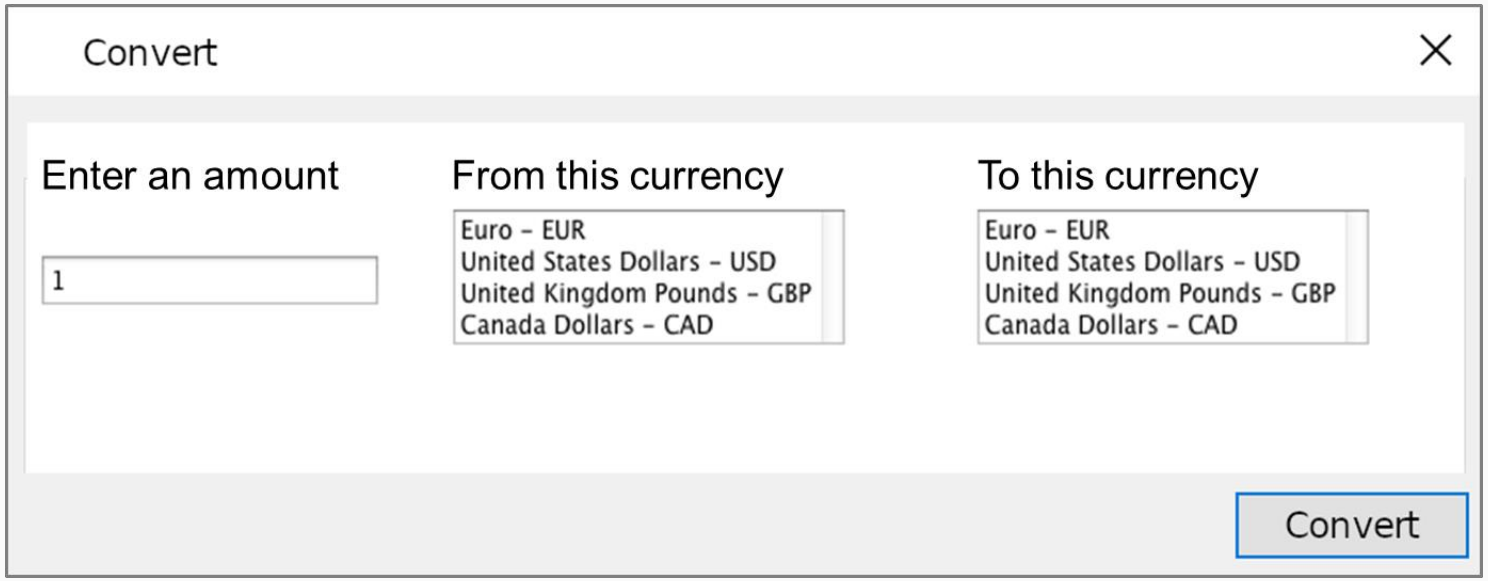
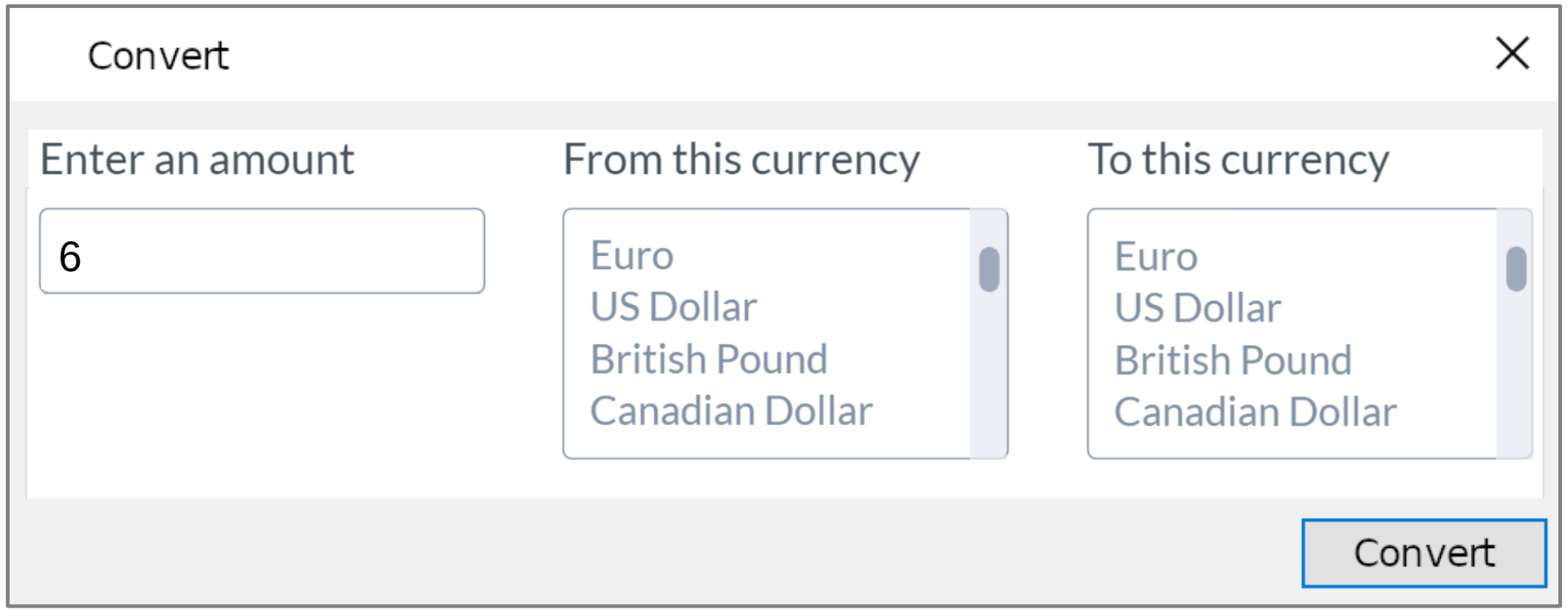


