

A Comparative Study of 3D Visualization versus Immersive Visualization (HoloCave) - Knowledge Discovery Redefined.



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Visualization in modern cartography become more advanced follow the evolving of the future technology. 3D visualization is a method commonly used for visualizing while immersive visualization is a new approach. The same interaction (pan, zoom and rescale) function for both visualizations are the same but in different mechanism. Therefore, this research is about comparing the knowledge discovery in two different visualization. The case study of this research is in "Gua Damai" wall cave in Malaysia.



Figure 1: Wall cave hologram of Gua Damai with air tap gesture interaction

BACKGROUND

There is a relationship between data, information and knowledge. Visualization takes part mainly in between data and information stage. Human's brain processes the information begin with iconic memory and it takes 500ms to recognized [1]. Immersion is defined by "feel in presence" [2]. Therefore, it assume can reduce the cognitive workload in knowledge discovery through the hologram. Since the area of study is one of the wall cave, the hologram is named "HoloCave". The purpose of this research is to compare which one of them can offer better overview and understanding of rock structure to plan for climbing route in the short time taken.

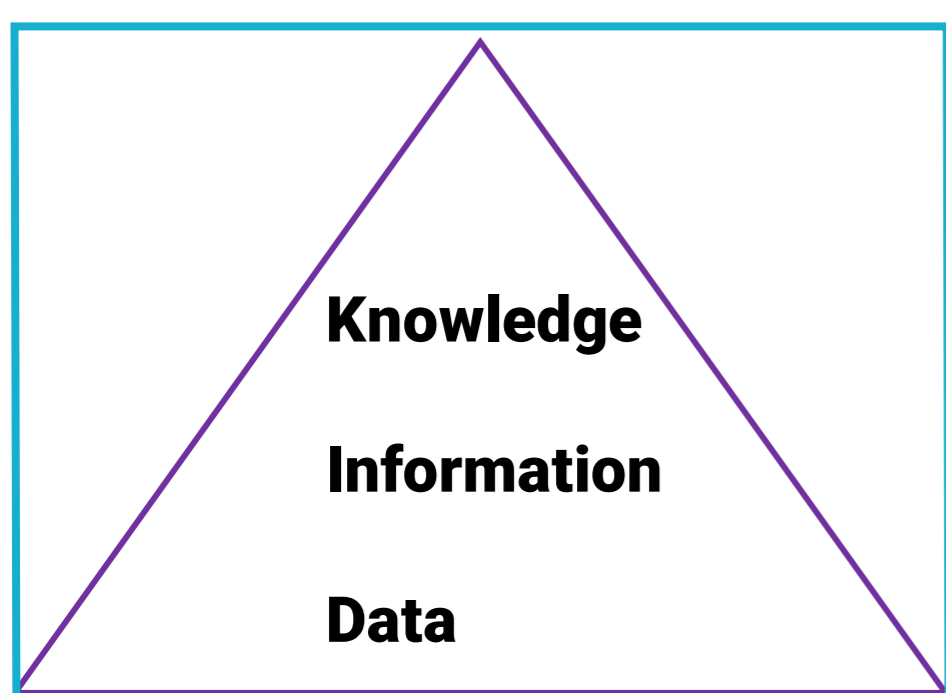


Figure 1: D.I.K model by Finck (2005). Redrawn

USER STUDY

The target group of the user study is among the persons who have experience in rock climbing either beginner, intermediate or expert level. There are 17 participants involved in this user study. They are 9 men and 8 women. Among all of them, 5 out of 17 considered themselves as an expert climbers, 4 persons claim as intermediate while the rest are beginner level in climbing. All of them are given the hardcopy orthophoto, and they need to draw a climbing route based on 3D point cloud visualization and HoloCave.

EVALUTION TASK

Task lists

1. Plan and draft the climbing route on hardcopy of orthophoto given while or after have first visualization.
2. Recheck the drafted route with second visualization.
3. If there is any changes marked in different colour.
4. By using the same orthophoto, make another possible route with second visualization.

