

# Comparing Usability of a Single versus Dual Interaction Metaphor in a Multitask Healthcare Simulation

Lauren Cairco Dukes<sup>1</sup> Jeffrey Bertrand<sup>1</sup> Manan Gupta<sup>1</sup> Rowan Armstrong<sup>1</sup> Tracy Fasolino<sup>1,2</sup> Sabarish Babu<sup>1</sup> Larry F. Hodges<sup>1</sup>



<sup>1</sup>Clemson University, Clemson, SC <sup>2</sup>Bon Secours St. Francis Hospital, Greenville, SC  
 {Lcairco, jbertra, mgupta, rarmstr, tfasoli, sbabu, LFH}@clemson.edu



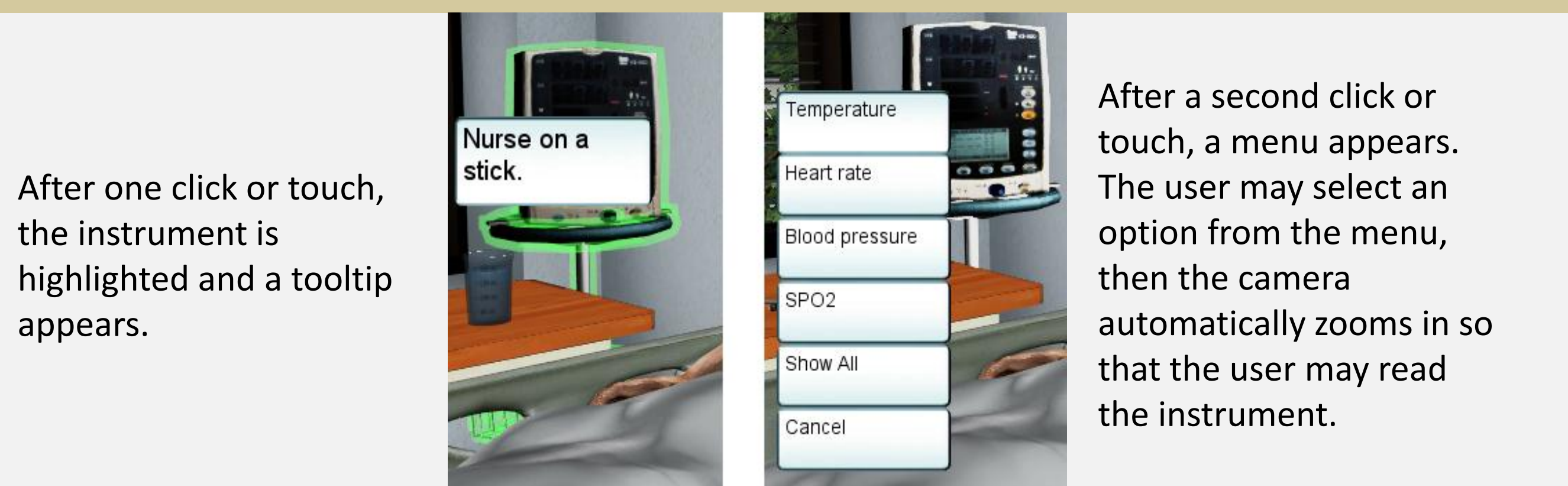
## Introduction & Motivation

- We focus on providing usable 3D interaction techniques for nurses, since their demographic is different than the demographic of typical virtual environment users [1][9]
- Several researchers have successfully implemented simulations for healthcare training but few have performed empirical evaluation for their 3D interaction techniques [6][7]

