# THE NATURE AND TIMING OF INTERRUPTIONS IN A COMPLEX, COGNITIVE TASK: EMPIRICAL DATA AND COMPUTATIONAL COGNITIVE MODELS

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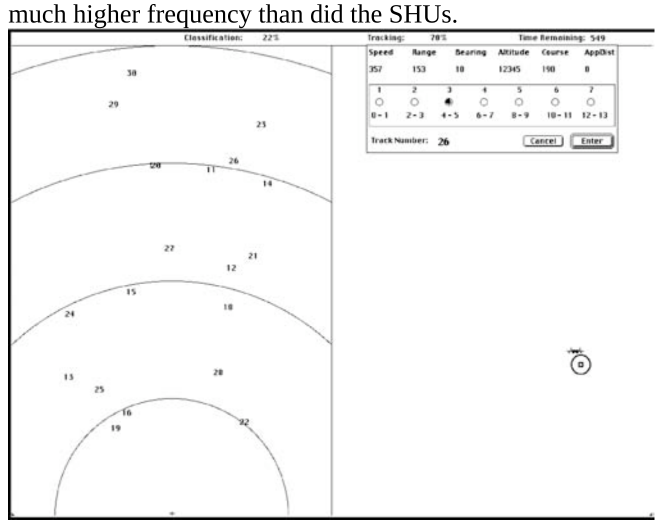
Much can be revealed regarding the cognitive control of interactive behavior by understanding the way in which multiple tasks are interleaved. Across three studies we held one task constant and varied the nature of the secondary task. The main task was the Argus Prime (Schoelles & Gray, 2001) simulated task environment (Gray, 2002). Argus is a complex task designed to mimic aspects of a radar operator's job. The basic paradigm entails keeping track of 20 moving targets on a radar-screen interface, calculating the threat value of each, and classifying the target by its threat value. In a 12-min scenario, 70-85 accurate calculations and classifications are required for perfect performance.

Across all three studies, part 1 entailed an hour of training and one hour of practice on four 12-min scenarios. The three studies differed in the last hour. In study 1, subjects continued the basic Argus task for 4 additional, 12-min scenarios. Study 2 added a perceptual-motor secondary task. As subjects performed the primary task, they were required to use the mouse to track a plane that was randomly moving around the right-side of the screen. With accurate tracking the cursor turned blue. As inaccuracies increased, it turned yellow, and then red. Avoiding "red" required that subjects monitor cursor color and switch from Argus to the secondary task whenever the cursor turned yellow. Study 3 traded the perceptual-motor task for a cognitive "alpha" task. For this task subjects heard one randomly sampled letter of the alphabet every 4-s. Their task was to press "x" if the current letter (n) came before the prior letter (n-1) in the alphabet (e.g., n = c, n-1 = m) or "v" if it came after (e.g., n = s, n-1 = m).

Schoelles (2002) created 24 simulated-human users (SHUs) in ACT-R 5.0. Each SHU incorporated a different combination of strategies observed by our subjects as they performed study 1. The fit of model performance to various measures of human performance was quite good and accurately mimicked overall performance as well as performance on each of 4 within-subject interface conditions. For study 2, the same 24 SHUs were used. Predictions as to when subjects would interrupt the classification task to switch to the tracking task were made based on a task analysis of Argus. The only change to the 24 SHUs was to add productions that would consider switching to the tracking at the completion of certain subtasks.

For study 2, the models predicted overall performance on Argus and on each of the four within-subject interface conditions as well as they did for study 1. As the models were based on study 1 data, we argue that their use in study 2 is essentially a zero-parameter fit. Unfortunately, more detailed examination of the data showed that human subjects switched from Argus to the tracking task with a much higher frequency than did the SHUs.




**Screen shot of Argus Prime from Study 2. Radar display is on left-side. Operator position is represented by the small + at the bottom left. The flying numbers represent planes. Right-side shows information window at top with information on the currently selected target. Bottom right shows the randomly moving target and the cursor with which the operator is supposed to track the target.**

For the original model of task switching, control of behavior was top-down (i.e., goal directed). We have created models that incorporate top-down and/or bottom-up control of task switching. During the talk we will compare and contrast the performance of these models in fitting the study 2 and study 3 data.

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