Details that Matter: A Study of the Reading Distance and Revision Time of Electronic over Dry-Erase Whiteboards

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ABSTRACT
Electronic whiteboards are replacing dry-erase whiteboards in many contexts. In this study we compare electronic and dry-erase whiteboards in emergency departments (EDs) with respect to reading distance and revision time. We find inferior reading accuracy for the electronic whiteboard at all three levels of distance in our study. For revision time, the electronic whiteboard is slower on one subtask but there is no difference on another subtask. Participants prefer the electronic whiteboard. Given the font size of the electronic whiteboard, the inferior reading accuracy is unsurprising but the reduced possibilities for acquiring information at a glance when clinicians pass the whiteboard may adversely affect their overview. Conversely, the similar revision times for one subtask show that logon may be done quickly. We discuss how details such as font size and logon may impact the high-level benefits of electronic ED whiteboards.

Author Keywords
Electronic whiteboard; usability; efficiency; font size; logon

ACM Classification Keywords
H.5.2 [User Interfaces]: Interaction styles; Screen design.

General Terms
Design; Experimentation; Human Factors

INTRODUCTION
- High-level benefits often motivate the introduction of new technologies in workplaces and when these benefits are not attained the reasons are often mundane details [3][5][8].
- Region Zealand has introduced electronic whiteboards (EW) to Emergency Departments (ED) as replacements for dry-erase whiteboards.
- Dry-erase whiteboards have proven to be essential for smooth and safe operation of EDs [7].
- The EW system is expected to improve quality of care and increase workplace efficiency by decreasing waiting times and patient length of stay [4].
- During our involvement in implementing and evaluating the EW we observed design details that might threaten the attainment of the high-level benefits.
- These design details include the smaller font size used on the EW and the more intricate interaction methods for the EW.
- We compared the readability of the textual information on traditional whiteboards versus the EW system and task completion times related to interactions with the two systems.

METHOD
- The study was carried out as a controlled within-subjects experiment with a total of 18 participants.
- The participants solved two types of task with each whiteboard. A *reading task* where the participants read out loud the contents of three rows on the whiteboards at decreasing distances and a *revision task* were the participants first altered the triage code of a patient and then changed the transfer-to-ward information.
- After solving both tasks the participants were asked to rate the *ease of use* for both whiteboards and rank the whiteboards in order of preference. Also, they were asked to state their reasons for their ranking.
- Each *reading task* was audio recorded and coded to determine the accuracy of the participants' readings compared to the actual whiteboard contents. Also, the participants' preferences were audio recorded.
- Each *revision task* was timed using a digital stopwatch to recorded task completion times.

RESULTS
- Data were analyzed using analyses of variance (ANOVA). For the reading task the independent variables were the type of whiteboard and distance whilst the accuracy ratings were the dependent variable. For the revision task the independent variable was the whiteboard type and completion time was used as the dependent variable.

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- Participants read the dry-erase whiteboard significantly more accurate than the EW – $F(1, 16) = 73.92$, $p < 0.001$.
- Participants read the whiteboards with higher accuracy at decreasing distances – $F(2, 15) = 43.89$, $p < 0.001$.
- Significant interaction effect between distance and whiteboard on accuracy indicates that reduced accuracy at longer distances is due to the EW – $F(2, 15) = 30.70$, $p < 0.001$.
- Participants solved the first revision subtask significantly faster with the dry-erase whiteboard – $F(1, 17) = 12.28$, $p < 0.01$.
- Participants solved the second revision task equally fast with the two whiteboards – $F(1, 17) = 0.20$, n.s.
- There was found no difference in the participants ease-of-use ratings – $F(1, 17) = 2.36$, n.s.
- A Friedman test of the preference data showed a significant preference in favour of the electronic whiteboard – $\chi 2(1, N=18) = 8.07$, $p < 0.01$.

DISCUSSIONS

- Unsurprisingly the dry-erase whiteboard can be read accurately at greater distance than the EW and revised at least as quickly. It is however surprising that the ability to read and revise the EW effectively has been down prioritized compared to other design consideration e.g. more displayed information.
- ED clinicians often glance at whiteboards in passing making efficient reading an important trait of any such system. This is also a important trait for other systems [6]. The EW reduces the clinicians' ability to do so and could thus slow down their work pace.
- The reduced readability of the EW seems to be negated by the advantages provided by the system. This is indicated by the preference ratings provided by the participants.
- The results from the *revision task* indicate that the log-on procedure for the EW makes for a relatively quick and simple log-on process. This is especially important for IT systems in hospital environments because work in these environments is nomadic, frequently interrupted, and characterized by brief periods of use [1].
- In order to avoid that important details go unnoticed in design processes and thus end up hampering system use, we recommend that systems be evaluated in the field before their design is finalized.
- Such pilot implementation under realistic conditions appear more likely to lead to the identification of mundane details, such as the importance of accurate reading at a glance, than more fieldwork prior to the design phase or more reflection during the design phase.

CONCLUSION

- This study shows that design details that may seem mundane and trivial can impact the usability of electronic whiteboards.
- To tease out such details before a system is taken into operational use we recommend evaluation in the field.

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REFERENCES

1. Bardram, J.E. 2005. The trouble with login: On usability and computer security in ubiquitous computing. Personal and Ubiquitous Computing, 9, 6 (2005), 357-367.
2. Landis, J.R. and Koch, G. G. 1977. The measurement of observer agreement for categorical data. Biometrics, 33, 1 (1977), 159-174
3. Mackay, W.E. 1999. Is paper safer? The role of paper flight strips in air traffic control. ACM Transactions on Computer-Human Interaction, 6, 4 (1999), 311-340.
4. Rasmussen, R. Electronic whiteboards in emergency medicine: A systematic review. Proceedings of the 2012 International Health IT Symposium. ACM Press, New York.
5. Sassene, M.J. and Hertzum, M. 2009. Incompatible images: Asthmatics' non-use of an e-health system for asthma self-management. In *Patient-Centered E-Health,* E.V. Wilson, Ed. IGI Global, Hershey, PA, 186-200.
6. Tan, D.S., Smith, G., Lee, B., Robertson, G.G. 2007. AdapativiTree: Adaptive tree visualization for tournament-style brackets. IEEE Transactions on visualization and computer graphics, 13, 6 (2006), 1113 - 1120.
7. Wears, R.L. and Perry, S.J. 2007. Status boards in accident emergency departments: Support for shared cognition. Theoretical Issues in Ergonomics Science, 8, 5 (2007), 371-380.
8. Whittaker, S., and Schwarz, H. 1999. Meetings of the board: The impact of scheduling medium on long term group coordination in software development. Computer Supported Cooperative Work, 8, 3 (1999), 175-205.