



# Modelul sarcinilor

Ștefan Trăușan-Matu

# Modelarea sarcinilor ('Tasks')

- ◆ Ford
- ◆ Descompunerea sarcinilor în
  - Subsarcini
  - Acțiuni elementare

# Modelarea sarcinilor

- ◆ Aspecte cognitiv-fiziologice
- ◆ Ierarhizare
- ◆ Structură
- ◆ Aspecte sociale - colaborare

# Modele ale sarcinilor

- ◆ Lingvistice (BNF, TAG)
- ◆ Cognitive (GOMS, KLM)
- ◆ Ierarhice (HTA, GOMS, CTT)
- ◆ De grup (GTA)
- ◆ Concurente (CTT)

# BNF

- ◆ draw line ::= select line + choose points + last point
- ◆ select line ::= pos mouse + CLICK MOUSE
- ◆ choose points ::= choose one | choose one + choose points
- ◆ choose one ::= pos mouse + CLICK MOUSE
- ◆ last point ::= pos mouse + DBL CLICK MOUSE
- ◆ pos mouse ::= NULL | MOVE MOUSE+ pos mouse

# TAG (Task Action Grammar)– gramatici atributate

## *Lista comenzilor*

- move cursor one character forward                      ctrl-C
- move cursor one character backward                      meta-C
- move cursor one word forward                              ctrl-W
- move cursor one word backward                            meta-W

## *Lista atributelor*

- direction
- unit

## *valori posibile*

forward, backward  
character, word

## *Dictionar de sarcini elementare*

- move cursor one character forward    {direction=forward, unit=char}
- move cursor one character backward {direction=backward, unit=char}
- move cursor one word forward        {direction=forward, unit=word}
- move cursor word backward            {direction=backward, unit=word}

## *Scheme de reguli*

task [direction, unit] → symbol [direction] + letter [unit]

symbol [direction = forward] → "ctrl"

symbol [direction = backward] → "meta"

letter [unit = word] → "W"

letter [unit =character] → "C"

# TAG

- ◆  $\text{action} ::= A + \text{filename} + \text{filename}$   
                                  |  $A + \text{filenames} + \text{directory}$
- ◆  $A ::= \text{cp} \mid \text{mv} \mid \text{ln}$

# Modele cognitive

- *Modelul Procesorului Uman*
- *Legea lui Fitts*
- *KLM (Keystroke-Level Model)*

Acțiuni de nivel scăzut

- *GOMS*

De nivel mai înalt decât KLM, cu structură și ierarhie



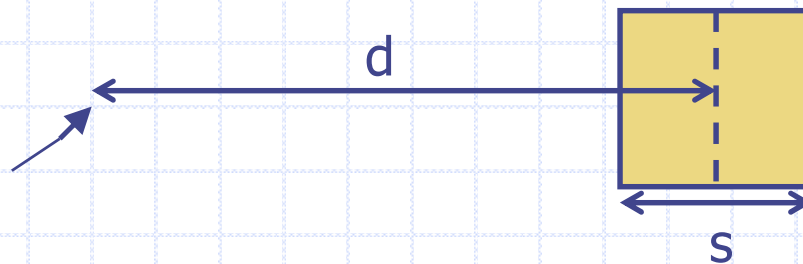
# Legea lui Fitts (1954)

$$T_{\text{msec}} = a + b \log_2 (d/s + 1)$$

$a, b$  = constante empirice

$d$  = distanța între start și țintă

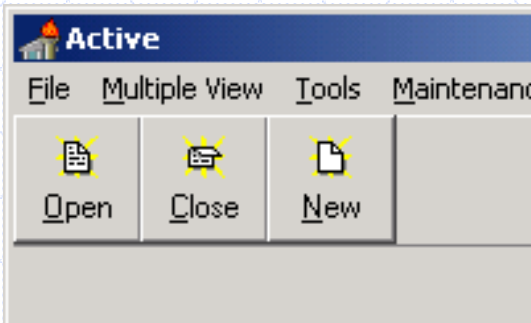
$s$  = distanța finală admisă față de țintă



# Fitts in Practice

Microsoft Toolbars allow you to either keep or remove the labels under Toolbar buttons

According to Fitts' Law, which is more efficient?

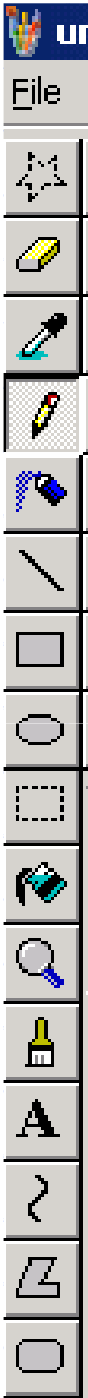


# Fitts in Practice



You have a toolbar with 16 icons, each with dimensions of 16x16

Without moving the array from the left edge of the screen, or changing the size of the icons, how can you make this more efficient?



