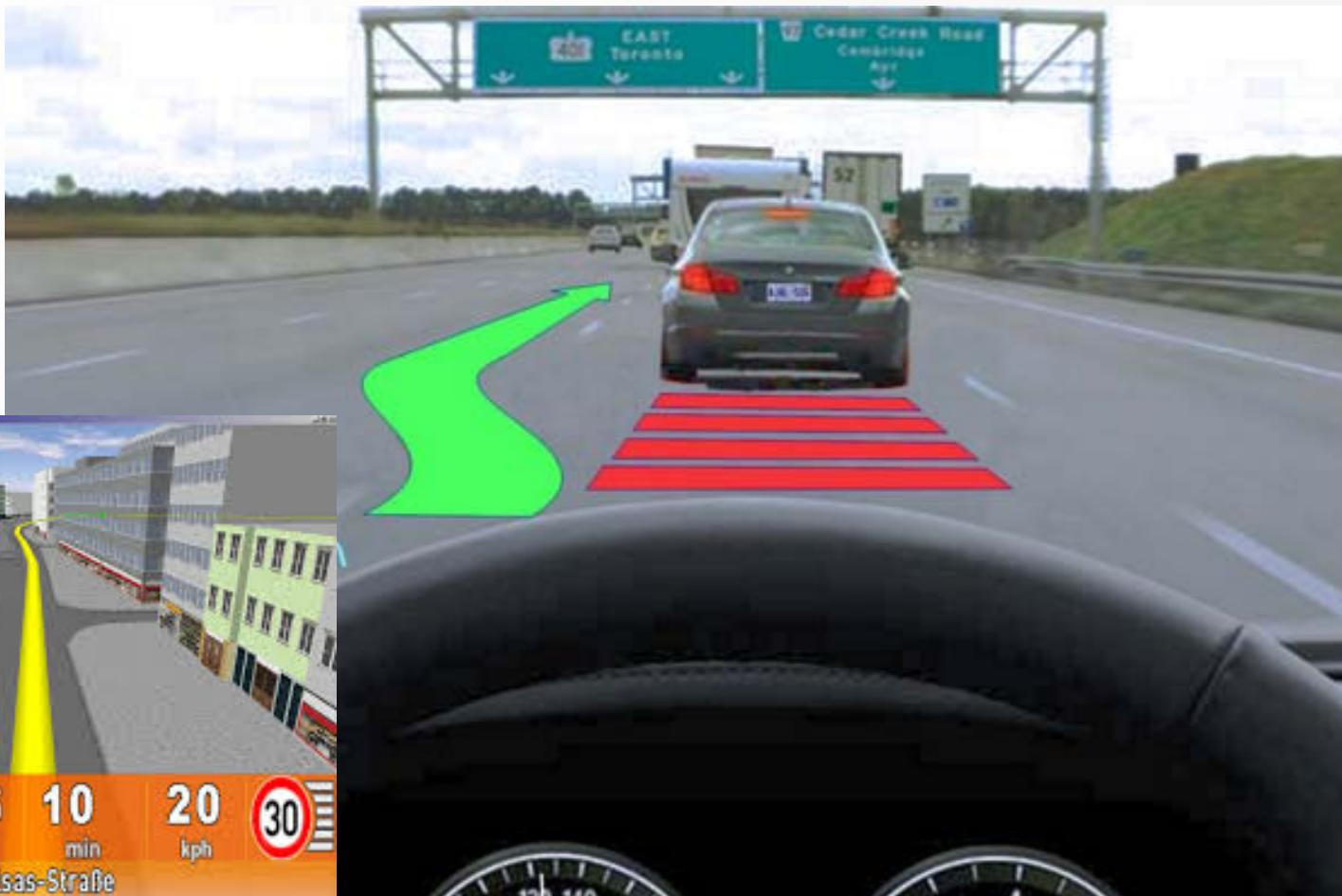


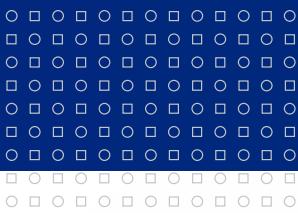
... rozšířená realita potom pro piloty





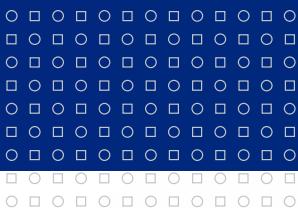
...pro řidiče





... pro Iron Mana





A prostředkem komunikace v rámci UI je... Vizualizace

Vizualizace je grafická reprezentace informace.

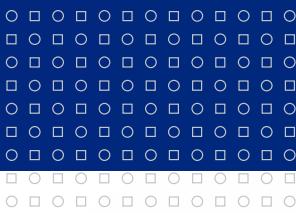
Přirozeným vývojem je snaha o tvorbu 3D prostředí, které co nejvíce odpovídá reálnému světu



3D VIZUALIZACE.

As the use of 3D technologies in such areas as **aviation, crisis management, medicine, urban planning, traffic, geography** and **cartography** is growing (Lin et al., 2015; Hirmas et al., 2014; Popelka & Dědková, 2014; Herman & Řezník, 2013; Wilkening & Fabrikant, 2013; Popelka & Brychtová, 2013; Konečný, 2011; Fabrikant, Montello, Mark, 2010; Weber et al., 2010; Bleisch et al., 2008), the more often the usability of 3D depiction is discussed within the field of human factors.



