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Interactive 3D visualization and geospatial data depiction

Petr Kubíček, Zdeněk Stachoň, Čeněk Šašinka, Vojtěch Juřík and Lukáš Herman
Masaryk Univerzity, Brno, Czech Republic

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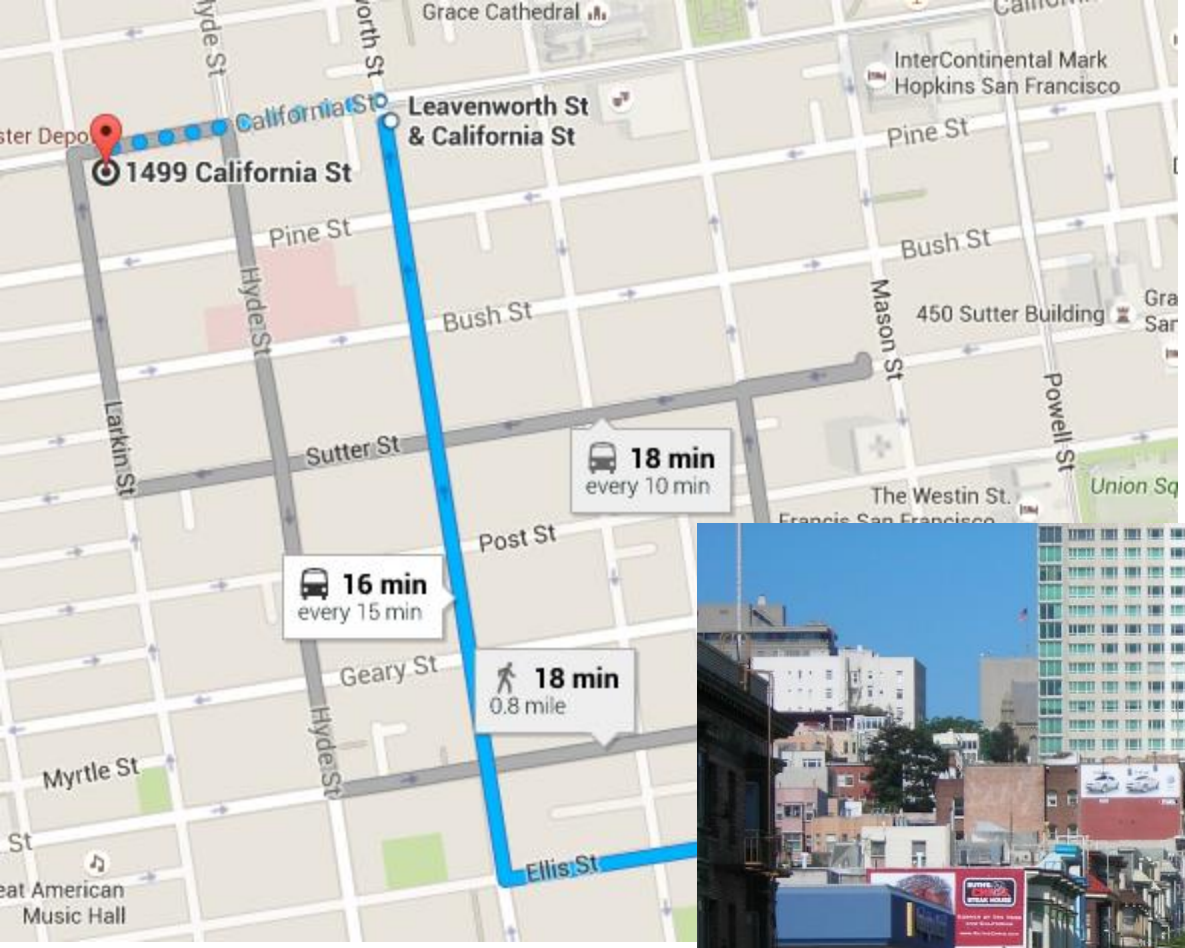
DEPARTMENT OF GEOGRAPHY
FACULTY OF SCIENCE MASARYK UNIVERSITY