# Fitts in Practice

Answer: Line up all 16 icons on the left hand edge of the screen

Make sure that each button can be activated up the last pixel on the left hand edge

Why? Because you cannot move your mouse off of the screen, the effective width  $s$  is infinite

# Keystroke-Level Model (KLM)

**K** Key - Apasă tastă sau buton

**P** Point - mută cursorul la o țintă pe ecran

**H** Home

**D** Draw - desenează un segment

**M** Mental - pregătire acțiune

**R** Responde - timp răspuns

# Estimarea Operatorilor

## **K**eystroke – viteza de tastare

0.28s mediu (40 cuvinte/min)

0.08s avansați (155 cuvinte/min)

1.20s începători

## **P**ointing – legea lui Fitts'

$T = a + b \log (d/s + 1)$  sau

$T = 1.1s$

## **D**rawing - legea Steering

$T = a + b (d/s)$

# Estimarea Operatorilor

**Homing** – din măsurători

$T = 0.36s$  (între keyboard și mouse)

**Mental** – pregătire – estimată din  
măsurători

$T = 1.35s$

# Exemplu

## Description

Reach for mouse

Move pointer to "Replace" button

Click on "Replace" command

Home on keyboard

Specify word to be replaced

Reach for mouse

Point to correct field

Click on field

Home on keyboard

Type new word

Reach for mouse

Move pointer on Replace-all

Click on field

## Operation

H[mouse]

P[menu item]

K[mouse]

H[keyboard]

M4K[word]

H[mouse]

P[field]

K[mouse]

H[keyboard]

M4K[word]

H[mouse]

P[replace-all]

K[mouse]

## Time (s)

0.40

1.10

0.20

0.40

2.15

0.40

1.10

0.20

0.40

2.15

0.40

1.10

0.20

Total 10.2



# Euristici pentru M (Tapan Parikh)

Basic idea: Put an **M** before each step requiring access of a "chunk" from long-term memory

Insert **M**'s before each K and P

$K \rightarrow MK; P \rightarrow MP$

Delete **M**'s in the middle of typing a word or string

$MKMKMK \rightarrow MKKK$

Delete **M**'s in the middle of composite actions (for example, point and click)

$MPMK \rightarrow MPK$

# Utilizare KLM

- ◆ Proiectare
- ◆ Evaluare
- ◆ Comparații

# Exemplu: Ștergere cuvânt

## Cu Shift-Click

M  
P [start cuvânt]  
K [click]  
M  
P [sfârșit cuvânt]  
K [shift]  
K [click]  
H [la keyboard]  
M  
K [Del]

Total:  $3M + 2P + 4K$   
= 7.37 sec

## Cu Delete

M  
P [start cuvânt]  
K [click]  
H  
M  
K [Del] x n [lg cuvânt]

Total:  $2M + P + H + (n+1) K$   
=  $4.44 + 0.28n$  sec

# Limitări KLM

Pentru experți care fac sarcini de rutină

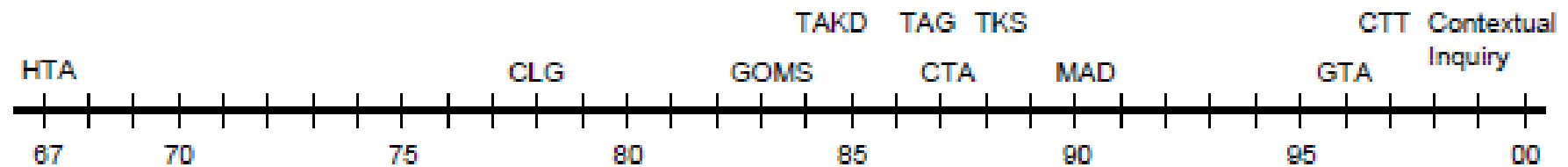
Prezice doar eficiența, nu rata de erori,  
memorizabilitatea, învășabilitatea etc.