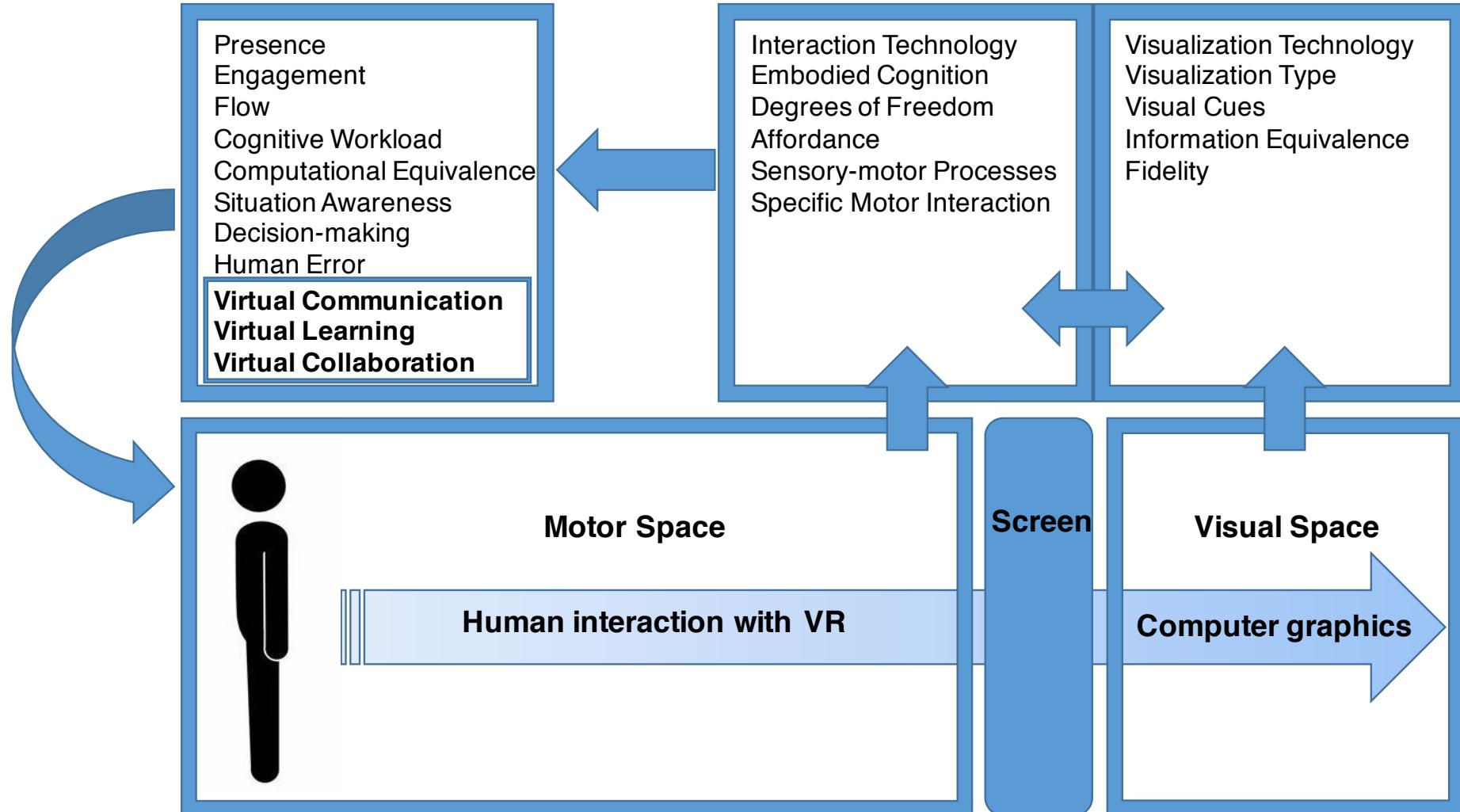
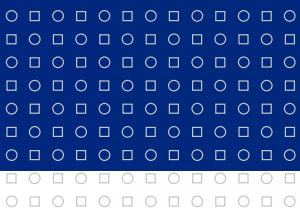


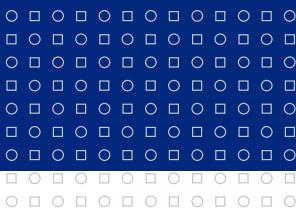
... a ta základní otázka?

Ovlivňuje typ 3D vizualizace uživatele v tom,
**(a) jak vyhodnocuje
(b) a také jak interaguje
s konkrétním typem UI?**

Naše výzkumná linie poukázala na fakt, že rozdíly existují
(Sprinarova et al., 2015)...
tak jsme pokračovali dále



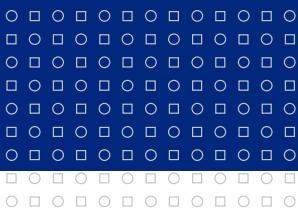




Co jsme tedy zkoumali v Experimentu 2016

Jak ovlivňuje Reálné (stereoskopické) 3D zobrazení manipulaci a vyhodnocení virtuálních 3D geografických modelů uživateli oproti Pseudo 3D zobrazení?





Interface je tvořen před screenem a za screenem

A) Vstupy

Motorická akce

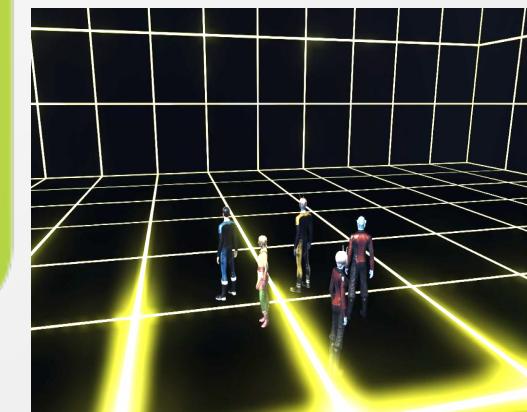
- Tracking device (**MoCap**)
- Control device (**Wii RC**)

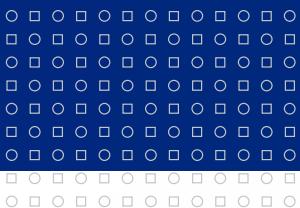
B) Výstupy

- 3D projekční plátno

- Pseudo 3D

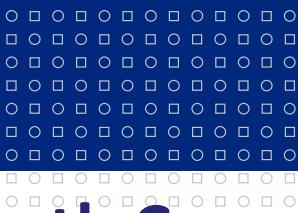
- Real 3D (**Dolby 3D technology**)





