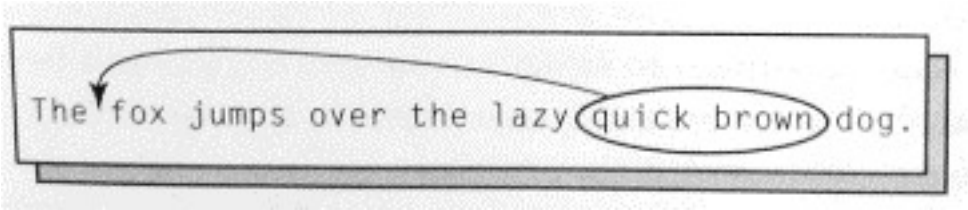
GOMS Model

Goals, Operators, Methods and Selection Model

Model based evaluation

Overview of GOMS

- GOMS is a method for describing a task and the user's knowledge of how to perform the task in terms of Goals, Operators, Methods and Selection rules.
- Consider the text editing example in the following figure



GOMS

- Goals
  - Goals are simply user's goal
  - What does he/she wants to achieve using the software?
- Operators
  - Operators are the actions that the software allows the users to take
  - With the original command line interface, operators are commands and its parameters, typed on a keyboard
  - The most common operator are at "Keystroke level" and include moving the cursor, clicking the mouse button etc. (involve keyboard and mouse)
  - Example from GUI?

- Methods
  - Well-learned **sequences of subgoals** and operators that can accomplish a goal.
- For our example, method is
  - Highlight the text to be moved
  - Type Ctrl-x
  - Move the cursor to the desired location
  - Click the mouse button
  - Type CTRL-v
- Notice that this expression of the method is a combination of operators (actions not readily decomposable) and subgoals (easily decomposable to more primitive actions)

- Selection Rules
  - If there is more than one method to accomplish the same goal, then selection rules are required
  - Selection Rules are personal rules that users follow in deciding what method to use in a particular circumstance.
  - For example, if the text to be moved is one or two character long, then the specific person may delete it from wrong location and rewrite it in the right location. If the text is three or more characters long that person may use keyboard shortcuts.
  - So, these personal selection rules depend on the length of the word.
- GOMS analyses are applies to situations in which user will be expected to perform the tasks that they have already mastered.

Top-level goal	Edit manuscript, or, more specifically, move "quick brown" to before "fox"
Subgoal	Highlight text
Operators	Move-mouse Click mouse button Type characters (keyboard shortcuts)
Methods	For the editing goal: 1. Delete-word-and-retype (*retype* method) 2. Cut-and-paste-using-keyboard-shortcuts (*shortcuts* method) 3. Cut-and-paste-using-menus (*menus* method) For the highlighting subgoal: 1. Drag-across text (*dragging* method) 2. Double-click first; shift-click last (*all-clicking* method)
Selection rules	For the editing goal: If the text to be moved is one or two characters long, use *retype* method Else, if remember shortcuts, use *shortcuts* method Else, use *menus* method For the highlighting subgoal: If the text to be moved is not whole words, use *dragging* method Else, use *all-clicking* method

Possible GOMS elements in the fox task.

KLM: The Keystroke-level Model

- The simplest GOMS technique
- Given the task and the method the KLM uses **duration estimates** of these keystroke level operators to predict the time a skilled user will need to execute the task.

Types of operators in KLM

- The Original KLM included six types of operators:
  - K=0.2 sec Press a key
  - P=1.1 sec Point with a mouse
  - H=0.4 sec Home hands on the keyboard or other device
  - D: Draw a line segment on grid
  - **M=1.3 sec To mentally prepare to do an action**
  - R: To represent the system response time during which the user has to wait for the system
- The KLM also include a set of Six heuristic rules for placing mental operator to account for mental preparation time

Six heuristic rules are

- Rule 0: Initial insertion of candidate *Ms*
  - Insert Ms in front of all Ks
  - Place Ms in front of all Ps
  - But do not place Ms in front of any Ps that point to arguments of those commands
- Rule 1: Deletion of anticipated Ms
  - If an operator following an M is fully anticipated in an operator just pervious to that M, then delete that M.

- Rule 2: Deletion of Ms within cognitive units
  - If a string of M Ks belongs to a cognitive unit, then delete all the Ms but the first.
  - Cognitive unit is a contiguous sequence of typed characters that form a command name etc.
  - For example, ***move*** command or 4567.8 etc.

- Rule 3: Deletion of Ms before consecutive terminators
  - If a K is a redundant delimiter at the end of a cognitive unit, such as the delimiter of a command immediately following the delimiter of its argument, then delete M in front of it.

- Rule 4: Deletion of Ms that are terminators of commands
  - If a K is the delimiter that follows a constant string-for example, a command name or any typed entity that is the same every time that you use it-then delete the M in front of it.
- Rule 5: Deletion of overlapped Ms
  - Do not count any portion of an M that overlaps an R-a delay, with the user waiting for a response from the computer.

Description	Operator	Duration (sec)
Mentally prepare by Heuristic Rule 0	M	1.35
Move cursor to "quick"	P	1.10
(no M by Heuristic Rule 1)		
Double-click mouse button	K	0.40
Move cursor to "brown"	P	1.10
(no M by Heuristic Rule 1)		
Shift-click mouse button	K	0.40
Mentally prepare by Heuristic Rule 0	M	1.35
Move cursor to Edit menu	P	1.10
(no M by Heuristic Rule 1)		
Click mouse button	K	0.20
Move cursor to Cut menu item	P	1.10
(no M by Heuristic Rule 1)		
Click mouse button	K	0.20
Mentally prepare by Heuristic Rule 0	M	1.35
Move cursor to before "fox"	P	1.10
(no M by Heuristic Rule 1)		
Click mouse button	K	0.20
Mentally prepare by Heuristic Rule 0	M	1.35
Move cursor to Edit menu	P	1.10
(no M by Heuristic Rule 1)		
Click mouse button	K	0.20
Move cursor to Paste menu item	P	1.10
(no M by Heuristic Rule 1)		
Click mouse button	K	0.20
TOTAL PREDICTED TIME		14.90

mark text to be moved

Two commands needed to complete a move. Should we consider a MOVE command instead?

cut text

indicate insertion point

paste text