Practic pentru sarcini simple simplest tasks

Foarte simplist

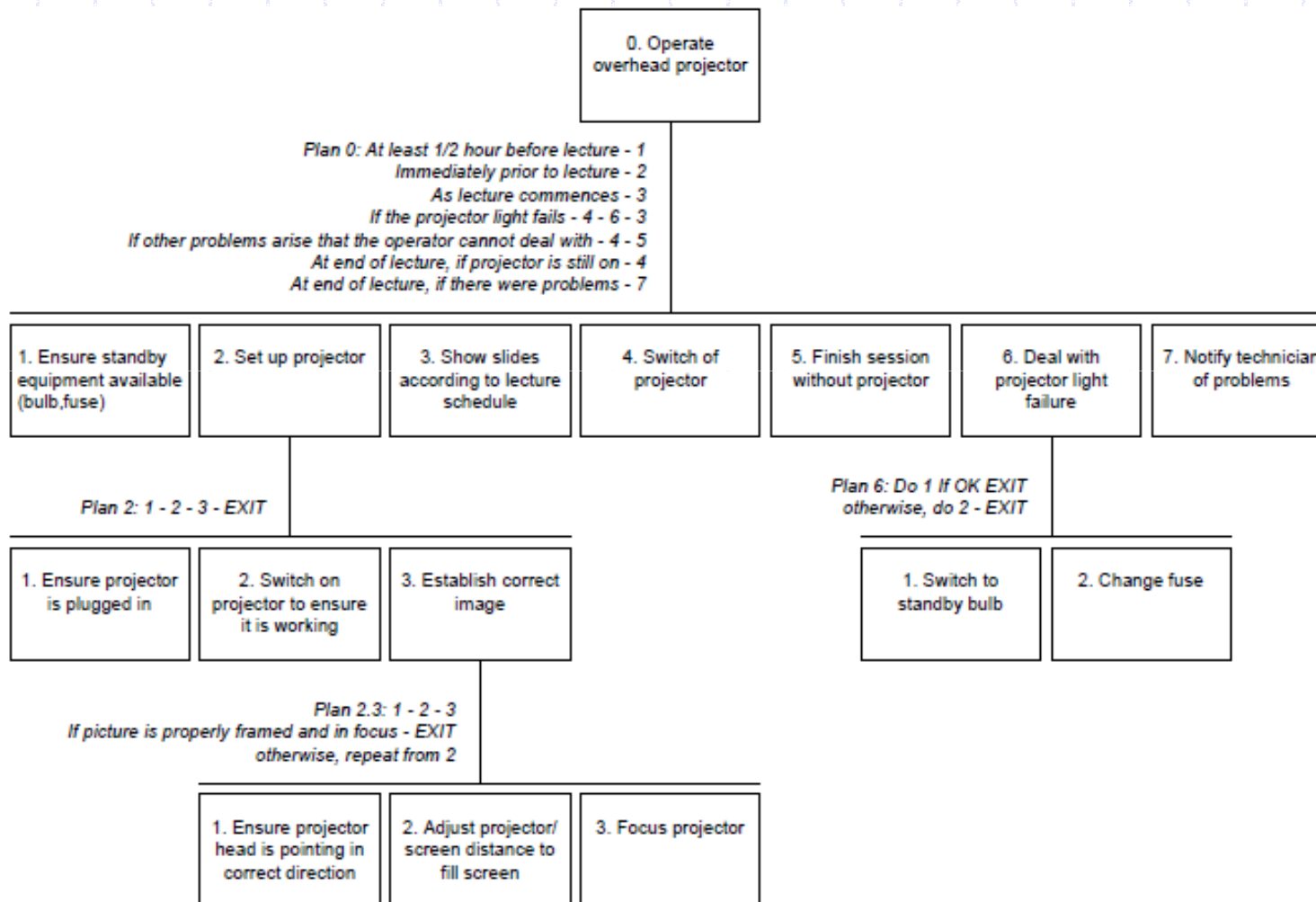
# Istoric

(Martijn van Welie, 2001)



# Exemplu HTA

(Martijn van Welie, 2001)



# GOMS

- ◆ Goals
- ◆ Operators
- ◆ Methods
- ◆ Selectors

# Example GOMS

## John & Kieras (1996)

GOAL: EDIT-MANUSCRIPT

- . GOAL: EDIT-UNIT-TASK ... repeat until no more unit tasks
- . . GOAL: ACQUIRE UNIT-TASK
- . . . GOAL: GET-NEXT-PAGE ... if at end of manuscript page
- . . . GOAL: GET-FROM-MANUSCRIPT
- . . GOAL: EXECUTE-UNIT-TASK ... if a unit task was found
- . . . GOAL: MODIFY-TEXT
- . . . . [select: GOAL: MOVE-TEXT\* ...if text is to be moved
- . . . . GOAL: DELETE-PHRASE ...if a phrase is to be deleted
- . . . . GOAL: INSERT-WORD] ... if a word is to be inserted
- . . . . VERIFY-EDIT