Keystroke-Level Model

Learning Goals

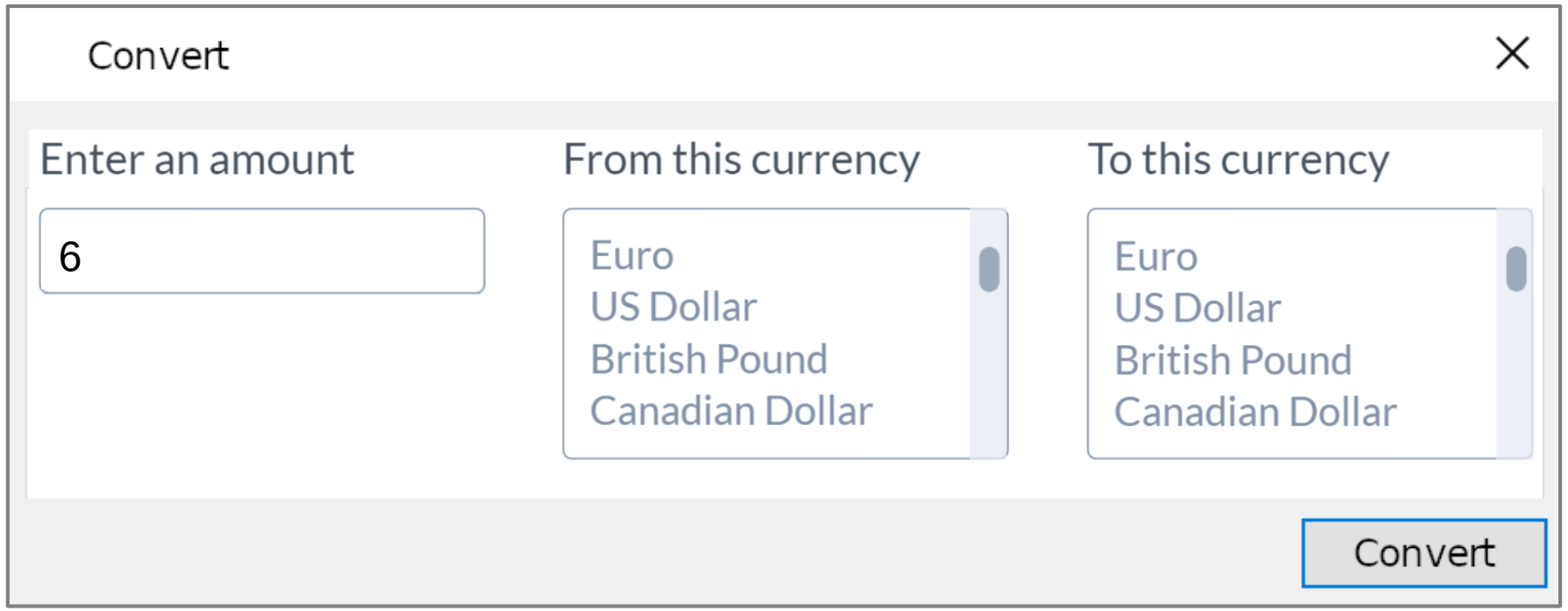
- Know what KLM stands for
- Know the KLM operators
- Being able to predict how long tasks take using KLM