Interface





Depth Cues

Monocular depth cues

A) Static monocular depth cues

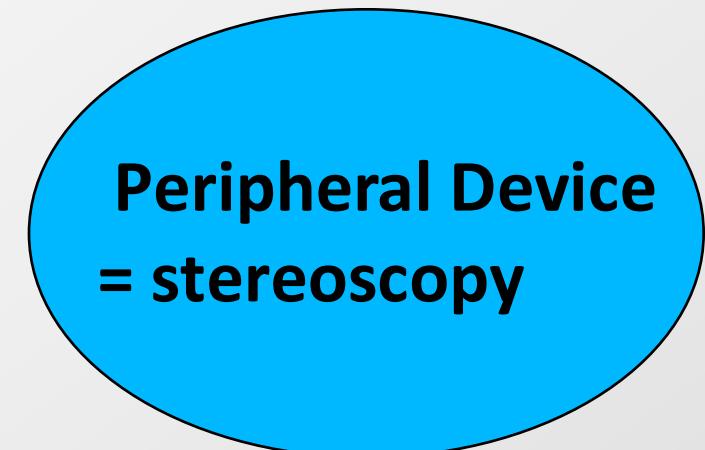
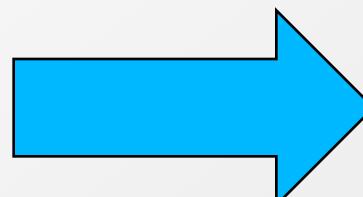
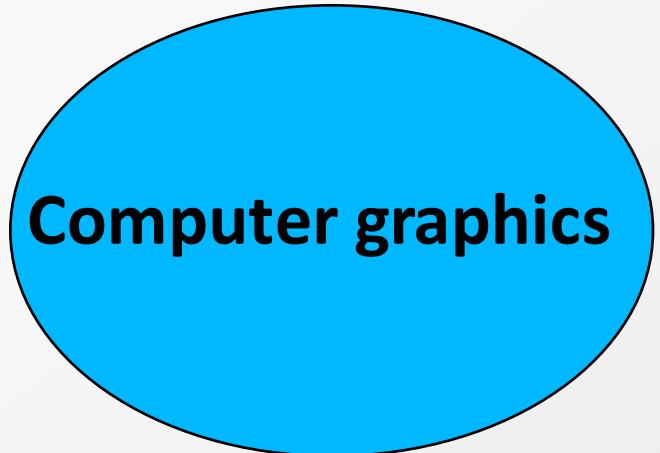
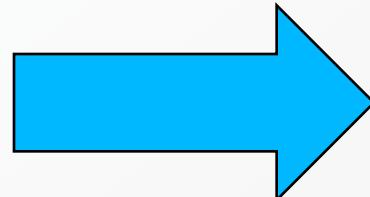
- Linear perspective
- Aerial perspective
- Relative size
- Interposition
- Texture gradient
- Shading and lightening
- Elevation

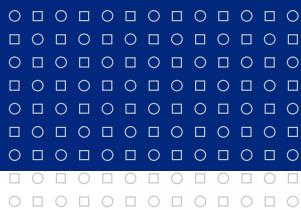
B) Dynamic monocular depth cues

- Motion parallax
- Kinetic depth effect

Binocular depth cues

- Binocular convergence
- Binocular disparity



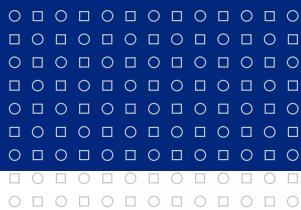


Real a Pseudo 3D zobrazení

The Pseudo 3D visualization or also called the **weak 3D** visualization (Seipel, 2012), is displayed perspective-monoscopically on planar media (Buchroithner & Kunst 2013).

Real 3D or **strong 3D** visualization (Seipel, 2012) is based on the principle of stereoscopy (providing binocular disparity) and uses both binocular and monocular depth cues (Buchroithner & Kunst 2013).