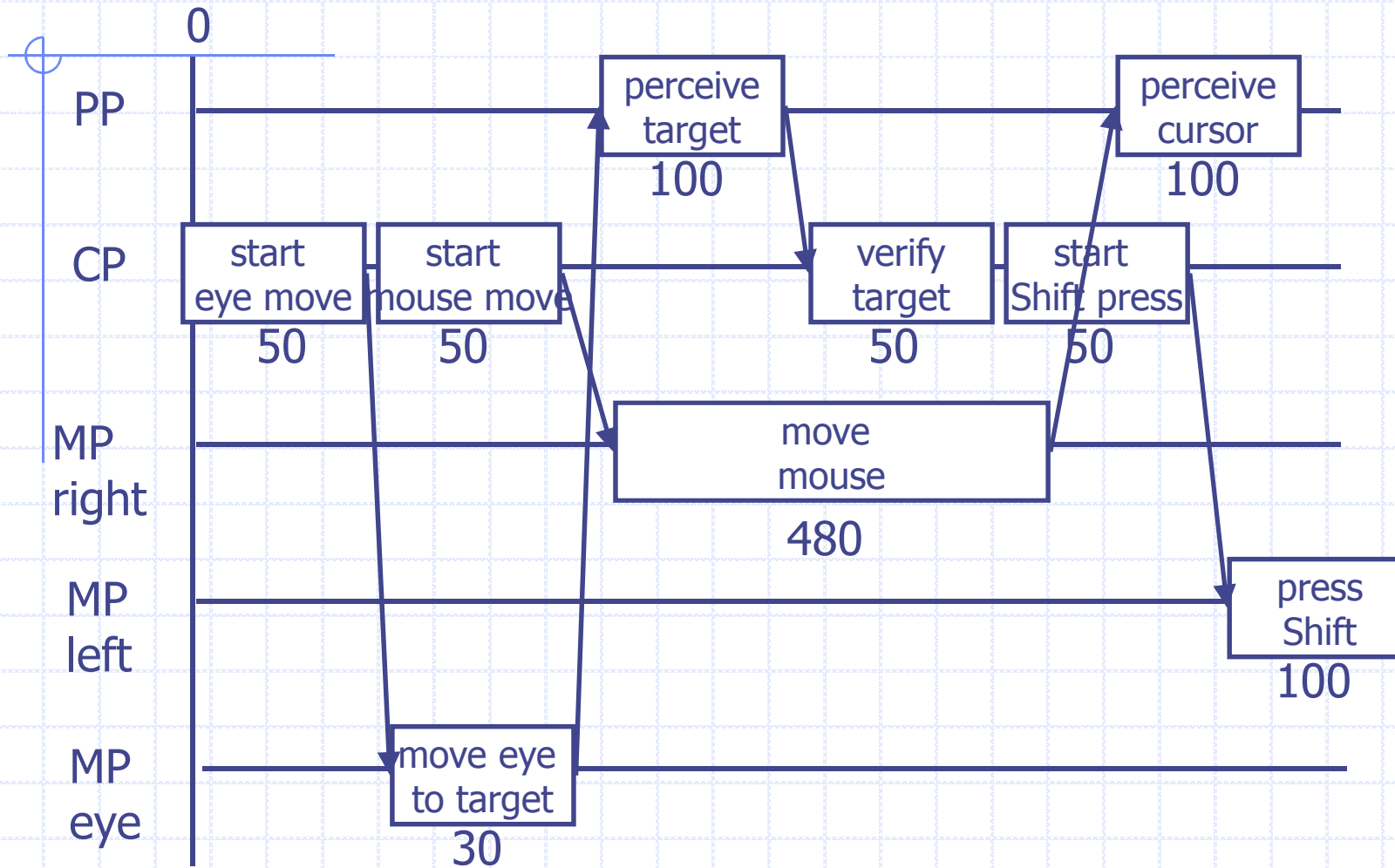


```

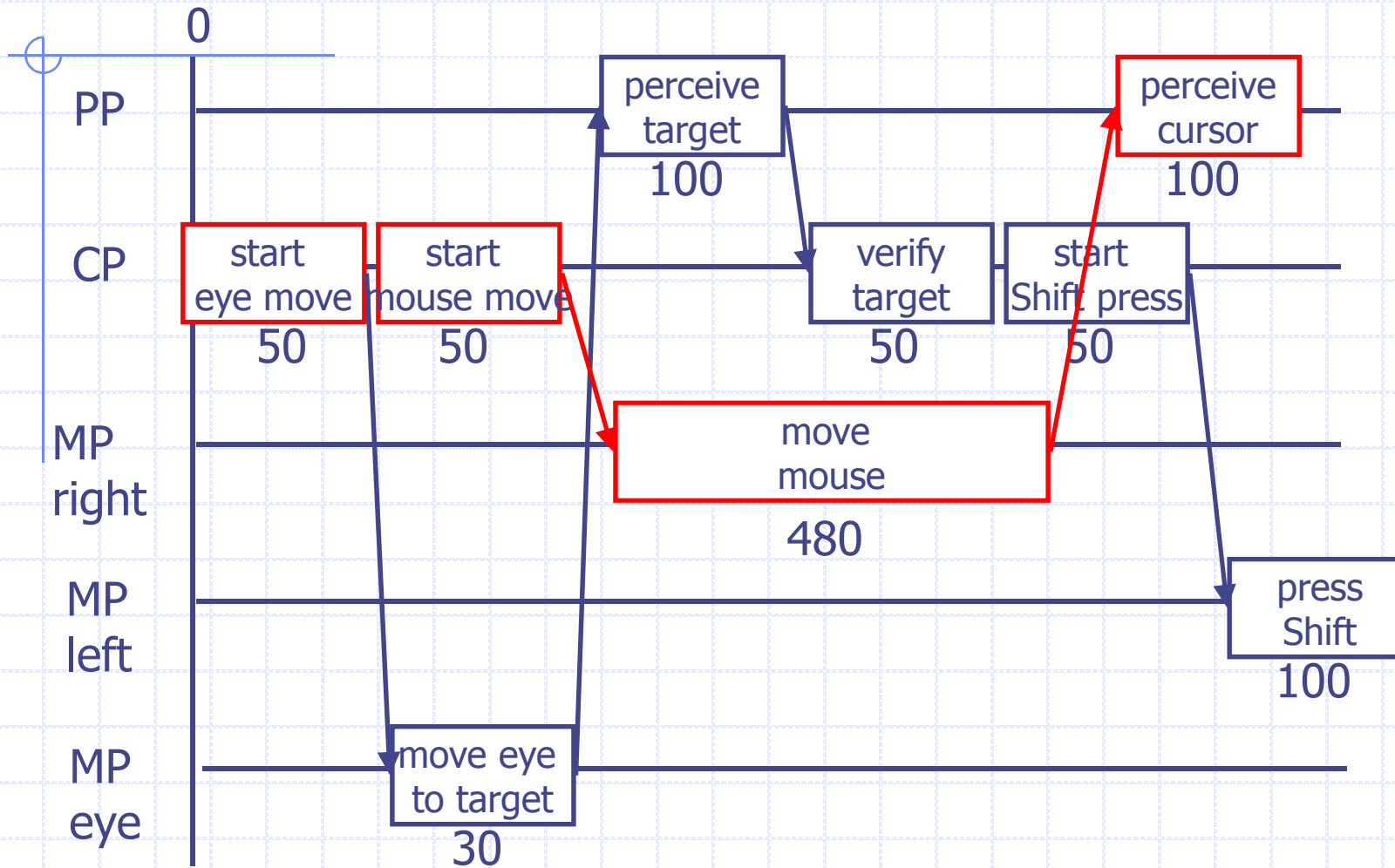
GOAL: MOVE-TEXT
.   GOAL: CUT-TEXT
.   .   GOAL: HIGHLIGHT-TEXT
.   .   .   [select**: GOAL: HIGHLIGHT-WORD
.   .   .   .   MOVE-CURSOR-TO-WORD
.   .   .   .   DOUBLE-CLICK-MOUSE-BUTTON
.   .   .   .   VERIFY-HIGHLIGHT
.   .   .   GOAL: HIGHLIGHT-ARBITRARY-TEXT
.   .   .   .   MOVE-CURSOR-TO-BEGINNING      1.10
.   .   .   .   CLICK-MOUSE-BUTTON          0.20
.   .   .   .   MOVE-CURSOR-TO-END          1.10
.   .   .   .   SHIFT-CLICK-MOUSE-BUTTON    0.48
.   .   .   .   VERIFY-HIGHLIGHT]          1.35
.   .   GOAL: ISSUE-CUT-COMMAND
.   .   .   MOVE-CURSOR-TO-EDIT-MENU        1.10
.   .   .   PRESS-MOUSE-BUTTON             0.10
.   .   .   MOVE-CURSOR-TO-CUT-ITEM        1.10
.   .   .   VERIFY-HIGHLIGHT              1.35
.   .   .   RELEASE-MOUSE-BUTTON          0.10
.   GOAL: PASTE-TEXT
.   .   GOAL: POSITION-CURSOR-AT-INSERTION-POINT
.   .   .   MOVE-CURSOR-TO-INSERTION-POINT  1.10
.   .   .   CLICK-MOUSE-BUTTON            0.20
.   .   .   VERIFY-POSITION               1.35
.   .   GOAL: ISSUE-PASTE-COMMAND
.   .   .   MOVE-CURSOR-TO-EDIT-MENU        1.10
.   .   .   PRESS-MOUSE-BUTTON             0.10
.   .   .   MOVE-MOUSE-TO-PASTE-ITEM      1.10
.   .   .   VERIFY-HIGHLIGHT              1.35
.   .   .   RELEASE-MOUSE-BUTTON          0.10
.   .   .   .   TOTAL TIME PREDICTED (SEC)  14.38