Grace Cathedral
InterContinental Mark Hopkins San Francisco
Pine St
Bush St
Mason St
Powell St
450 Sutter Building
Union Sq
The Westin St. Francis San Francisco
Leavenworth St & California St
California St
1499 California St
Hyde St
Larkin St
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18 min
every 10 min
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every 15 min
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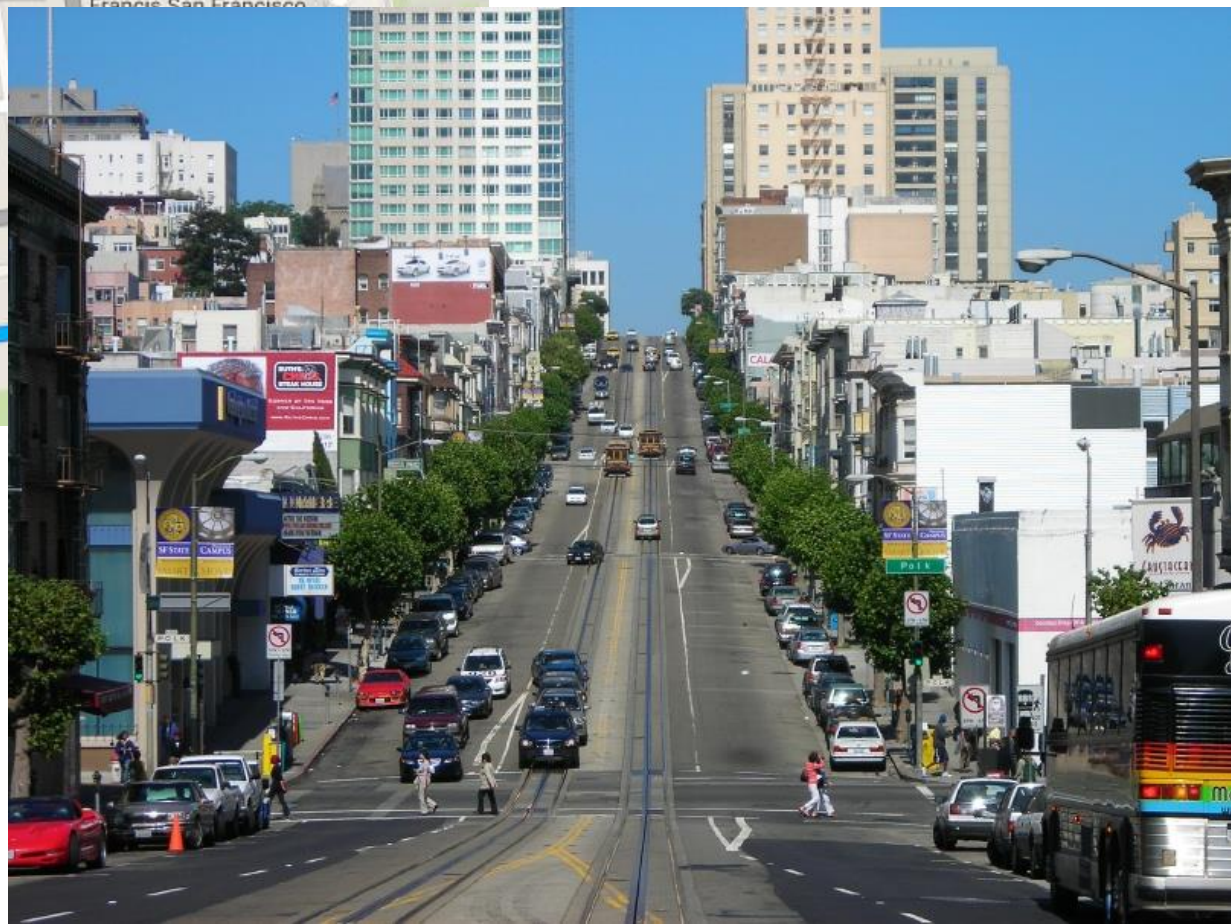
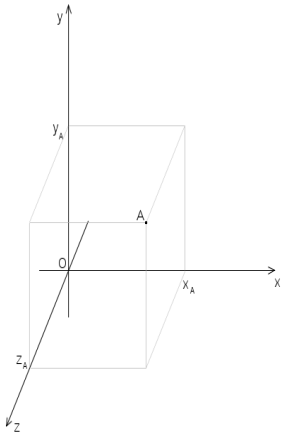
Music Hall



Motivation - „Decision making with the immersive visual analytics – is it necessary?“(Alex Klippel, 3D VR and AR for GI)

- We have entered 3D Era (Boughzala, 2012)
- 3D technologies in geographic related areas as:
  - crisis management,
  - virtual geo-collaboration,
  - aviation,
  - traffic,
- Importance of human factors



BUT

- …the use of 3D is still ambigous (Livatino et al., 2015; Seipel, 2012; Beurden et al., 2010; Pascher & Philip, 2001 and others).