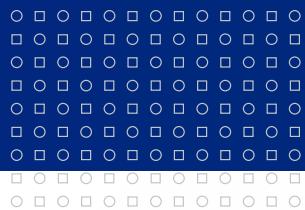


Metoda

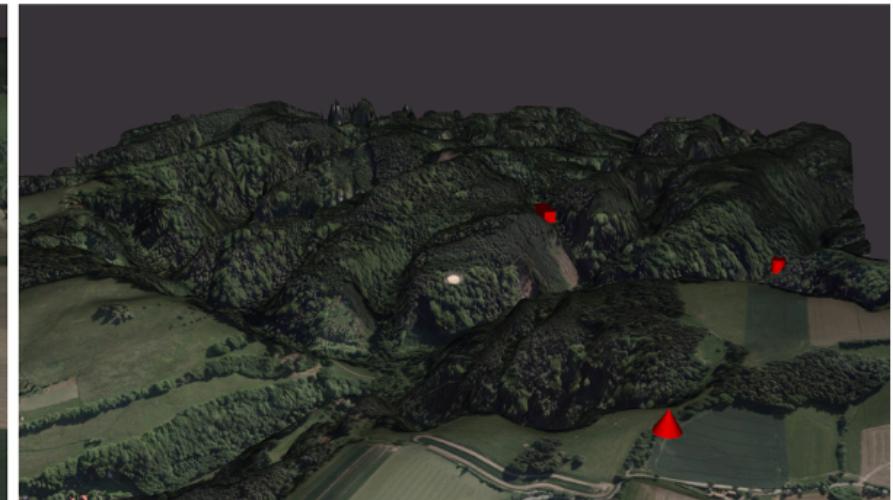
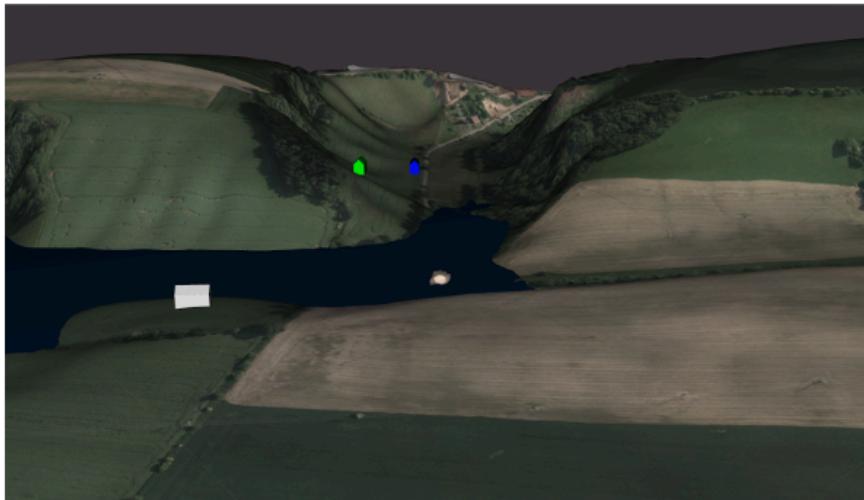
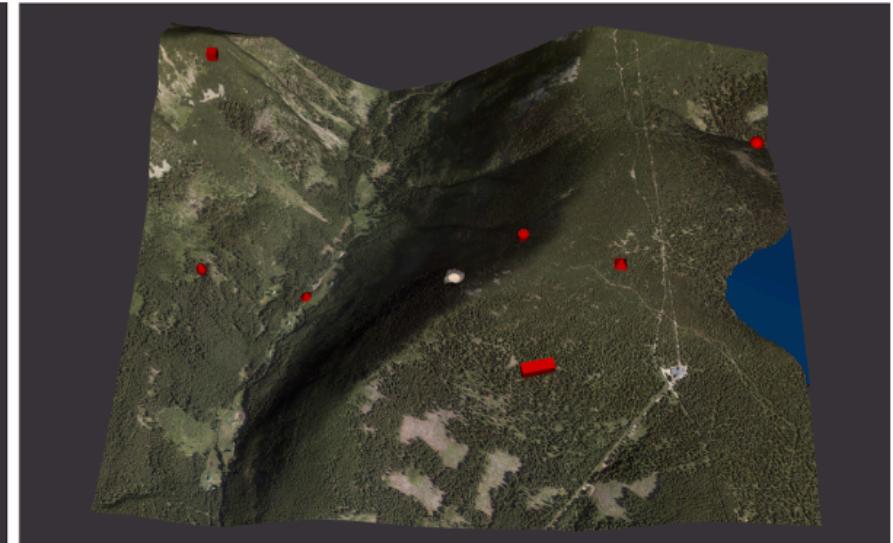
V rámci specifického UI postaveného na softwareové platformě VRECKO jsme vytvořili 3D modely geografických prostředí. Měřili jsme schopnost participantů určovat nadmořskou výšku předmětů v terénu.

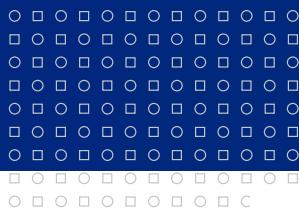
- ❖ Reakční čas
- ❖ Správnost (přesnost) určení pořadí
- ❖ Motorickou aktivitu při hledání řešení (MoCap)
- ❖ Error rate – počet opomenutých předmětů při řešení