```

# Cale critică



# Cale critică



# CPM-GOMS Success Story

Phone company considering redesign of a workstation for telephone operators

- Reduced keystrokes needed for common tasks
- Put frequently-used keys closer to user's fingers

New design was 4% slower than old design

- 1 sec/call = \$3 million/year

Keystroke-level model has no explanation

But CPM-GOMS explained why:

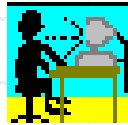
- Keystrokes removed were not on the critical path
- Used during slack time, while greeting customer
- A keystroke was moved from the beginning of call (during slack time) to later (putting it on the critical path)

# CTT (ConcurTaskTrees)

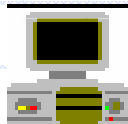
## Fabio Patterno

- ◆ Focus pe Activități
- ◆ Structură ierarhică
- ◆ Sintaxă grafică
- ◆ Operatori temporali (Lotos)

# Categorii de sarcini



**Interacțiune**



**Aplicație**



**Utilizator**



**Abstract**

# Operatori temporali

**Activare**

$T1 \gg T2$

**Activare cu schimb  
de informație**

$T1 [ ] \gg T2$

**Dezactivare**

$T1 [ > T2$

**Înterupere**

$T1 / > T2$

**Alegere**

$T1 [ ] T2$

**Iterație**

$T1^*$  sau  $T1_{\{n\}}$

**Concurență**

$T1 ||| T2$