- Task: Convert 12 Euro in US Dollar
- One hand on the mouse, nothing selected

- What do we need to know?

- Task: Convert 12 Euro in US Dollar
- One hand on the mouse, nothing selected



select text field
delete value
enter value
select Euro
select Dollar
select Convert

Keystroke-Level Model (KLM)

- Simplified version of the "**G**oals, **O**perators, **M**ethods, and **S**elections rules" (GOMS) Model
- KLM predicts how much time it takes to execute a task

- Execution of a task is decomposed into primitive operators
  - Physical motor operators
    - Pressing a button, pointing, drawing a line, …
  - Mental operator
    - Preparing for a physical action
  - System response operator
    - User waits for the system to do something

Operator	Description	Associated Time
K	Keystroke, typing one letter, number, etc. or function key such as ‘CRTL’ or ‘SHIFT’	
H	‘Homing’, moving the hand between mouse and keyboard	
B/BB	Pressing (B) or clicking (BB) a button	
P	Pointing with a mouse to a target	
$D(n_D, l_D)$	Drawing n_D straight line segments of length l_D	
M	Subsumed time for mental acts; sometimes used as ‘look-at’	
R(t)	System response time, time during which the user cannot act	

Operator	Description	Associated Time
K	Keystroke, typing one letter, number, etc. or function key such as ‘CRTL’ or ‘SHIFT’	Expert typist (90 wpm): 0.12s Averaged skilled typist (55 wpm): 0.20s Average non-secretarial typist (40 wpm): 0.28 Worst typist (unfamiliar with keyboard): 1.2s
H	‘Homing’, moving the hand between mouse and keyboard	
B/BB	Pressing (B) or clicking (BB) a button	
P	Pointing with a mouse to a target	
$D(n_D, l_D)$	Drawing n_D straight line segments of length l_D	
M	Subsumed time for mental acts; sometimes used as ‘look-at’	
R(t)	System response time, time during which the user cannot act	

Operator	Description	Associated Time
K	Keystroke, typing one letter, number, etc. or function key such as ‘CRTL’ or ‘SHIFT’	Expert typist (90 wpm): 0.12s Averaged skilled typist (55 wpm): 0.20s Average non-secretarial typist (40 wpm): 0.28 Worst typist (unfamiliar with keyboard): 1.2s
H	‘Homing’, moving the hand between mouse and keyboard	0.4s
B/BB	Pressing (B) or clicking (BB) a button	
P	Pointing with a mouse to a target	
$D(n_D, l_D)$	Drawing n_D straight line segments of length l_D	
M	Subsumed time for mental acts; sometimes used as ‘look-at’	
R(t)	System response time, time during which the user cannot act	

Operator	Description	Associated Time
K	Keystroke, typing one letter, number, etc. or function key such as ‘CRTL’ or ‘SHIFT’	Expert typist (90 wpm): 0.12s Averaged skilled typist (55 wpm): 0.20s Average non-secretarial typist (40 wpm): 0.28 Worst typist (unfamiliar with keyboard): 1.2s
H	‘Homing’, moving the hand between mouse and keyboard	0.4s
B/BB	Pressing (B) or clicking (BB) a button	0.1s / 2*0.1s
P	Pointing with a mouse to a target	
$D(n_D, l_D)$	Drawing n_D straight line segments of length l_D	
M	Subsumed time for mental acts; sometimes used as ‘look-at’	
R(t)	System response time, time during which the user cannot act	