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„Technology push“ (Transformational research in Geography)

Technological infrastructure for visualization and testing:

- Widescreen 3D projection
- Active Shutter 3D Glasses (3D vision)
- Dolby 3D Technology (Passive 3D Glasses)
- Wii Remote Controller (Active button)
- Motion Capture System (Tracking of motion)
- Mobile Eye-tracking Device
- Head Mounted Display

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The Perspective on Three-dimensional Interaction with Virtual Geographical Environments – Pilot studies

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Pilot Study I - „Comparison of usability between immersive 3D environment and 2D representation?“(Josh Johnson, 3D VR and AR for GI)

- Different level of immersion - comparison of Real (Stereoscopic) 3D visualization and Pseudo (2,5d) visualization in informationally equivalent static and interactive virtual geographical environments (VGE).
- We observed the participants‘ ability to indicate spatial distribution of the objects in the landscape (altitude) and we measured how they interacted with 3D environment.
- The aim was to explore whether Real 3D visualization emphasize the ability to discriminate altitude in VGE.

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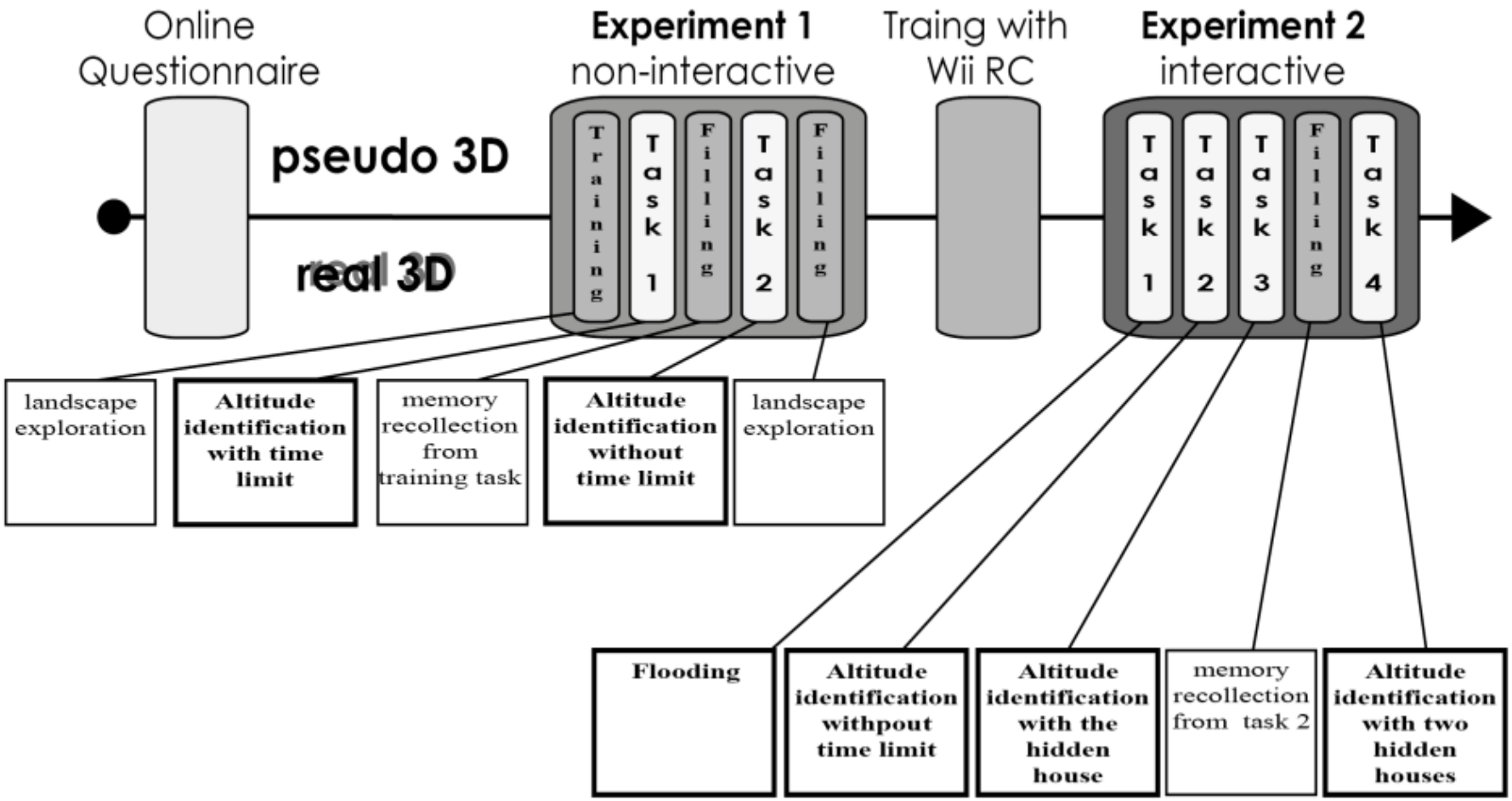
Experiment design