**Concurență cu schimb  
de informație**

$T1 | [ ] | T2$

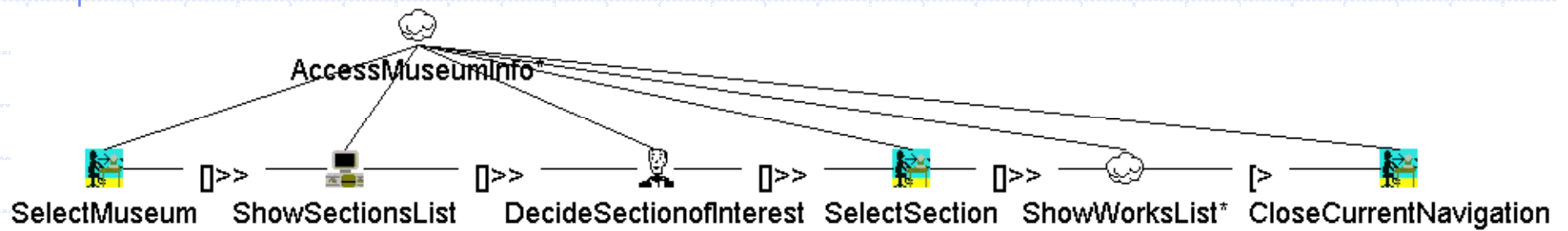
**Opțional**

$[T]$

**Ordine Independentă**

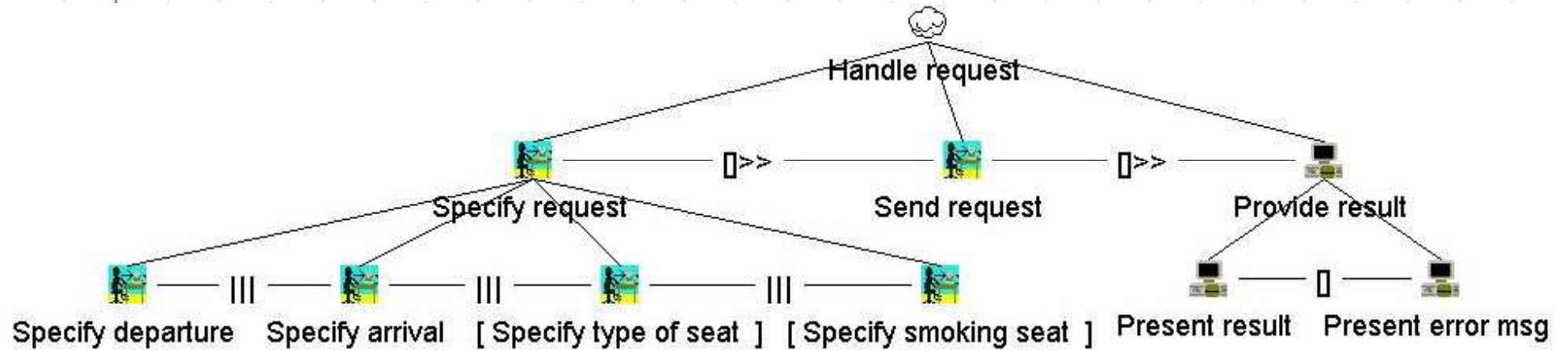
$T1 | = | T2$

# Relații task/subtasks

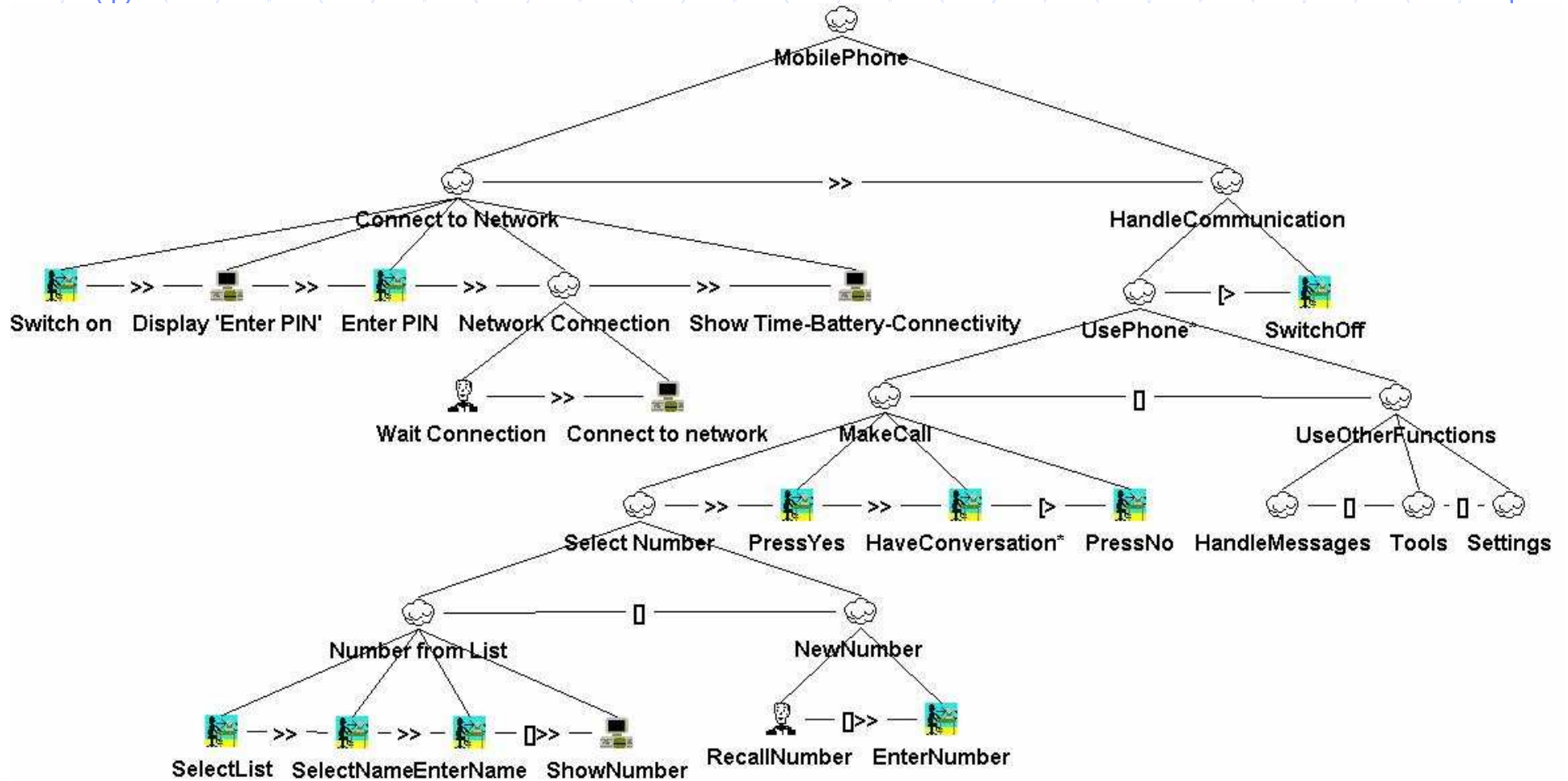




# Sarcini opzionale



# Exemplu



# Alte modalități de modelare

◆ UML

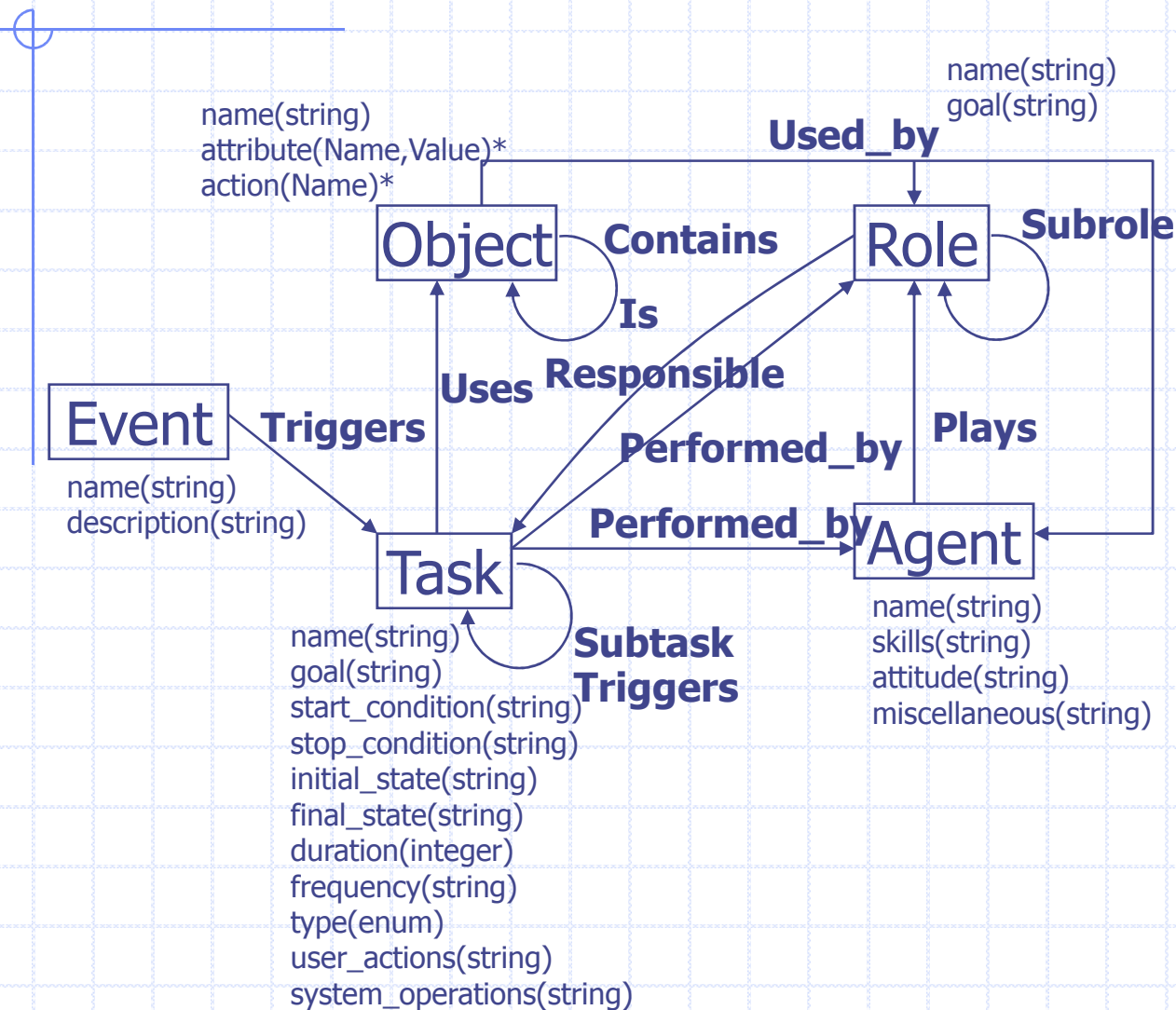
◆ BPL



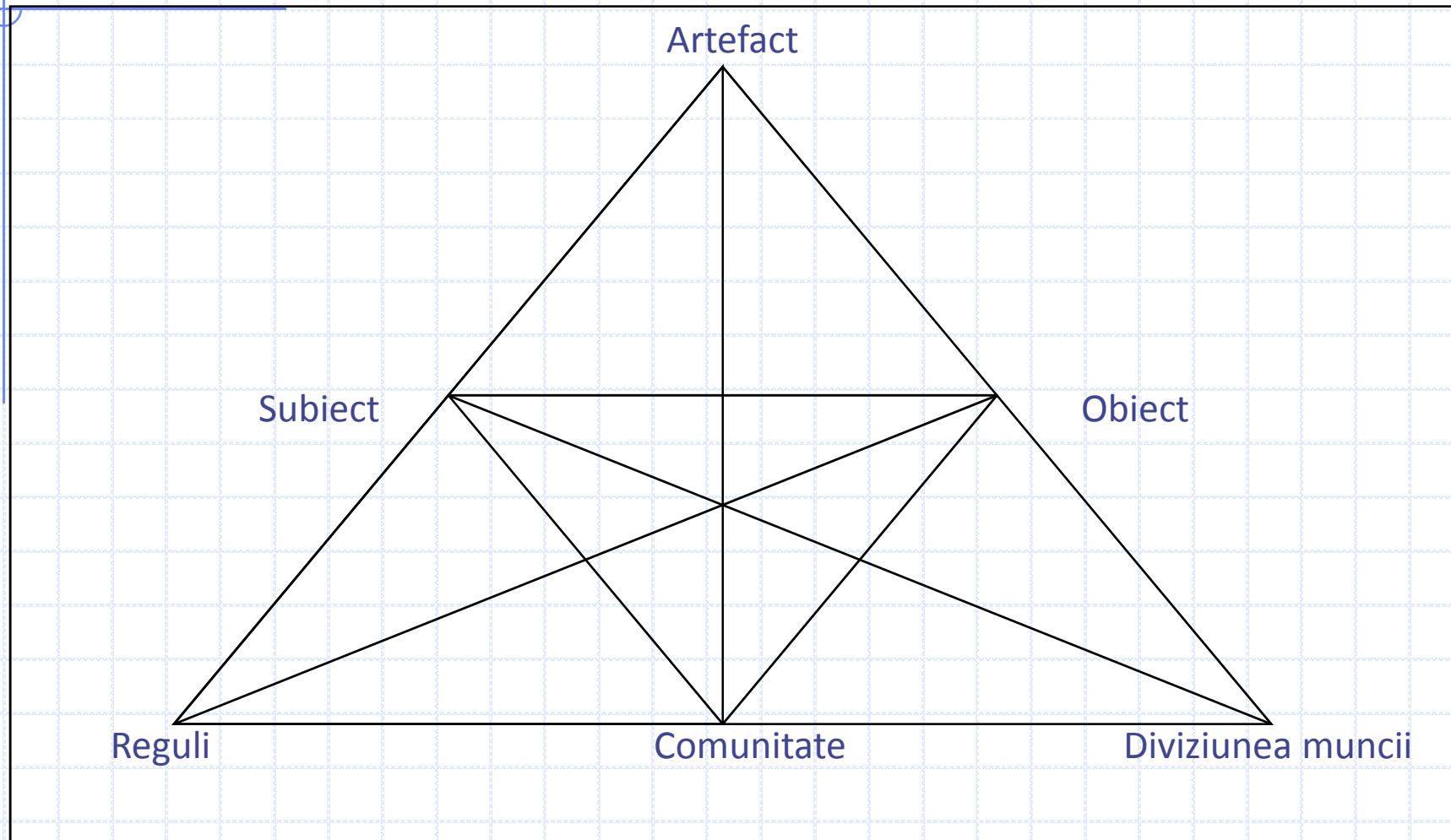
# Modelarea grupurilor

# GTA (Group Task Analysis)

(Martijn van Welie, 2001)



# Teoria activității (Engeström)



# Gerry Stahl (2006)

