

Enhancing the mapping between Real and Virtual World on Mobile Devices through efficient Rendering

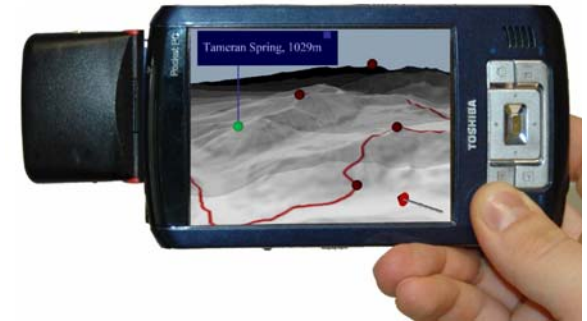
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Introduction

- Mobile devices are well suited for Mixed Reality applications
- Challenge is to obtain **one** consistent representation
- Identify rendering techniques that support the cognitive mapping



Hiking Assistant on PDA

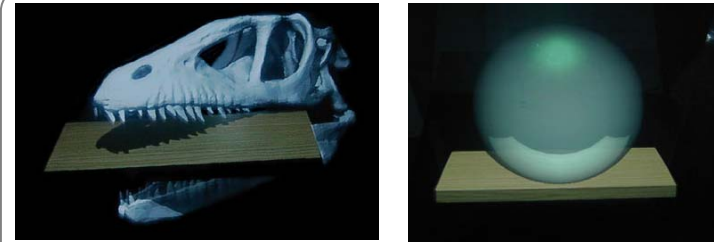


PR

NPR

Related Work

- Photo realistic rendering in MR
 - Shadows and reflection between real and virtual objects
 - Bimber [1] , Madsen [5] and Naemura[6]
- Non-Photo realistic rendering in MR
 - Contour/silhouette rendering
 - Stylized or cartoon-like shading
 - Haller [4], Fischer and Bartz [3]



Shadows and reflection in MR by Bimber [3]



Cartoon like MR by Fischer and Bartz [3]

Challenge and Questions

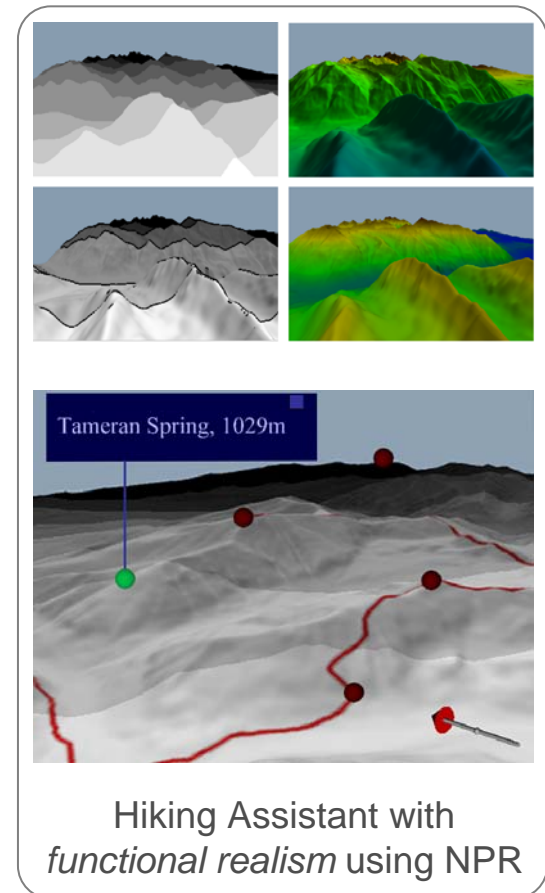
- Create **one** consistent and convincing world
- Still technical problems with Mobile Devices
 - GPS error up to 5m makes tracking difficult
 - No knowledge of the environment
 - Latency in data transfer (remote rendering)
 - Small screen

→ Necessary to superimpose real and virtual image?

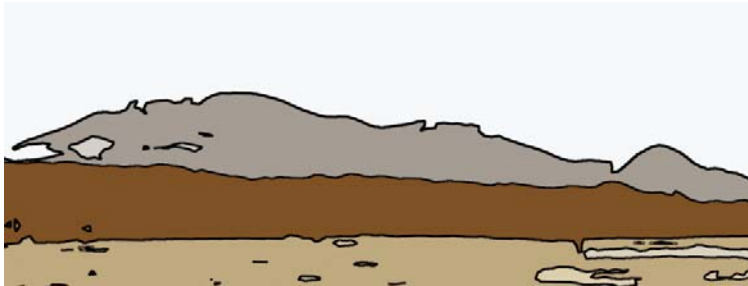
→ How far can the rendering technique support the user to map the real and virtual objects by himself?

