

Lost in Menuspace: Variability among Users Programming Infusion Devices under Controlled Conditions

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Introduction: "User error" is a common component of incident reports involving infusion devices. The programming task itself can be a complex sequence of actions in which many variations are possible. Little information is available, however regarding which design details contribute to programming error. We studied the details of user-device interaction in an attempt to categorize some of the factors that may lead to error.

Methods: Institution Review Board approval was obtained for the study. Fourteen practitioners who use the device in their regular work came to the laboratory where they performed a group of simple tasks with the device: checking a running dopamine infusion, changing the infusion rate of dopamine, setting up a maintenance crystalloid infusion, and converting from a maintenance infusion to a dopamine infusion. The sessions were videotaped, and the tapes analyzed to the level of individual key presses. User programming was analyzed for efficiency, choice of mode, and sequence selection.

Data: For all users and all tasks, users pressed buttons 3.1 times more often than was required. They employed as little as 10 to as many as 316 key presses to accomplish a single task. Of all 2877 key presses, 64.7% were goal-directed; the range across users was 43 to 96%. Eleven users became lost in small "loops" in a programming pathway, backtracking through their previous steps.

The device permits users to program the device in several different ways. Some users demonstrated an understanding of these multiple pathways. During debriefing some admitted not having thought about the possibility of multiple routes to a goal. Few users demonstrated any flexibility in programming during the tasks.

Some programming behavior suggested that users were lost within the complex menus and windows needed for programming. Users could program effectively in some menu screens, but would move randomly through others, suggesting that large parts of the menuspace are unfamiliar. When encountering these unfamiliar areas, users appear to be "lost in menuspace".

Discussion: The different behaviors of experienced programmers give some clues to the nature of device-associated error, especially mode error¹. The variably low key press efficiency not only hints at limited user understanding of the moment-to-moment of device state, but also suggests the possibility of errant programming simply as the result of random keystrokes. Subjects did not demonstrate a high degree of mode awareness and mode error is a likely form of failure with this and other devices² associated with complex programming.

1. Sarter and Woods. *Human Factors*, 37:, 1995.

2. Cook and Woods. *J Clin Anesth*, 1996.

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