Perception

Inferrence



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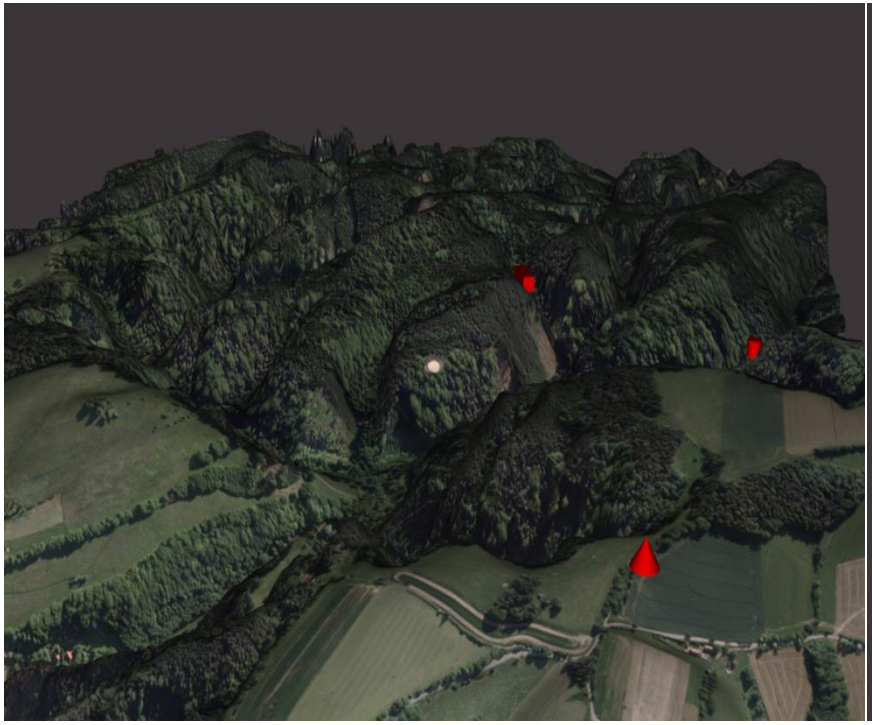
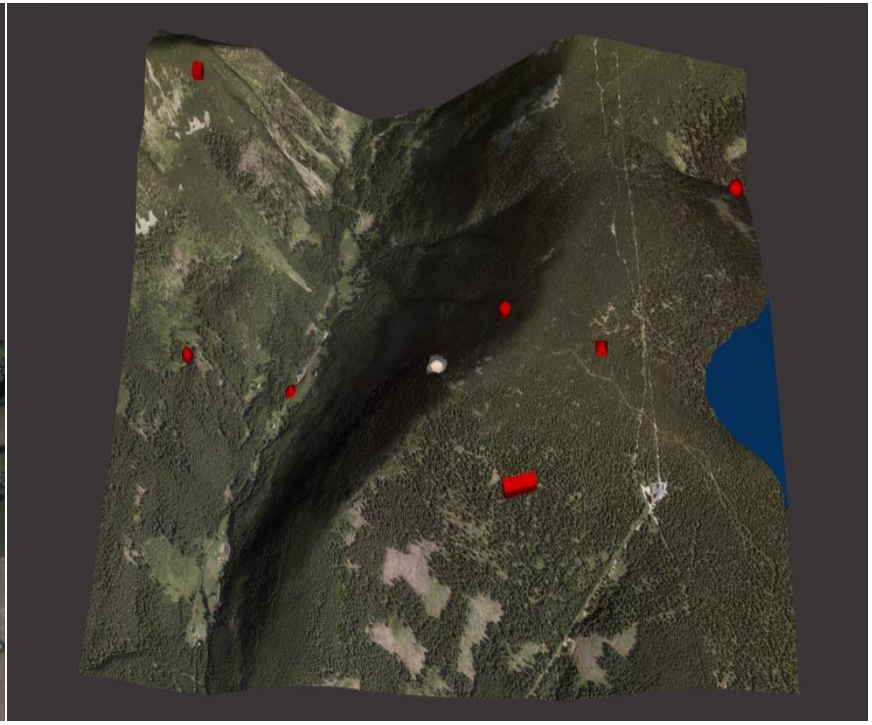
Examples of Stimuli and Tasks