## Virtual Hospital Ward



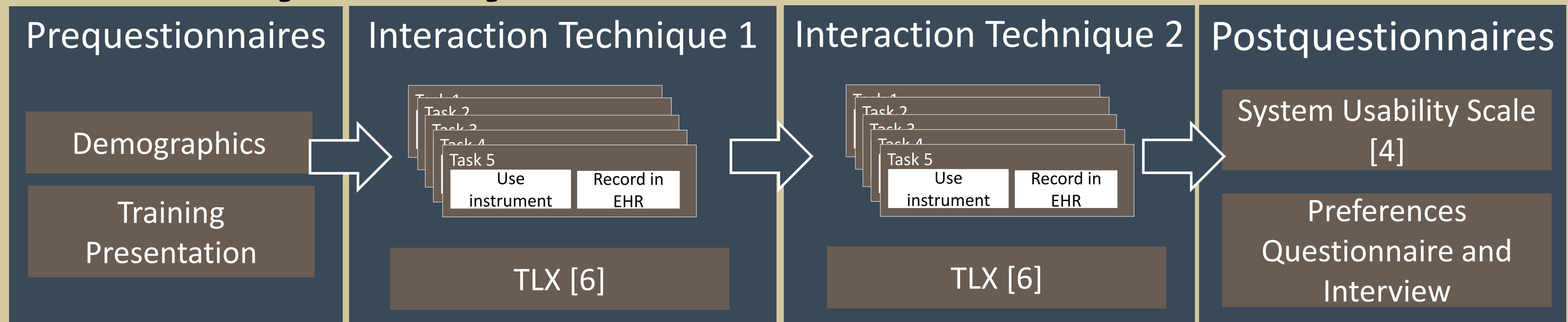
- Designed for a dual monitor computer with the patient's room (virtual environment) on the left screen and the electronic health record (EHR) on the right screen (more details on design in [5])
- EHR designed after existing system at St. Francis Hospital, uses familiar 2D widgets and GUI elements
- Virtual hospital room contains instruments nurses may interact with using three-step menu-based interaction similar to [3]
- Designed for touchscreen [2] or mouse use



## Interaction Metaphor Choices

- Dual interaction metaphor: touch screen in the virtual environment and mouse/keyboard in the EHR
- Single interaction metaphor: mouse for both virtual environment and EHR
- Our hypothesis: users may prefer using the touch screen for the virtual environment because it more closely matches the way they would interact with the patients, but performance may suffer due to switching techniques

## Usability Study



Participants performed five tasks using mouse only, and five tasks using touch screen for the VE and mouse/keyboard for the EHR. We randomized the ordering of the interaction technique for each participant to account for ordering effects.