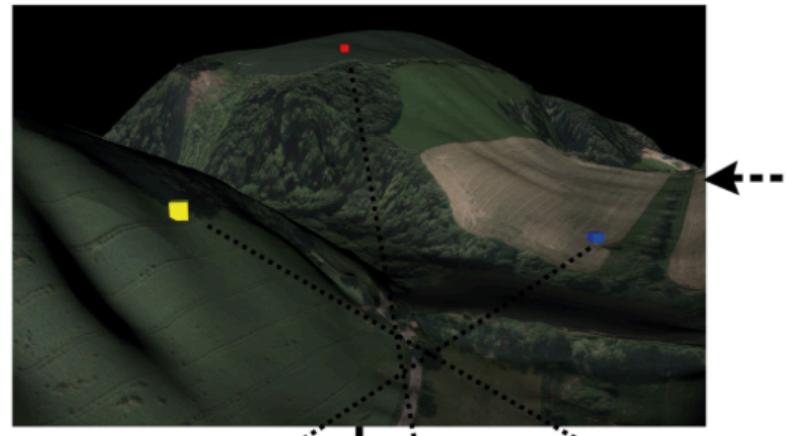


Příklady Tasků





Stimuli presentation: without time limit



blue red yellow 20 times

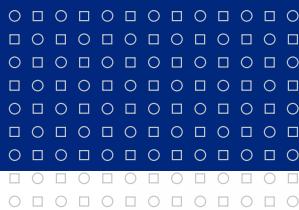
the highest

middle

the lowest

Response screen: without time limit

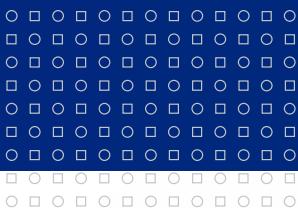




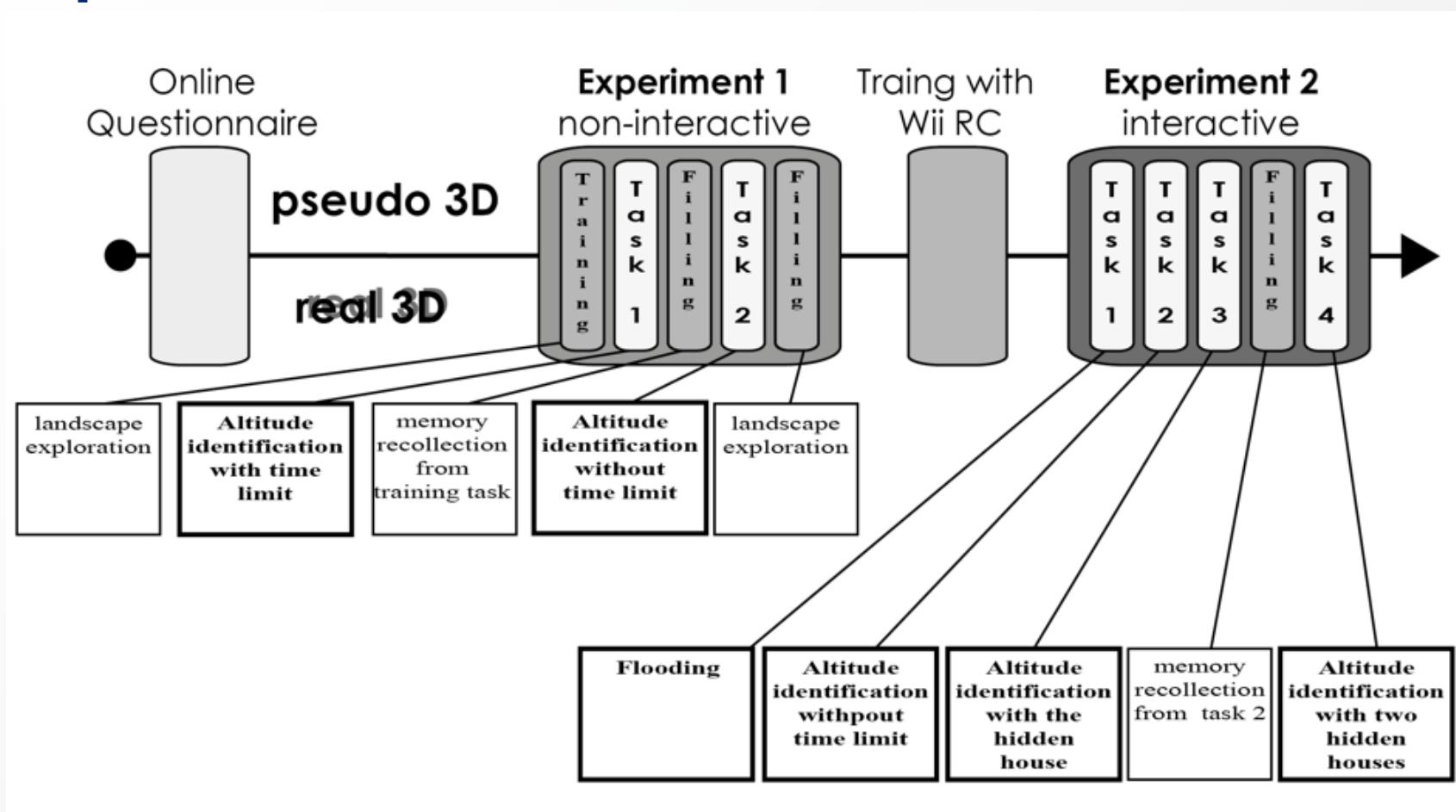
The Research Sample (N = 61)

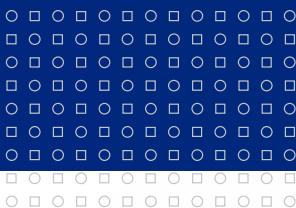
- Participants were 61 volunteers - students of psychology recruited from Departments of Psychology at Masaryk University, Brno (42F-19M; age 19-31, $m=23,24$, $sd=2,609$).





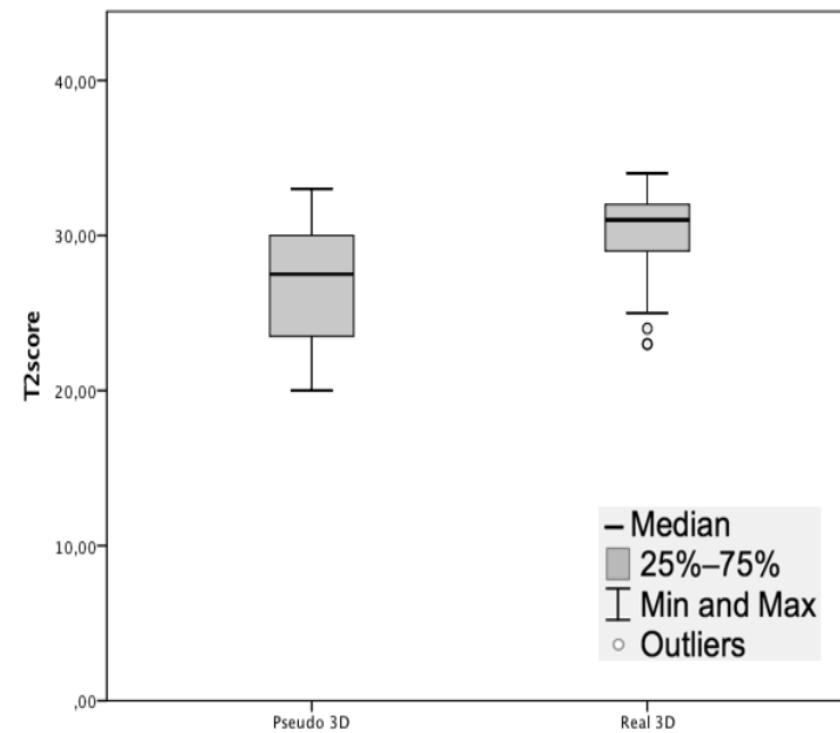
Experimental Scheme

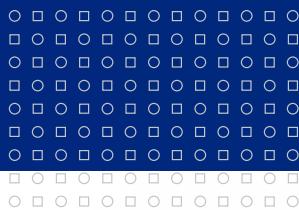




Zjištění

- ❖ In static VGE without time limit were Real 3D users more capable to identify altitude ($p<0,01^{**}$), due to the binocular disparity provided by Real 3D technology



