Keystroke-based Cognitive Modeling

The assessment and creates a "cognitive crash dummy" to compare competing designs, measure a designs against performance criteria, or predict performance improvements of design changes.

The simplest variant of the GOMS modeling method, Keystroke / Cognitive modeling or KLM-GOMS simulates how trained, expert users will perform on the system design. With a KLM-GOMS analysis, a given flow through a user interface (a task) is broken down into atomic pieces (keystrokes, mouse clicks, moving hands back and forth between the keyboard and mouse, etc.) A lookup table like the one below is then used to retrieve the interaction time for each atomic action, and then total task time is calculated by adding all the actions together.

The KLM-GOMS technique can be used to compare predicted performance across different variations on a user interface. The method does not require users or a working prototype - only a description of the path through which the software is needed. KLM can also predict task times for different approaches to the same task. For example, you could use KLM to compare the time it takes to change attributes using keyboard shortcuts versus mouse and toolbar options.

KLM-GOMS is only valid for well practiced (repetitive) tasks, and does NOT take into account any learning required for the user to work through the task for the first time. There is an "M" operator in the KLM-GOMS approach that is used to indicate mental preparation for a step in a task. For example, an expert might have to make a decision during a task and the decision time would be represented by an "M" (mental operator).

The quality of the KLM analysis depends highly on the assumptions of the modeler. Some assumptions that might be considered in the creation of a KLM are:

* The user is an expert in the domain and system being analyzed.
* The user will start with her hands on the keyboard.
* The user is not interrupted during the tasks.
* The user is familiar with the hardware.
* The user's system has essentially instantaneous response time (or you will include a "Wait" operator).
* The user is a good typist (and thus will take 0.12 seconds to press a key).

KLM-GOMS does not address the quality of the work produced by a task, the quality of the output of a task, or the effects of context of use attributes like fatigue, group influence, the readability or layout of the user interface, or interruptions.

**Benefits**

* The GOMS and KLM-GOMS cognitive models are amongst the few models of human-computer interaction that is based on empirical research.
* Allows analysts to benchmark and compare the user efficiency of multiple interfaces. This includes comparisons to a system that hasn’t been built yet.
* Cognitive Modeling can be used to estimate cost savings associated with increased user performance.

**Limitations**

* Predictions are only valid for expert users who do not make any errors.
* Does not take into account novices who are just learning the system, or intermediate users who make occasional errors.
* Models all tasks as goal-directed, neglecting the problem-solving nature of some tasks.

Provides no insight on how useful or enjoyable the product under design will be.

**Outcomes**

Predicted performance times for all tasks using each alternative interface approach.

**Study Execution**

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| **​Milestone** | **​Owner** |
| ​Initiate Kick-off Call | HFE |
| Specify Study Objectives | ​                    Business Office |
| Create task list and alternative approaches to test | ​                    Business Office |
| Identify normative times for required actions | HFE |
| ​Conduct usability assessment | ​HFE |
| ​Analyze findings, write report | HFE |
| [**​Conduct After Action Review**](https://vaww.portal2.va.gov/sites/humanfactors/SitePages/AAR%20Process.aspx) |  |

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| **Phase of Development​** | |
| ​ | ​Planning, Scoping & Definition |
| ​ | ​Requirements Gathering |
| **✔** | **​Early Design** |
| **​✔** | **​Detailed Design & Development** |
| **​✔** | **​Field Testing** |
| ​ | ​Deployment |
| **✔** | **​Post-Deployment** |

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| **​Study Characteristics ​** | |
| ​**Timeframe** | ​2 weeks |
| **​Level of Effort** | High |
| ​**Data Collection** | N/A |
| ​**Data Reporting** | ​Quantitative |

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| **​Related Methods ​** | |
| **Derived from** | GOMS |
| **​Complimentary Methods** | [**Visual Modeling**](https://vaww.portal2.va.gov/sites/humanfactors/HFBoK/SitePages/Visual%20Modeling.aspx) |
| **​Similar Methods** | GOMS |
| **​Follow-Up** | ​[**Formative Usability Test**](https://vaww.portal2.va.gov/sites/humanfactors/HFBoK/SitePages/Formative%20Usability%20Test.aspx) |

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