Manipulate the scene and find the appropriate solution.

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What we found – preliminary results

- In **static VGE** without time limit were **Real 3D users more capable to identify altitude**, due to the binocular disparity provided by Real 3D technology.
- In **interactive VGE** were **differences flatten** due to the motion parallax – there were found no significant differences in time, accuracy or motor activity.
- In **Real 3D (higher immersion)** condition in interactive tasks were found **increased neglect of important objects** of the scene.

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Sample study II – „The role of personality – groups vs. individuals in immersive cognitive research“ (Alex Klippel, 3D VR and AR for GI) - Experimental tool for usability testing of interactive 3D maps

- Usability studies in interactive 3D environment – only few experiments that took place in an interactive 3D virtual environment have been published, e.g. Wilkening & Fabrikant (2014) - used Google Earth application and participants solve here practical tasks (e.g. selection of highest point along a given path).
- Need for unconventional tool and evaluation.
- Exploratory research within 3D environments, already described by Špriňarová et al (2015).
  - There were observed that participants use similar strategies and sequences of movement in a 3D virtual environment, which included terrain model.
  - This created a demand for tools that would prove to record movement data. It would be desirable that such a tool could record the speed, accuracy of responses and also the subjective opinion of participants.

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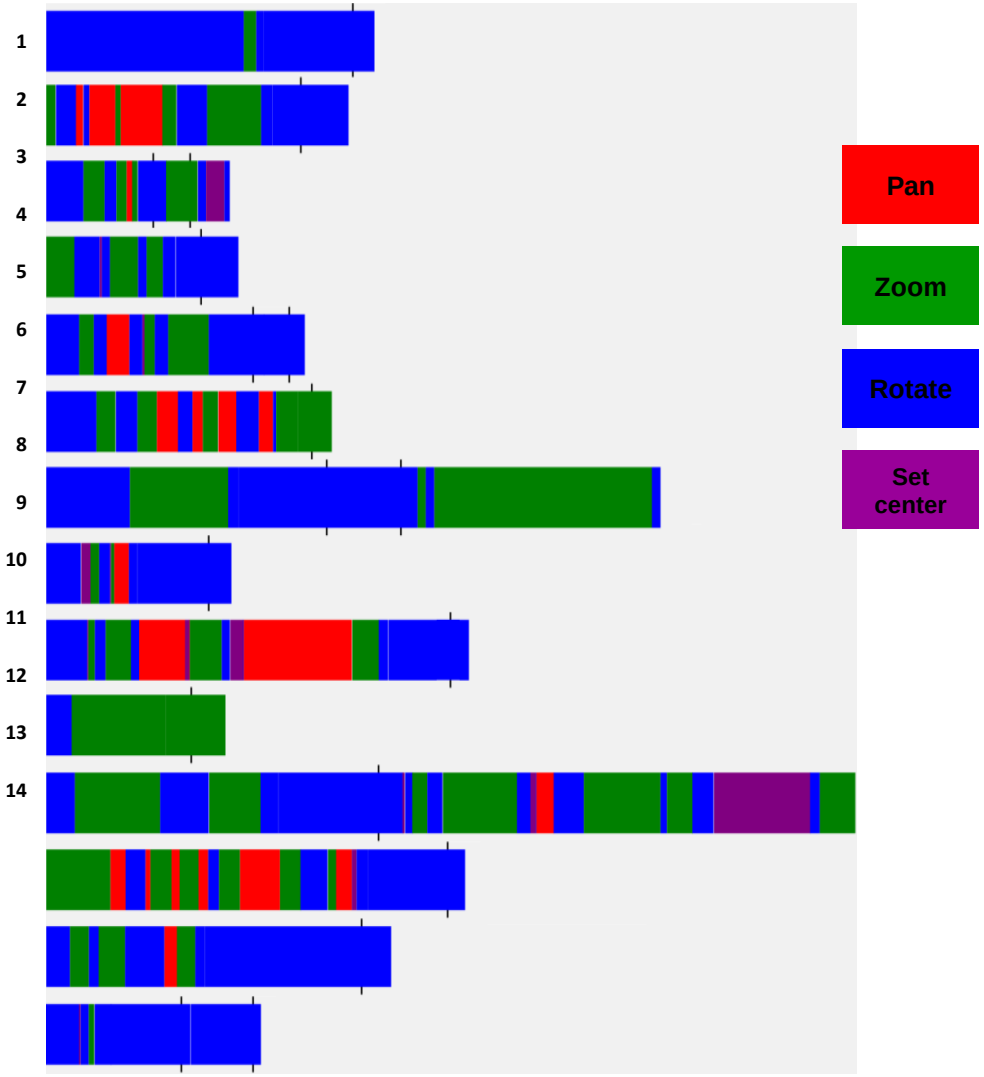
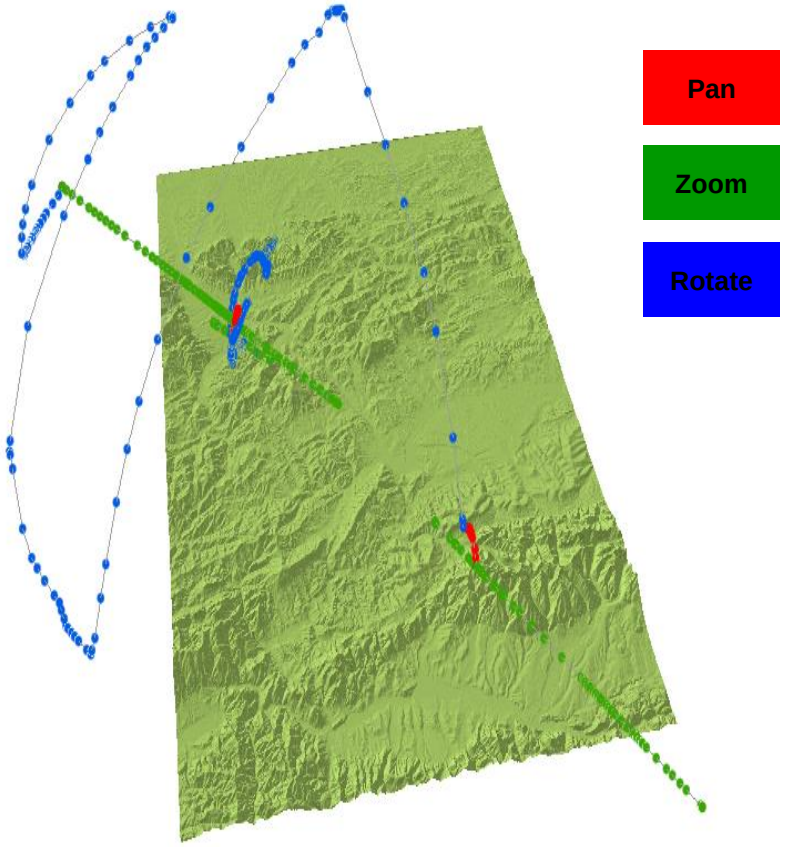
Possible results analysis