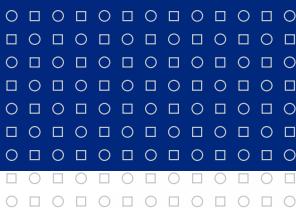


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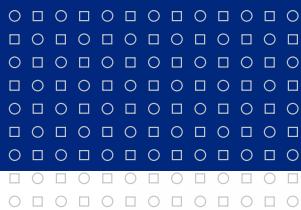
- ❖ In interactive VGE there were found no significant differences in time, accuracy or motor activity





		Task 1		Task 2		Task 3		Task 4	
		Pseudo 3D	Real 3D						
Response time (s)	m	70	72,24	135,22	102,38	91,44	93,31	171,85	153,59
	med	68	60	92	95	78	81	142	150
	sd	35,28	38,62	92,97	52,03	52,83	46,97	102,26	79,86
	U	393,50		477,50		408,00		464,00	
	p	0,974		0,471		0,787		0,652	
Accuracy	m	4,33	3,83	3,48	3,76	2,63	2,69	3,85	3,93
	med	6	4	3	4	2	2	4	4
	sd	1,96	1,67	1,19	1,75	1,47	1,29	1,88	1,41
	U	323,00		430,50		396,00		400,50	
	p	0,242		0,507		0,937		0,879	
Error Rate	m	0,04	0,07	0,07	0,14	0	0	0,26	0,52
	med	0	0	0	0	0	0	0	0
	sd	0,19	0,258	0,267	0,351	0	0	0,526	0,79
	U	404,00		416,50		391,50		449,50	
	p	0,599		0,444		1,00		0,230	
Motor Activity	m	227,44	251,86	346,41	231,48	349,56	453,38	497,48	292,17
	med	139	248	220	119	200	279	263	201
	sd	256,34	180,26	391,69	250,15	365,11	515,043	567,94	264,32
	U	454,00		331,00		450,50		313,00	
	p	0,305		0,321		0,333		0,198	

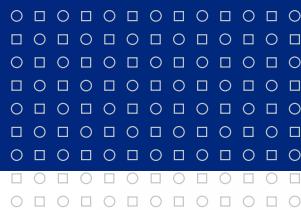




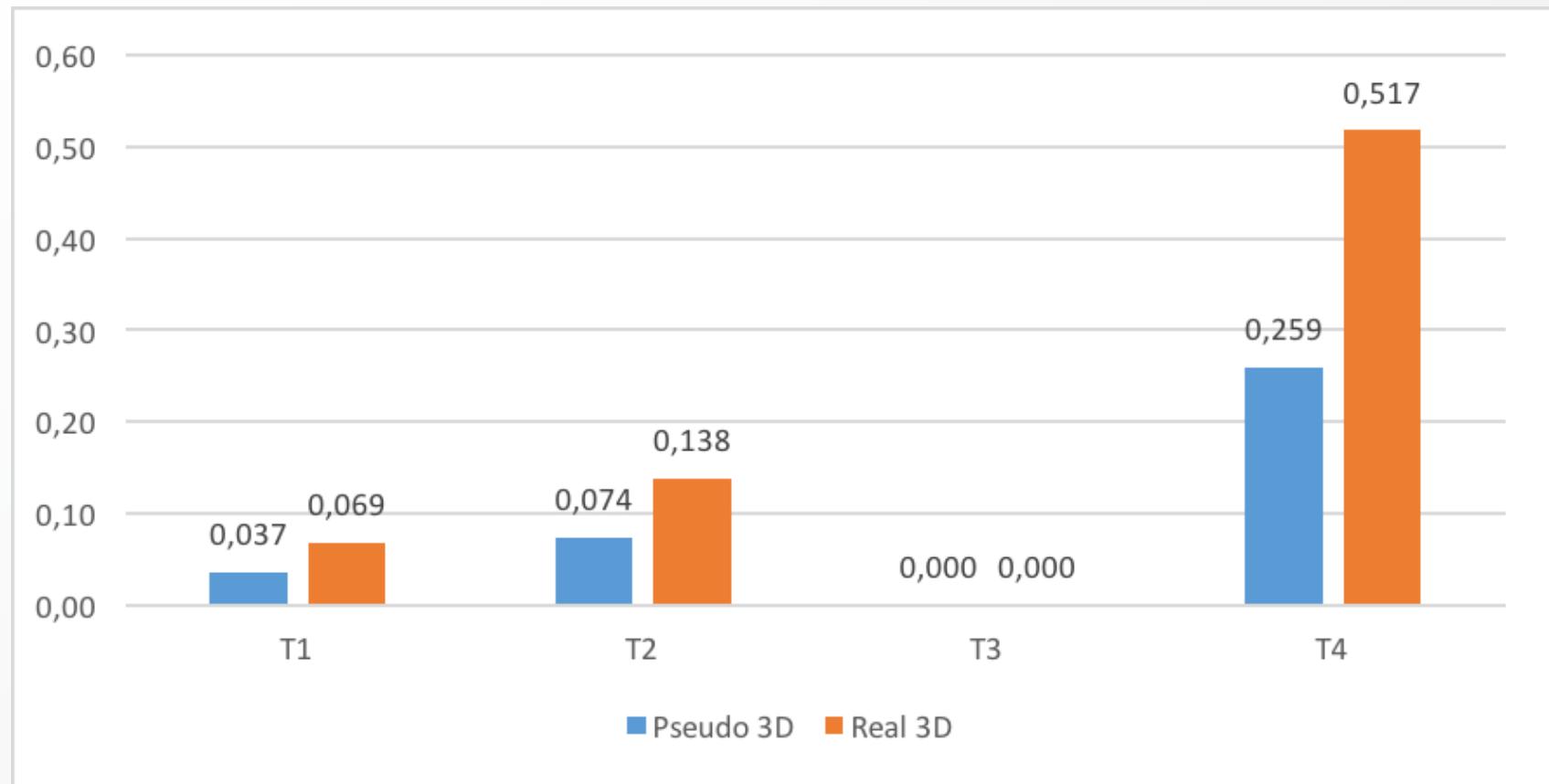
What we found - Overview

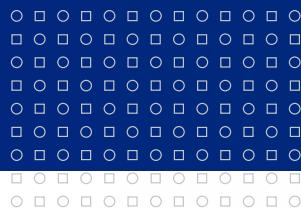
- ❖ In static VGE without time limit were Real 3D users more capable to identify altitude ($p<0,01^{**}$), due to the binocular disparity provided by Real 3D technology
- ❖ In interactive VGE there were found no significant differences in time, accuracy or motor activity
- ❖ In Real 3D condition in interactive tasks were observed increased neglects of important aspects of the scene, thus not statistically significant