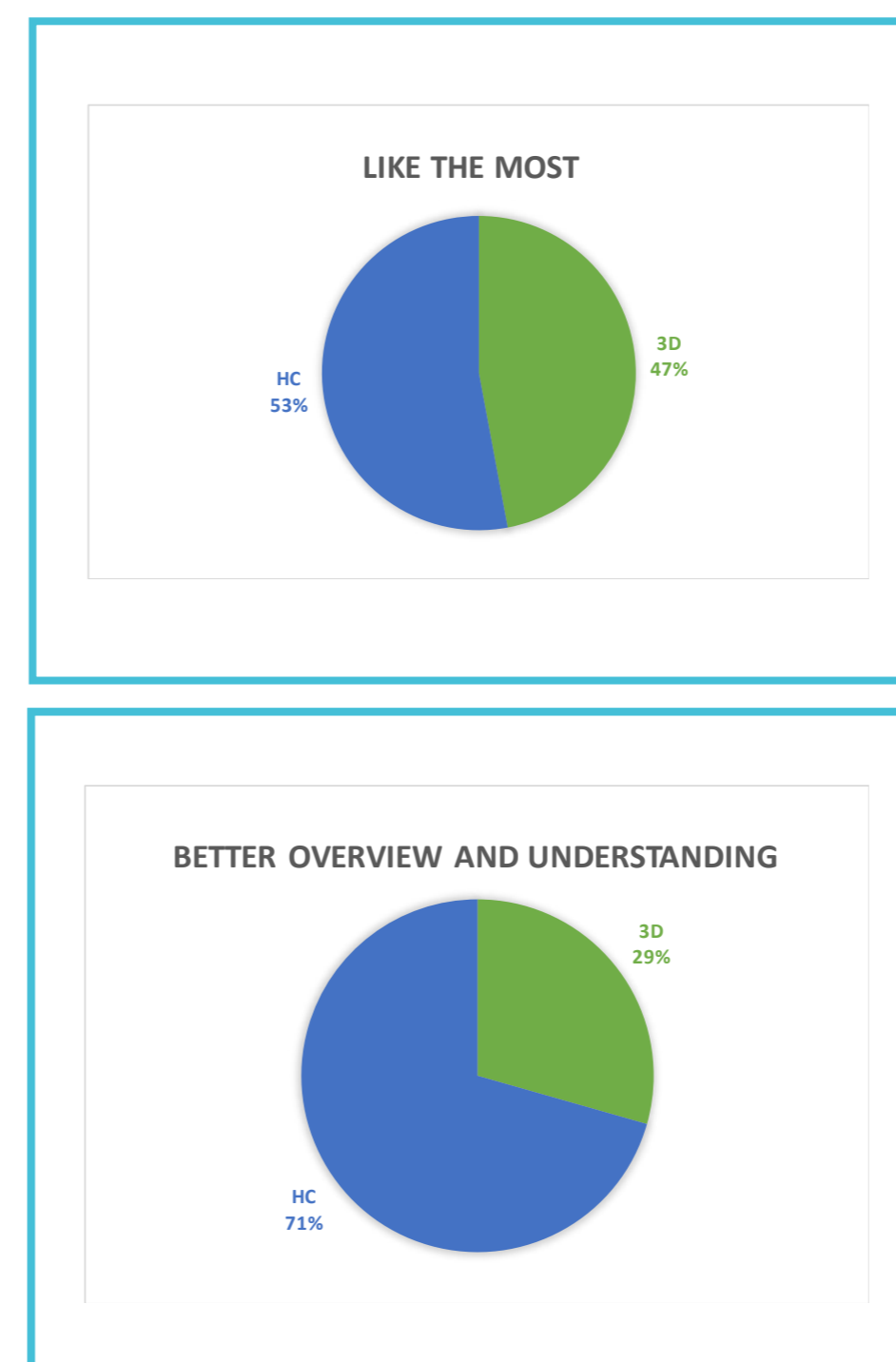


Figure 3: Pie chart result of both visualizations

RESULT AND ANALYSIS

From figure 3, it shows that HC which is represent HoloCave get higher vote in both criteria (most favourite visualization) of and (better overview and understanding) compared to 3D point cloud visualization. This quantitative analysis is computed through the questionnaire survey that provided by evaluator.

OBSERVATION

Through observation, time is recorded The statistical analysis of 2 way ANOVA is calculated, and the findings are:

- There is no significant difference in term of knowledge between HoloCave and 3D visualization.
- There is a significant difference in performance among participants based on their prior knowledge (climbing experience)

CONCLUSION

Knowledge can be gained deeper and better understanding when using immersive visualization because of the cognitive workload is reduced by the feeling in presence in front of the wall cave. Thus it creates the intuitive feeling among the participants to climb. However, there is no significant difference in time taken of knowledge discovery between both visualizations.

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REFERENCES

- [1] Humphreys, G. W. and V. Bruce (1989) Visual Cognition: Computational, Experimental and Neuropsychological Perspectives, Erlbaum, Hove.
- [2] Bailenson, J., Yee, N., Merget, D., & Schroeder, R. (2006). The Effect of Behavioral Realism and From Realism of Real-time Avatr Faces on Verbal Disclosure, Nonverbal Disclosure, Emotion Recognition, Copresence in Dyadic Interaction. Presence: Teleoperators and Virtual Environment, 15;4 ,page 359-372.
- [3] Finck, N. (2005) Knowledge Hierarchy. Retrived from <http://www.nickfinck.com/presentations/bbs2005/03.html>.

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