CptS 543 Assignment #1

Critical Review of Applying the Norman 1986 User-Centered Model to post-WIMP UIs: Theoretical Predictions and Empirical Outcomes

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Summary. This article "Applying the Norman 1986 User-Centered Model to post-WIMP UIs: Theoretical predictions and empirical outcomes" (Poor, et al., 2016) mainly discusses post-WIMP UIs which is improved through applying Norman model of interaction to WIMP interactions for decades. The body part of the article begins with the introduction of Norman model. The Norman model emphasizes that users' mental representations affect UI outcomes. The authors then introduced how they applied the Norman model to post-WIMP interactions. The authors examined the two highlighted mental representations and how post-WIMP will influence them. One is mental representations of UI, the other is mental representations of task. After reviewing a number of studies, such as RBI (Reality-Based Interaction) model, Instrumental Interaction Model, and alternative cognitive framework, the authors achieved the solution that two mental representations are enhanced within the post-WIMP UI experience.

The article continues by showing a study of CCT (Cube Comparison task) which was designed to empirically test authors theoretical assertions. In this study, participants completed a standard three-dimensional object manipulation task, which is a typical type of post-WIMP UIs target design. Based on solving CCT problem, three experiments were implemented. They are (1) Mouse interaction (M), (2) Touchscreen interaction (TS), and (3) Tangible/Post-WIMP interaction (TG). This study tested two hypotheses, that is, the interaction post-WIMP interactions enhanced mental representations of UI and task. Furthermore, the authors conducted further studies to analyze the relationships between mental representations and post-WIMP interactions. Finally, the authors discussed the results they had got from the study and the generalizability and applicability of the results.

Critical Review. There are 7 listed authors for this article: G. Michael Poor, Samuel D. Jaffee, Laura Marie Leventhal, Jordan Ringenberg, Dale S. Klopfer, Guy Zimmerman, and Brandi A. Klein. Based on simple research, some basic personal information can be found: the leading author G. Michael Poor is an associate professor at Baylor University in the Computer Science department and has received his Ph. D in computer science at Tufts University with the works in the Human-Computer Interaction Lab; author Dale Klopfer is an associate professor at Bowling Green state University in the department of psychology and has earned his Ph. D at Columbia University; author Jordan Ringenberg is an assistant professor of computer science at the University of Findlay and has earned his Ph. D in computer science from the University of Toledo.

As the co-first author of this article, G. Michael Poor has a plenty experience in computer science field and human-computer interaction area. Other authors all studied in related areas such as psychology but not exactly human-computer interaction area. Learning in related fields enables these authors to have basic knowledge reserve for this research and provides multi-dimensional views and perspectives. Thus, this composition of authors makes the article well-developed and well-supported. However, based on my research, G. Michael Poor is the only person who exactly studied in human-computer interaction area, so it might bring bias. In the process of research, there is no other experts in the same field to provide perspectives, which will reduce the reliability of articles and experimental results.

From my perspective, there is another weakness that could be improved. The sample description of CCT experiment is few, and the number of participants was probably not enough. We know there were 67 participants in the experiment. However, gender compositions, age composition, educational or working background, which may affect the results of the experiment are unknown. The experimental results might become more credible by categorizing the sample of tests. Moreover, the authors described the experimental process and results in detail but did not explain how they achieved those results from experiments. More analyses of experiment are expected. In order to make the progression, authors can provide more experimental data, present the data as graphs or charts. Especially in human-computer interaction area, it is necessary to gather a number of data before getting results.

One more suggestion would be applying more models rather than applying only Norman model. Even though this article is talking about applying the Norman model to post-WIMP UIs, authors still could have a discussion on applying other models at the end of the article for comparison. Comparisons might make the article completer and more reliable.

Integration with Related Work. The studies in this article are based on a number of empirical and theoretical studies. The authors also reviewed those studies in this article, for example, this article reviewed an interaction model for designing post-WIMP UIs which was proposed by Beaudouin-Lafon's (2000), called instrumental interaction. Another preceded paper which has strong connection to this article is written by Jacob et al. (2008), which proposed a framework for post-WIMP interfaces, that is, reality-based interaction, and mentioned the concept of post-WIMP UIs allow users to engage parallel perceptual systems and sophisticated knowledge structures. Thus, those two preceded papers laid a foundation for this article.

After this article published, we can find there are several papers cited this paper, and the connection between these papers is clear. For instance, in the article "How to teach your robot in 5 minutes: Applying UX paradigms to human-robot-interaction" (Kraft, et al., 2017), the authors have done the deeper studies in human-robot interaction field. In this case, the studies of post-WIMP UIs provided necessary foundations for deeper human-robot studies. Another related paper written by Girouard et al. (2019) analyzed the reality of reality-based interaction and considered human mental as a crucial point to build a success interface.

To sum up, G. Michael Poor et al. analyzed and tested how human interact with UIs, and the potential essential factors that would influence UIs' development. This study requires a lot of previous studies as a foundation. The results of this study that post-WIMP UIs will enhance mental representations also help further studies such as in robot field.

Implications for HCI. A major implication for HCI researchers is the coexistence of theory and research. HCI researchers can drive their research from old theory such as Norman model, and use research results to enhance the theory. With the development of theories and the conduction of new research, human-computer interaction will progress continuously. Another implication for HCI researchers is to bring up the issue and study, with this research, computer scientists could improve or modify existing UIs to a more perfect status since by revealing those problems and had a closer observation, it is easier to get to the point of what researchers have missed.

One main implication for HCI practitioners is the results that have been verified in the article, that is, post-WIMP UIs will enhance mental representations. Thus, this result will lead interface developers to focus on the study of post-WIMP UIs and the relationships between mental representations and post-WIMP interactions. This article argues that if human-computer interaction practitioners ignore the mental representations of user interface and task, it will have a significant impact on user interface design. Developers probably will improve their products by those kinds of studies. In addition, HCI practitioners can test their products by applying Norman model and optimize UIs.

An implication for users of technology is that users feedback matters. Empirical outcomes rely on the feedback of users. This article provides a closer understanding of how users could interact with UIs by conducting a number of studies. All studies need participants and them feedbacks. Thus, interface users might actively provide their feedbacks, all feedbacks will be used to improve human-computer interaction experience.

References

Poor, G, Jaffee, Samuel, Leventhal, Laura, Ringenberg, Jordan, Klopfer, Dale, Zimmerman, Guy, & Klein, Brandi. (2016). *Applying the Norman 1986 User-Centered Model to Post-WIMP UIs. ACM Transactions on Computer-Human Interaction, 23*(5), 1–33. https://doi.org/10.1145/2983531

Michel Beaudouin-Lafon. 2000. Instrumental interaction: An interaction model for designing post-WIMP user interfaces. *In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.* ACM, 446–453.

Robert K. Jacob, Audrey Girouard, Leanne M. Hirshfield, Michael S. Horn, Orit Shaer, Erin Treacy Solovey, and Jamie Zigelbaum. 2008. Reality-based interaction: A framework for post-WIMP interfaces. *In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.* ACM, 201–210.

Kraft, M., & Rickert, M. (2017). How to teach your robot in 5 minutes: Applying UX paradigms to human-robot-interaction. In *2017 26th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN)* (pp. 942-949). IEEE.

Girouard, A., Shaer, O., Solovey, E. T., Poor, G. M., & Jacob, R. J. (2019). The reality of reality-based interaction: Understanding the impact of a framework as a research tool. *ACM Transactions on Computer-Human Interaction (TOCHI)*, *26*(5), 1-35.