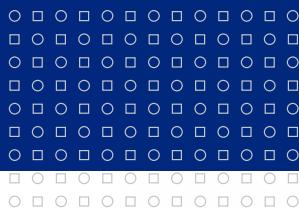




Opomenutí







Typologie chyb (Reason, 1990)

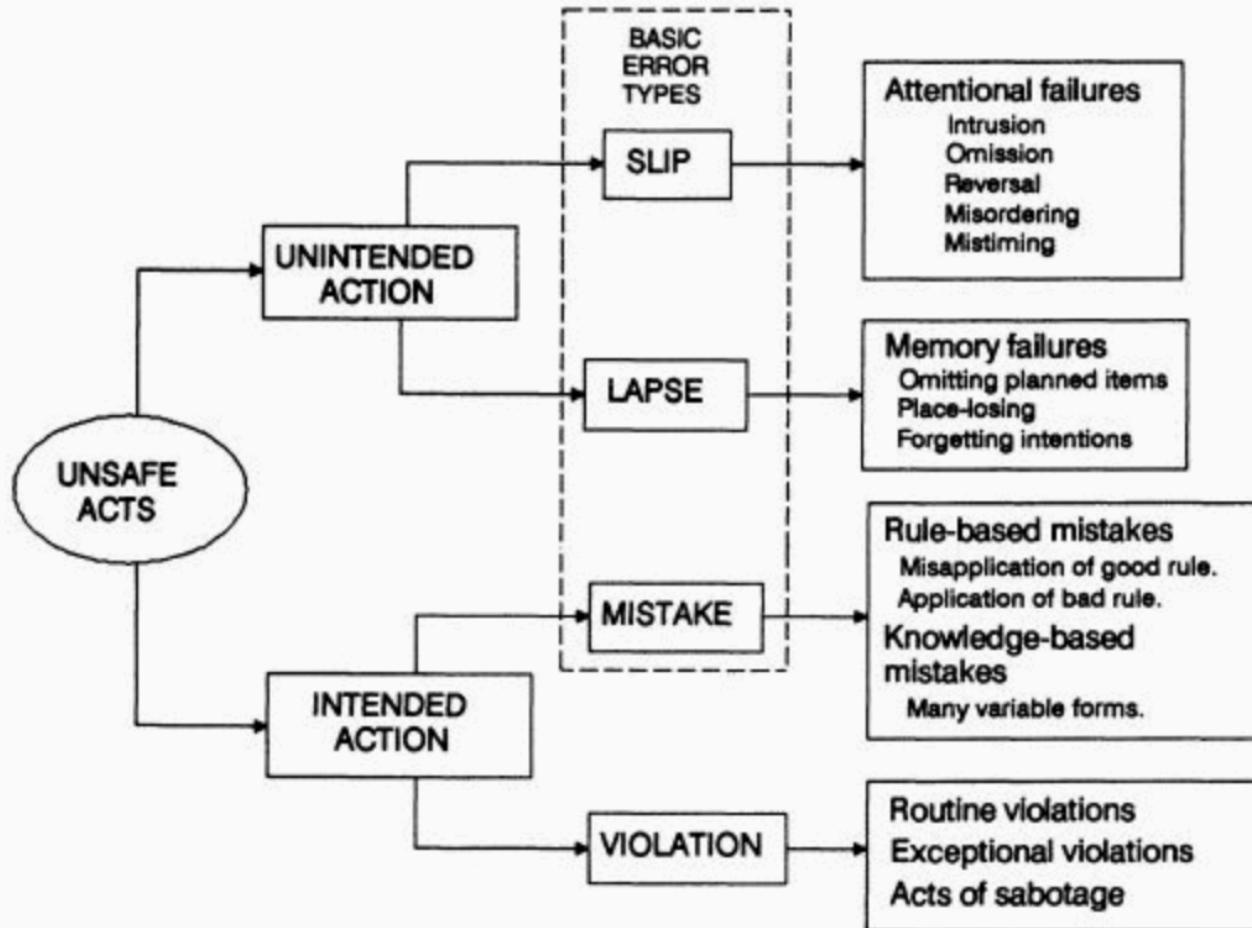
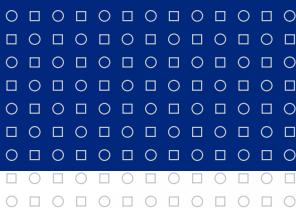
Category 1

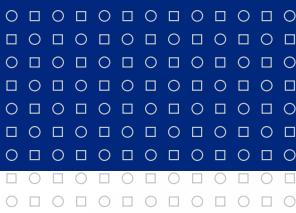
A person intends to carry out an action, the action is appropriate, carries it out incorrectly, and the desired goal is not achieved. - An execution failure has occurred. Execution errors are called Slips and Lapses. They result from failures in the execution and/or storage stage of an action sequence. Slips relate to observable actions and are commonly associated with attentional or perceptual failures. Lapses are more internal events and generally involve failures of memory.

Category 2

A person intends to carry out an action, does so correctly, the action is inappropriate, and the desired goal is not achieved - A planning failure has occurred. Planning failures are Mistakes. *"Mistakes may be defined as deficiencies or failures in the judgmental and/or inferential processes involved in the selection of an objective or in the specification of the means to achieve it."* (Reason, 1990).



