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SPEED-ACCURACY TRADEOFF MODELS IN TARGET-BASED AND TRAJECTORY-BASED MOVEMENTS

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Abstract. *Speed-accuracy tradeoff is a very common phenomenon in many types of human motor tasks. In general, the accuracy of a movement tends to decrease when its speed increases and vise versa. This issue has been studied for more than a century, during which some alternative performance models between the speed and accuracy have been presented. In this paper, we make a critical survey of the scientific literature dealing with the speed-accuracy tradeoff models in target-based movement and trajectory-based movement, which are two main and popular task paradigms in human computer interaction. Some of the models emerged from basic research in experimental psychology and motor control theory, whereas others emerged from the specific need in HCI to model the interaction between users and physical devices, such as mice, keyboard and stylus. This paper summarized these models from the perspective of spatial constraint and temporal constraint for each of the target-based and trajectory-based movements.*
Keywords: Human performance model, Speed-accuracy tradeoff, Target-based movement, Trajectory-based movement

1. **Introduction.** In many types of perceptual-motor tasks, there is a tradeoff between how fast a task can be performed and how many mistakes are made in performing the task. That is, a user can either perform the task very fast with a large number of errors or very slowly with very few errors. When asked to perform a task as well as possible, people will apply various strategies that may optimize speed, optimize accuracy, or combine the two. For this reason, comparing the performance of two users cannot be done on the basis of speed or accuracy alone, but both values need to be known.

Under some testing situations, people can be instructed to optimize either speed or accuracy, and they will effectively adopt the appropriate strategy. However, results can be extremely hard to compare, because time differences between a person who made zero errors and a person who made one error can be dramatic. For this reason, in situations where a speed-accuracy tradeoff exists, the relationship between speed and accuracy needs to be mapped out. This relationship is called as a model.

In human computer interaction, an important research branch is to seek to develop formal models useful for predicting or describing human behavior and evaluating input devices in interaction with computer systems. The most famous and often used models are Fitts' law [11] and the steering law [1], respectively established in pointing tasks (target-based movements) and steering tasks (trajectory-based movements). Both Fitts' law and the steering law related movement time with task's difficulty and reflected the nature of speed-accuracy tradeoff as imposed by objective task parameters. With the development of science and technology, and the improvement of human cognition, some