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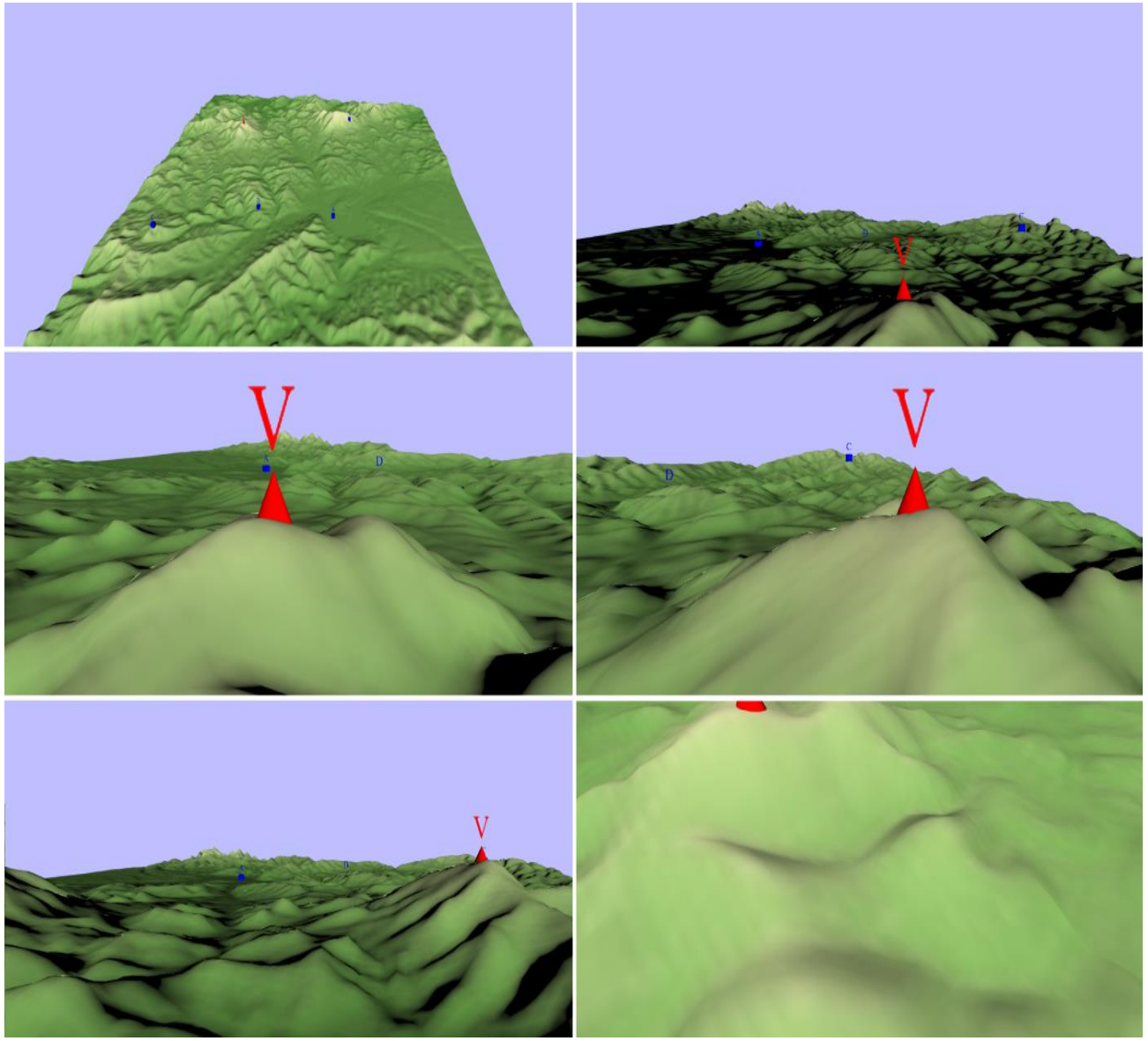
Final views of participant – qualitative analysis



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Conclusion and future perspectives

- The use of Real 3D technology for the interactive VGE remains ambiguous.
- Visualization, environment, and interactivity (HCI) matters.
- The consistent neglect of important aspects of the scene in Real 3D visualization is crucial aspect of human-machine interaction (human factors)

- *Particular studies will be presented on ISPRS conference in Prague (July 2016).*
- Further development of both technological background, data inputs, and experimental testing desings towards deeper understanding of:
  - 3D visualization principles,
  - user interaction,
  - role within decision making.
- See you in Washington 2017 ICC! ☺

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- Thank you for your attention!

Petr Kubíček, Zdeněk Stachoň, Čeněk Šašinka, Vojtěch Juřík and Lukáš Herman
Masaryk Univerzity, Brno, Czech Republic
kubicek@geogr.muni.cz, zstachon@geogr.muni.cz

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