Functional Realism

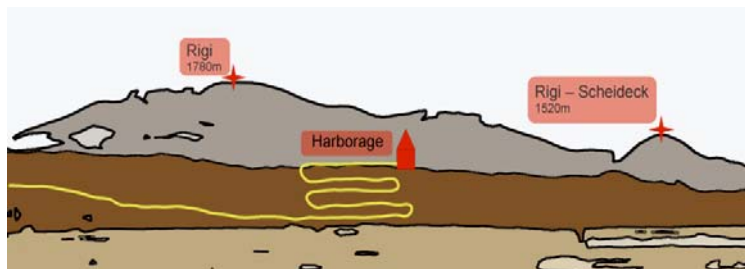
- Described by Ferwerda [3] in 2003
- preserves significant properties
 - Shapes
 - Sizes
 - Positions
- Realized using NPR rendering techniques
- Example Hiking-Assistant



Visualization on PDA

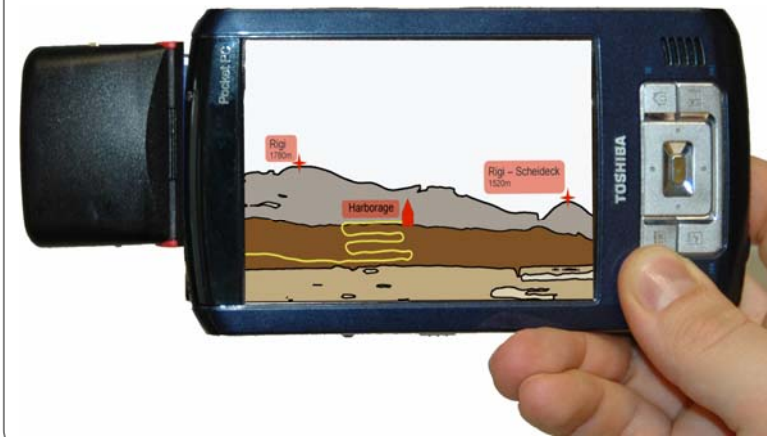


Combining stylized and contour rendering

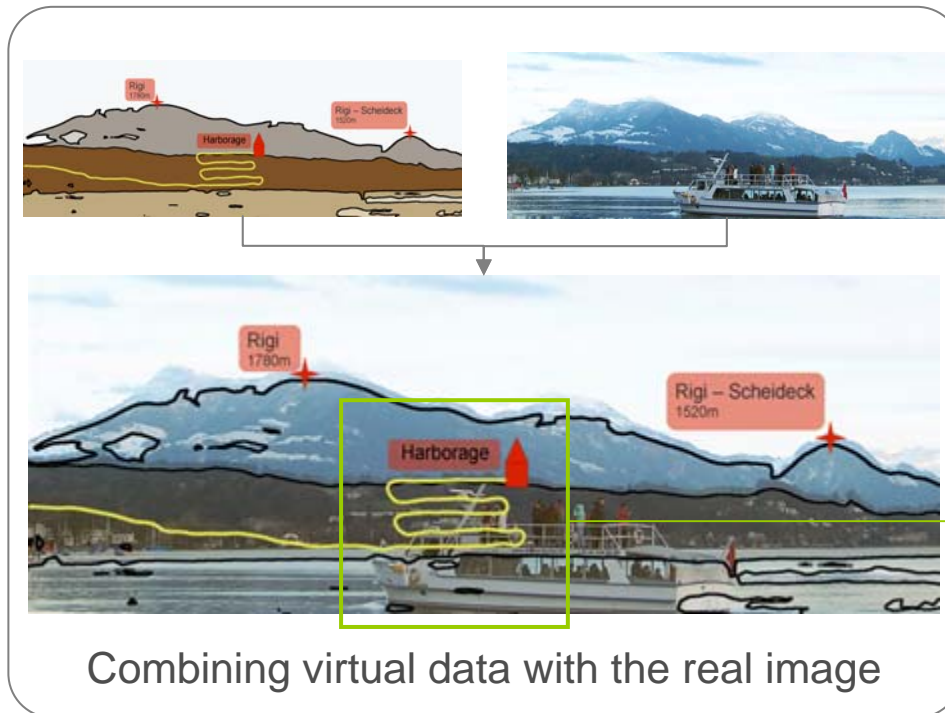


Adding important information

Functional representation on PDA



Visualization on PDA



Disturbing occlusions

Conclusion

- Generate *functional* representations
- Identify suitable rendering techniques (NPR)
- Evaluate the techniques in an experimental setup
 - way finding task
 - task completion time
 - Sketch maps to measure goodness of cognitive mapping (Billinghamurst [7])

References

- [1] O. Bimber, A. Grundhöfer, G. Wetzstein, and S. Knödel. Consistent illumination within optical see-through augmented environments. In Proceedings of ISMAR '03.
- [2] J. A. Ferwerda. Three Varieties of Realism in Computer Graphics. In Proceedings of Human Vision and Electronic Imaging VIII, pages 290–297, 2003.
- [3] J. Fischer and D. Bartz. Stylized augmented reality for improved immersion. In Proceedings of VR '05.
- [4] M. Haller. Photorealism or/and non-photorealism in augmented reality. In Proceedings of VRCAI '04.
- [5] C. B. Madsen, M. K. D. Sørensen, and M. Vittrup. The importance of shadows in augmented reality. In Proceedings: 6th Annual International Workshop on Presence, 2003.
- [6] T. Naemura, T. Nitta, A. Mimura, and H. Harashima. Virtual shadows - enhanced interaction in mixed reality environment. In Proceedings of VR '02.
- [7] M. Billinghurst, S. Weghorst. The use of sketch maps to measure cognitive maps of virtual environments In Proceedings VRAIS 1995

Thank you!