

CptS 543 Assignment #1
Critical Review of Applying the Norman 1986 User-Centered Model to
Post-WIMP UIs: Theoretical Predictions and Empirical Outcomes
Rusu Wu
3/3/2021

Summary. This article is mainly to explore how post-WIMP UIs (Post Window Icon Menu PointerInterface) enhances users' experiences based on the Norman's 1986 model of interaction (Norman's model). To begin with, the authors gave brief background information about Norman's model which includes mental representations of UI and task that connected to user's activity. Along with other alternative theoretical models such as Beaudouin-Lafon's Instrumental Interaction Model, the authors hypothesized that post-WIMP UIs improve user's experience through enhancing these two mental representations. Since the patterns of rotation of Cube Comparison Task (CCT) can reflect the mental representation of tasks and the solving strategies of participants, the article uses CCT as the basic test tool to investigate user's mental representation enhancement of post-WIMP UIs compared to WIMP UIs.

According to CCT, the authors continued design a experiment with three interactions including mouse interaction, touchscreen interaction and tangible/Post-WIMP interaction. Based on RBI model, they provided ergonomic differences between these three interactions and gave brief evaluation for each interaction. Further more, with more than 65 participants, the results prove that applying RBI knowledge and multi-sensory on UIs as post-WIMP UIs can enhance mental representations. Nevertheless, their results fail to support the positive relationship between mental representation and SA(spacial ability).

Critical Review. Seven authors have been listed for this research including G. Michael Poor, Samuel D. Jaffee, Laura Marie Leventhal, Jordan Ringenberg, Dale S. Klopfer, Guy Zimmerman, and Brandi A. Klein. Michael Poor is an associate professor who is leading a HCI(Human Computer Interaction) research group from Baylor University. He earned his PhD degree at Tufts University specifically focused on HCI. According to my research, I got brief information about other authors. Both Samuel D. Jaffee and Dale S. Klopfer are Psychology expert who got Ph.D. at Bowling Green State University. Also, Brandi A. Klein earned Ph.D. degree at Missouri University of Science and Technology. Laura Marie Leventhal and Jordan Ringenberg also earn Ph.D on Computer and Communication Sciences from Bowling Green State University. The authors often publish paper about HCI together since 2009.

Based on my research, all of the authors had earned Ph.D. working on Computer Science or Psychology, and some of them are professors working for universities. These authors are pioneers on their field; it means that the paper has a certain authority. Further more, HCI is a subject related to Computer Science and Psychology. In this case, the paper can provide a comprehensive analysis in UI. However, by looking at the references of the paper, most of the reference papers are not current at all. Too many reference that are too old would reduce the credibility of the paper. What is more, the most current three cited papers are from the authors' previous research papers, which may also cause biases.

One weakness is that the authors did not apply all the three primary SA factors to measure the SA of participants. To explain, there are three primary SA factors given in the paper includes Visualization, Speeded rotation and Perceptual speed. However, the paper only has Visualization and Speeded rotation for testing SA, which is not comprehensive. Due to this issue, the conclusion about the 3rd hypothesis becomes less reliable. To strengthen the conclusion of this paper, I suggest that all the three factors need to be tested.

Another obvious weakness is about the number of participants. As there are only 67 participants and 63 valid sample data, the sample number could be a significant problem of generating reliable results. What is more, the author mentioned that mental rotation is differ from gender in the article. This indicates that gender may affect the results of the experiment. However, the paper did not consider gender as a influencing factor. Therefore, no matter for gaining a reliable result on mental rotation or mental representations, the number of different gender participants should be equal.

Integration with Related Work. Trough comparing the features of WIMP and post-WIMP, this paper provides theoretical explanations on the enhancement of user's experience post-WIMP. In the previous publication of Hutchins, Hollan and Norman (2000), direct manipulation which is related to post-WIMP has been highly accepted by users because direct manipulation system provides representations of objects. The paper that published by Poor et.al (2016) explored the representation much further and specified the representation as mental representations of UI and task. Another related paper by Beaudouin-Lafon (1986) proposed a novel interaction model which matches to direct manipulation principle. This interaction model provides a framework for designing the three interactions including mouse interaction, touchscreen interaction and tangible/Post-WIMP interaction for the article by Poor et.al (2016).

There are several papers cited this article as reference, and this can indicate that this article is acknowledged in science community of HCI. To explain, in the paper by Girouard et. al (2019), the authors aimed at providing a comprehensive method to evaluate frameworks, while Poor et.al (2016) set an example for them to apply mental representations of users as the evaluation factors, which could enlighten then in psychology perspective. Further more, Jaffe(2018) tried to investigate the influences of projection to interactive 3D objects. The research process is based on from the paper of Poor et.al (2016); the average accuracy in an interactive CCT is not sensitive . All in all, the paper of Poor et.al (2016) provides crucial theory of HCI and CCT for the future researches.

Implications for HCI. A major implication for HCI researchers is that the article proposed a theoretical explanation for the performance of UI. Until the article was published, HCI researchers only knew that post- WIMP can bring better experience to users than WIMP, but the reasons was not discovered. Therefore, although HCI researchers know how to investigate a well received framework of UI by users, the uncertain reason could restrict their future researches on post-WIMP; researchers have no actual theory to back up their researches. With the implication of this article, HCI researchers could form a better sense between users' psychology and interface development.

One main implication for HCI practitioners is that they can combine the theory explanation and the reality reflections from users. As the article shows, post-WIMP generates better user experience than WIMP because post-WIMP enhances the mental representations of user. In this case, the article shows the direction for HCI practitioners to design user-friendly UI. Moreover, It it not enough for HCI practitioners just to know how to make good interfaces since ignoring user's mental representation would cause design flaws. UI is designed for users to use, so understanding users' psychology is necessary.

One of the implications for users of technology is that the article points what kind of UI can enhance user experience. In this case, users of technology can choose what kind of products they purchase in order to have nice experience. Further more, they can have a better sense of why they have nice experience while they use specific UIs. Such that they can have a better evaluation feedback to the HCI practitioners or themselves.

References

- Beaudouin-Lafon, M. (2000). Instrumental interaction: An interaction model for designing post-WIMP user interfaces. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI '00*. doi:10.1145/332040.332473
- Girouard, A., Shaer, O., Solovey, E. T., Poor, G. M., & Jacob, R. J. (2019). The reality of reality-based interaction. *ACM Transactions on Computer-Human Interaction*, 26(5), 1-35. doi:10.1145/3319617
- HUTCHINS, E. L., HOLLAN, J. D., & NORMAN, D. A. (1986). Direct manipulation interfaces. In User Centered System Design: New Perspectives on Human-Computer Interaction. *User Centered System Design*, 87-124. doi:10.1201/b15703-5
- Jaffee, S. D., Leventhal, L. M., Ringenberg, J., & Poor, G. M. (2018). Interactive 3D Objects, projections, and touchscreens. *Proceedings of the Technology, Mind, and Society*. doi:10.1145/3183654.3183669
- Poor, G. M., Jaffee, S. D., Leventhal, L. M., Ringenberg, J., Klopfer, D. S., Zimmerman, G., & Klein, B. A. (2016). Applying the Norman 1986 User-Centered model TO Post-wimp uis. *ACM Transactions on Computer-Human Interaction*, 23(5), 1-33. doi:10.1145/2983531