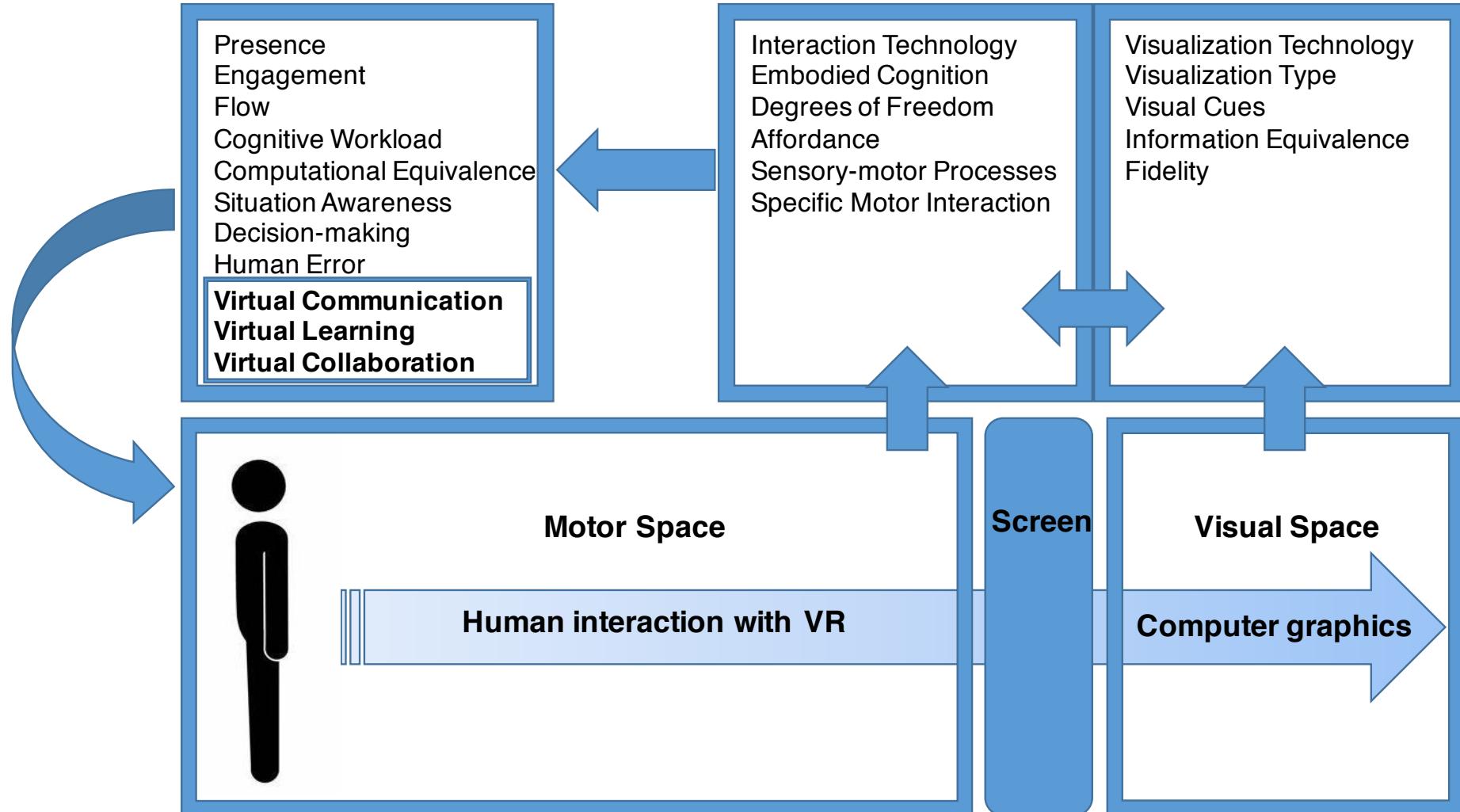
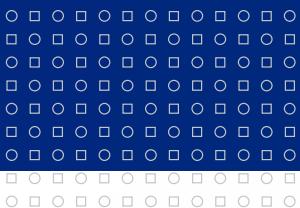


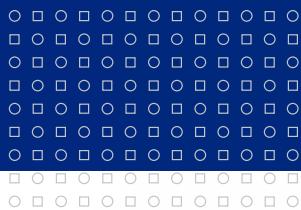


Dohady

- ❖ Zvýšená chybovost je konstatní pro Real 3D
- ❖ Byť Real 3D nabízí více visuálních návodů, vystpují zde další hráči, kteří ovlivňují proces interakce
- ❖ Ačkoliv není signifikance, v oblastech, kde se jedná o lidské životy je jakékoliv pochybení (nebo tendence k pochybení) zcela zásadní otázka



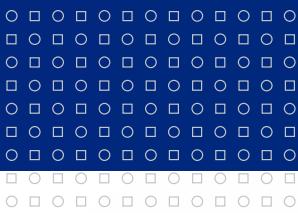




Further Research

- ❖ We have designed optimal interface for measuring human behavioral activity when interacting with virtual environment
- ❖ The platform for data pick-up and analysis was created
- ❖ The interaction with VE should be deeper analyzed with respect to the specific types of action combined with the areas of interests in the visual field
- ❖ The Real 3D group tendency to neglect some aspects of the scene should be highlight of this study suggested for the future research with respect to the applied areas of 3D technology

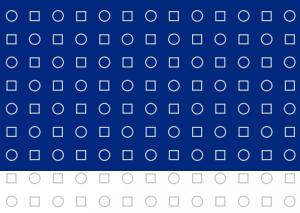




- Errors are the result of actions that fail to generate the intended outcomes. They are categorized according to the cognitive processes involved towards the goal of the action and according to whether they are related to planning or execution of the activity.

- Actions by human operators can fail to achieve their goal in two different ways: The actions can go as planned, but the plan can be inadequate, or the plan can be satisfactory, but the performance can still be deficient (Hollnagel, 1993)





Děkuji za pozornost

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