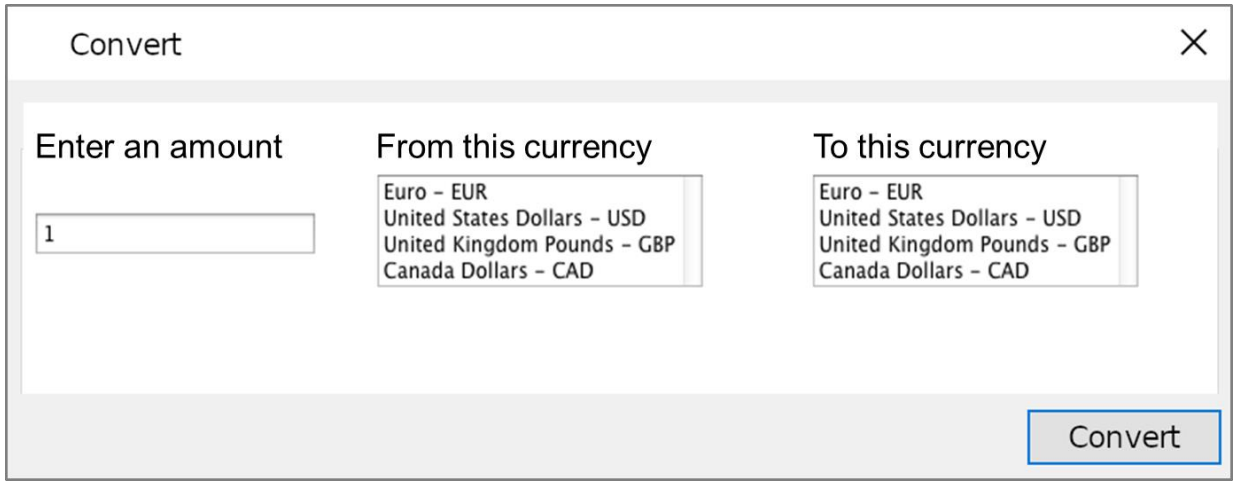
Operator	Description	Associated Time
K	Keystroke, typing one letter, number, etc. or function key such as ‘CRTL’ or ‘SHIFT’	Expert typist (90 wpm): 0.12s Averaged skilled typist (55 wpm): 0.20s Average non-secretarial typist (40 wpm): 0.28 Worst typist (unfamiliar with keyboard): 1.2s
H	‘Homing’, moving the hand between mouse and keyboard	0.4s
B/BB	Pressing (B) or clicking (BB) a button	0.1s / 2*0.1s
P	Pointing with a mouse to a target	0.8s to 1.5s with an average of 1.1s Can also use Fitts’ Law
$D(n_D, l_D)$	Drawing n_D straight line segments of length l_D	
M	Subsumed time for mental acts; sometimes used as ‘look-at’	
R(t)	System response time, time during which the user cannot act	

Operator	Description	Associated Time
K	Keystroke, typing one letter, number, etc. or function key such as ‘CRTL’ or ‘SHIFT’	Expert typist (90 wpm): 0.12s Averaged skilled typist (55 wpm): 0.20s Average non-secretarial typist (40 wpm): 0.28 Worst typist (unfamiliar with keyboard): 1.2s
H	‘Homing’, moving the hand between mouse and keyboard	0.4s
B/BB	Pressing (B) or clicking (BB) a button	0.1s / 2*0.1s
P	Pointing with a mouse to a target	0.8s to 1.5s with an average of 1.1s Can also use Fitts’ Law
$D(n_D, l_D)$	Drawing n_D straight line segments of length l_D	$0.9s*n_D + 0.16*l_D$
M	Subsumed time for mental acts; sometimes used as ‘look-at’	
R(t)	System response time, time during which the user cannot act	

