The purpose of this research is to 1: determine which human factors are important to performance when using a robotic manipulator, 2: develop forward models that can be used to predict performance based on the important human factors, and 3: develop compensators that will mitigate any negative effects of the determined important human factors would have on a user’s performance. For the first step several human factors were chosen to be observed to determine their importance to performance. Those factors were reaction time, spatial orientation and visualization, visual perception, working memory, gross and fine dexterity, visual acuity, and depth perception. Performance for the study was measured using average Time-on-Task, Number-of-Moves, and Number-of-Moves per minute. From this study it was found that all but visual perception were considered important to performance. For the second part three models were then developed using random forest and least squares regression to develop log-linear and polynomial models. Out of these the log-linear and polynomial models performed the best when it came to predicting performance. While the polynomial models performed better when used on the training data set, both them and the log-linear models performed comparably well on the test data set. The linear model offers the simplest explanation of the relationships between the variables while the polynomial models provide a more in-depth understanding of the nature of the human factor relationships and their effect on performance. The third part utilized the important human factors to develop compensators to help improve the usability of the interface. The first compensator was a redesign of the GUI which was used to help compensate for working memory. Reminders of previous moves as well as suggestions if potential confusion is detected were also added to help compensate for poor working memory. Multimodal feedback in the form of visual cues as well as audio ones were added to help compensate for poor spatial abilities as well as poor visual prowess. Adjustments of the input device sensitivity and the speed of the robot were used to compensate for poor dexterity and poor reaction time respectively.

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The public is welcome to attend.