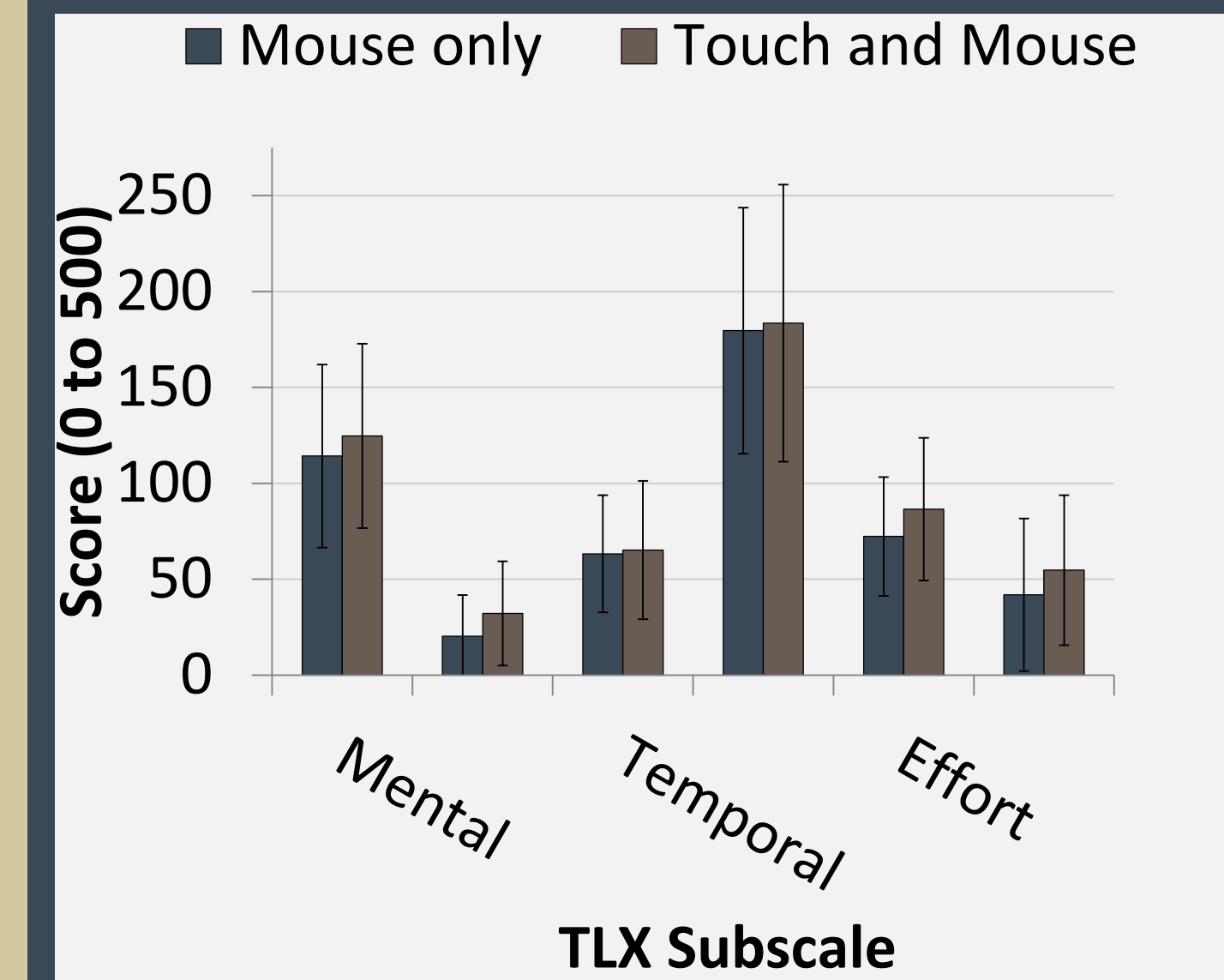
## Results

### Performance

	Mouse only		Touch and Mouse		p
	μ	SD	μ	SD	
Time per click (s)	3.43	0.74	3.18	0.85	0.052
% missed clicks	17.36	11.4	28.01	7.84	< 0.01
Transition time (s)	8.84	3.36	9.25	3.31	0.70

In all metrics, the mouse only technique outperformed the touch and mouse technique. The differences were significant for percent missed clicks.

### Workload



In all workload scales, the mouse only technique had lower scores than the touch and mouse technique.

### Preferences

Criteria	Mouse only	Touch + Mouse	Neutral	p
Easiest	45	29	3	0.02
Most comfortable	50	26	1	0.01
Helped achieve task	39	28	10	0.06
Accurate	45	19	13	0.01
Overall	39	37	1	0.29

For every criteria, users preferred the mouse only technique over the touch + mouse technique.

- The mean SUS score was 85.41% (sd=9.73%) indicating that the system was usable regardless of interaction technique
- In nearly all qualitative and quantitative measures, the mouse only technique was superior to the touch/mouse technique

### Acknowledgements

This work was supported in part by the NSF GRFP (fellow ID 2009080400), the NSF REU Site Grant CNS-0850695, St. Francis Hospital, and a grant from the College of Health Education and Human Development at Clemson University.

### References

- [1] National sample survey of registered nurses (nssrn) - health indicators warehouse. [http://healthindicators.gov/Resources/DataSources/NSSRN\\_107/Profile](http://healthindicators.gov/Resources/DataSources/NSSRN_107/Profile). Accessed 11/26/2012.
- [2] Windows development center guidelines for touch. <http://msdn.microsoft.com/en-us/library/windows/desktop/cc872774.aspx>. Accessed 1/19/2012.
- [3] D. A. Bowman and C. A. Wingrave. Design and evaluation of menu systems for immersive virtual environments. In Virtual Reality, 2001. Proceedings. IEEE, pages 149–156. IEEE, 2001.
- [4] J. Brooke. Sus-a quick and dirty usability scale. Usability evaluation in industry, 189:194, 1996.
- [5] L. Cairco, J. Bertrand, M. Gupta, R. Armstrong, S. Babu, L. Hodges, and T. Fasolino. Towards simulation training for nursing surveillance. Carolinas Women in Computing, 2012.
- [6] D. Chodos, E. Stroulia, P. Boechler, S. King, P. Kuras, M. Carbonaro, and E. de Jong. Healthcare education with virtual-world simulations. In Proceedings of the 2010 ICSE Workshop on Software Engineering in Health Care, pages 89–99. ACM, 2010.
- [7] M. Gupta, J. Bertrand, S. Babu, P. Polgreen, and A. Segre. An evolving multi-agent scenario generation framework for simulations in preventative medicine education. In 2nd ACM SIGHIT Internal Health Informatics Symposium, January 29-31 2012.
- [8] S. G. Hart and L. E. Staveland. Development of nasa-tlx (task load index): Results of empirical and theoretical research. Human mental workload, 1:139–183, 1988.
- [9] N. Yee. The demographics, motivations, and derived experiences of users of massively multi-user online graphical environments. Presence:Teleoperators and virtual environments, 15(3):309–329, 2006.