Operator	Description	Associated Time
K	Keystroke, typing one letter, number, etc. or function key such as ‘CRTL’ or ‘SHIFT’	Expert typist (90 wpm): 0.12s Averaged skilled typist (55 wpm): 0.20s Average non-secretarial typist (40 wpm): 0.28 Worst typist (unfamiliar with keyboard): 1.2s
H	‘Homing’, moving the hand between mouse and keyboard	0.4s
B/BB	Pressing (B) or clicking (BB) a button	0.1s / 2*0.1s
P	Pointing with a mouse to a target	0.8s to 1.5s with an average of 1.1s Can also use Fitts’ Law
$D(n_D, l_D)$	Drawing n_D straight line segments of length l_D	$0.9s*n_D + 0.16*l_D$
M	Subsumed time for mental acts; sometimes used as ‘look-at’	1.35s
R(t)	System response time, time during which the user cannot act	

Operator	Description	Associated Time
K	Keystroke, typing one letter, number, etc. or function key such as ‘CRTL’ or ‘SHIFT’	Expert typist (90 wpm): 0.12s Averaged skilled typist (55 wpm): 0.20s Average non-secretarial typist (40 wpm): 0.28 Worst typist (unfamiliar with keyboard): 1.2s
H	‘Homing’, moving the hand between mouse and keyboard	0.4s
B/BB	Pressing (B) or clicking (BB) a button	0.1s / 2*0.1s
P	Pointing with a mouse to a target	0.8s to 1.5s with an average of 1.1s Can also use Fitts’ Law
$D(n_D, l_D)$	Drawing n_D straight line segments of length l_D	$0.9s*n_D + 0.16*l_D$
M	Subsumed time for mental acts; sometimes used as ‘look-at’	1.35s
R(t)	System response time, time during which the user cannot act	Dependent on the system

- Task: Convert 12 Euro in US Dollar
- One hand on the mouse, nothing selected



select text field	P, BB
delete value	H, K
enter value	M, K, K
select Euro	H, M, P, BB
select Dollar	M, P, BB
select Convert	P, BB

select text field	P, BB
delete value	H, K
enter value	M, K, K
select Euro	H, M, P, BB
select Dollar	M, P, BB
select Convert	P, BB

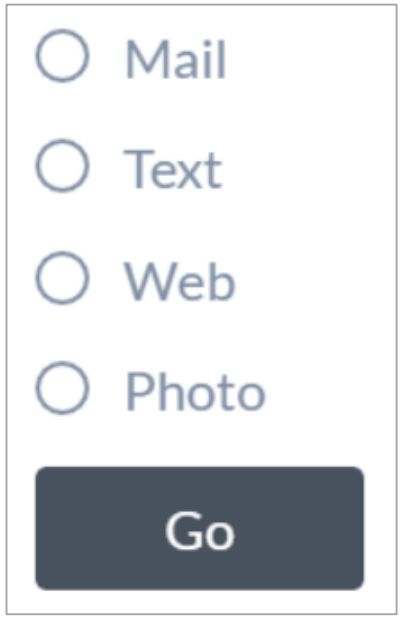
Operator Times:

P ≈ 1.1s B = 0.1s H = 0.4s

M = 1.35s K = 0.28s

4*P =	4.40s
8*B =	0.80s
2*H =	0.80s
3*M =	4.05s
3*K =	0.84s
Total =	**10,89s**

Version 1

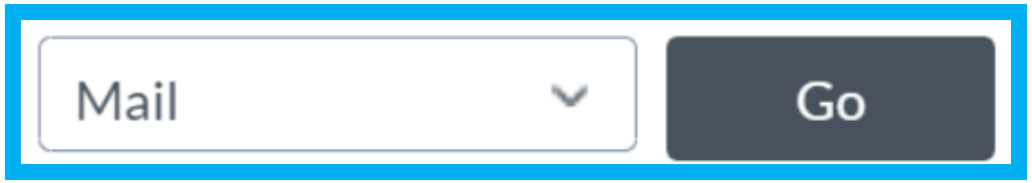


Version 2

Hand on mouse, nothing selected, go to photo:

- Which is the fastest interface?
- Which is the slowest?

Version 3



Version 4

Wrap-up

- The Keystroke-Level Model predicts task completion time for simple dialogs
- Assumes a trained average user
- Especially useful to compare alternatives
- Using KLM by hand can become lengthy and complex
- KLM is not useful for tasks that require reasoning

For more content see: https://hci-lecture.de