

# **CSCI 6304: Visual Languages**



## **A Systematic Approach to Building "User-Friendly" Software**

November 21, 2005

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# Research Articles

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- “Environments to support context and emotion-aware visual interaction,” 2005
  - Daniela Fogli, Antonio Piccinno
  
- “End-user development: the software shaping workshop approach,” 2004
  - Maria Francesca Costabile, Daniela Fogli, Piero Mussio, Antonio Piccinno
  
- Main Concept: “**Software Shaping Workshop**” methodology

# Agenda

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- Hurdles in Human-Computer Interaction
- Software Shaping Workshop Methodology
- Application: Industrial Robotics
- Application: Medicine
- Conclusions and References

# Hurdles in Human-Computer Interaction

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- ❑ Interacting with computers can be frustrating.



# Hurdles in Human-Computer Interaction

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- ❑ Reducing negative emotions from users can not only help with **software acceptance**, but also **reduce mistakes**
- ❑ Some of the negative emotions users may experience:

Irritation

Dissatisfaction

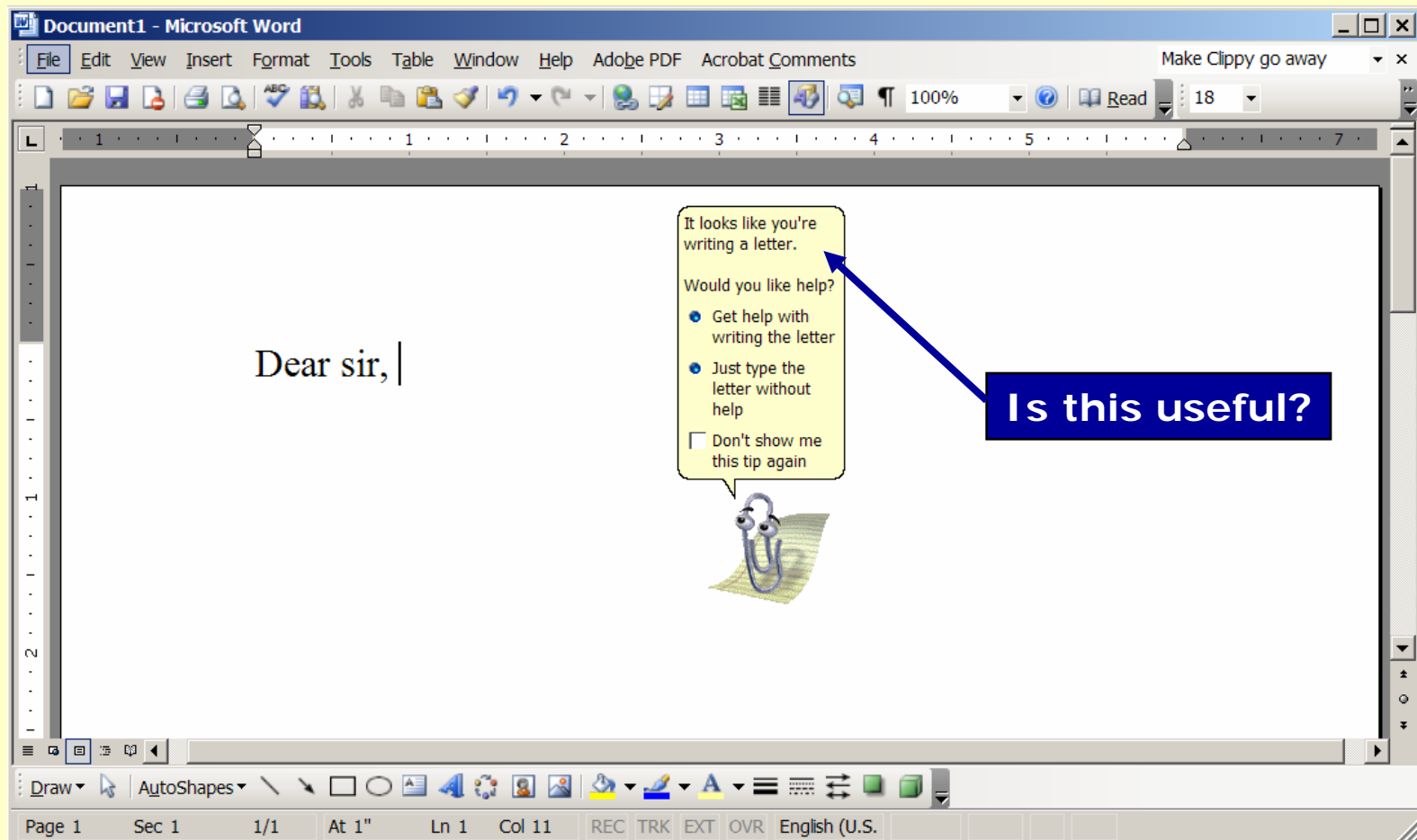
Frustration

Anxiety

PANIC

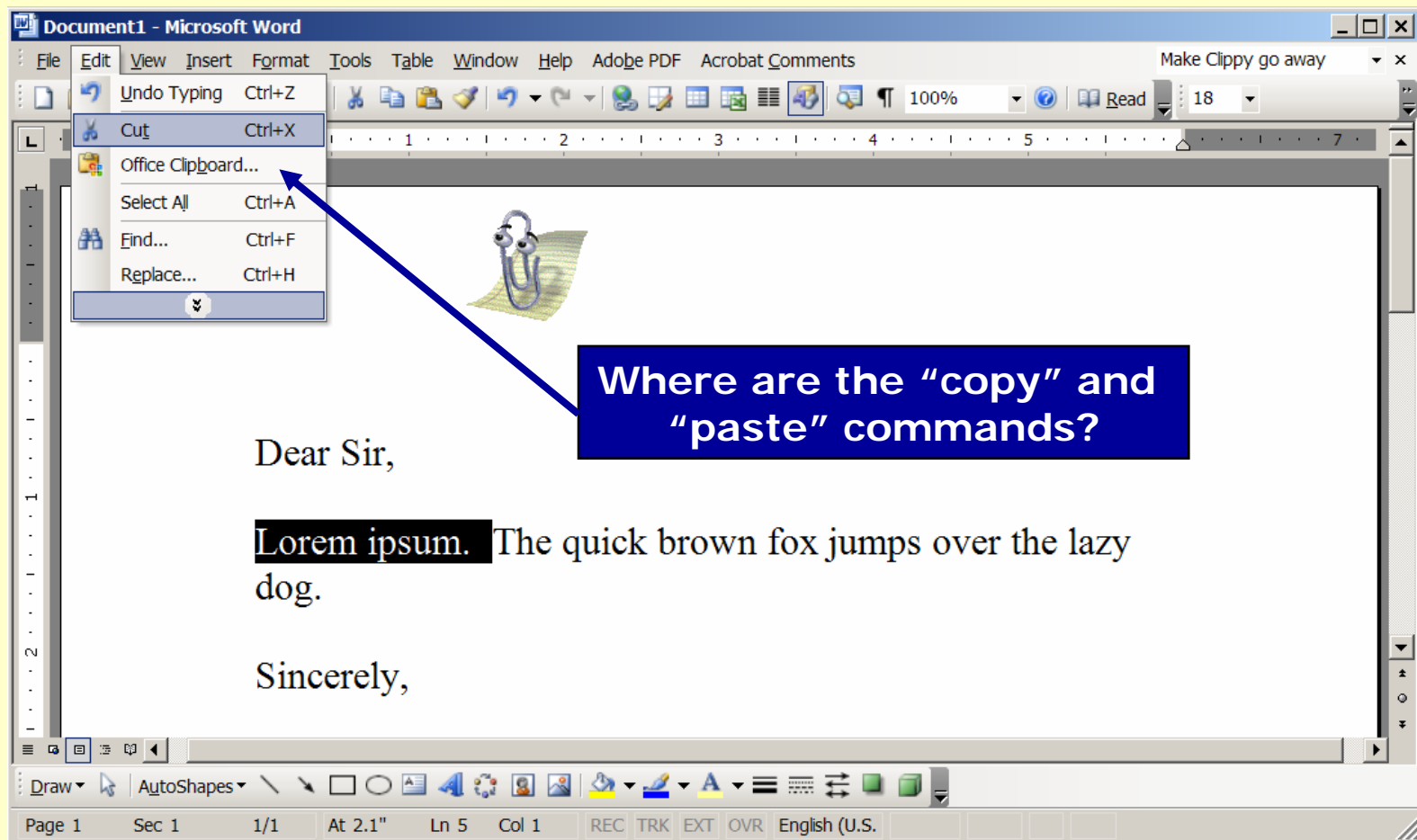
# Hurdles in Human-Computer Interaction

- Sometimes software behaves **intrusively** or **unexpectedly**.



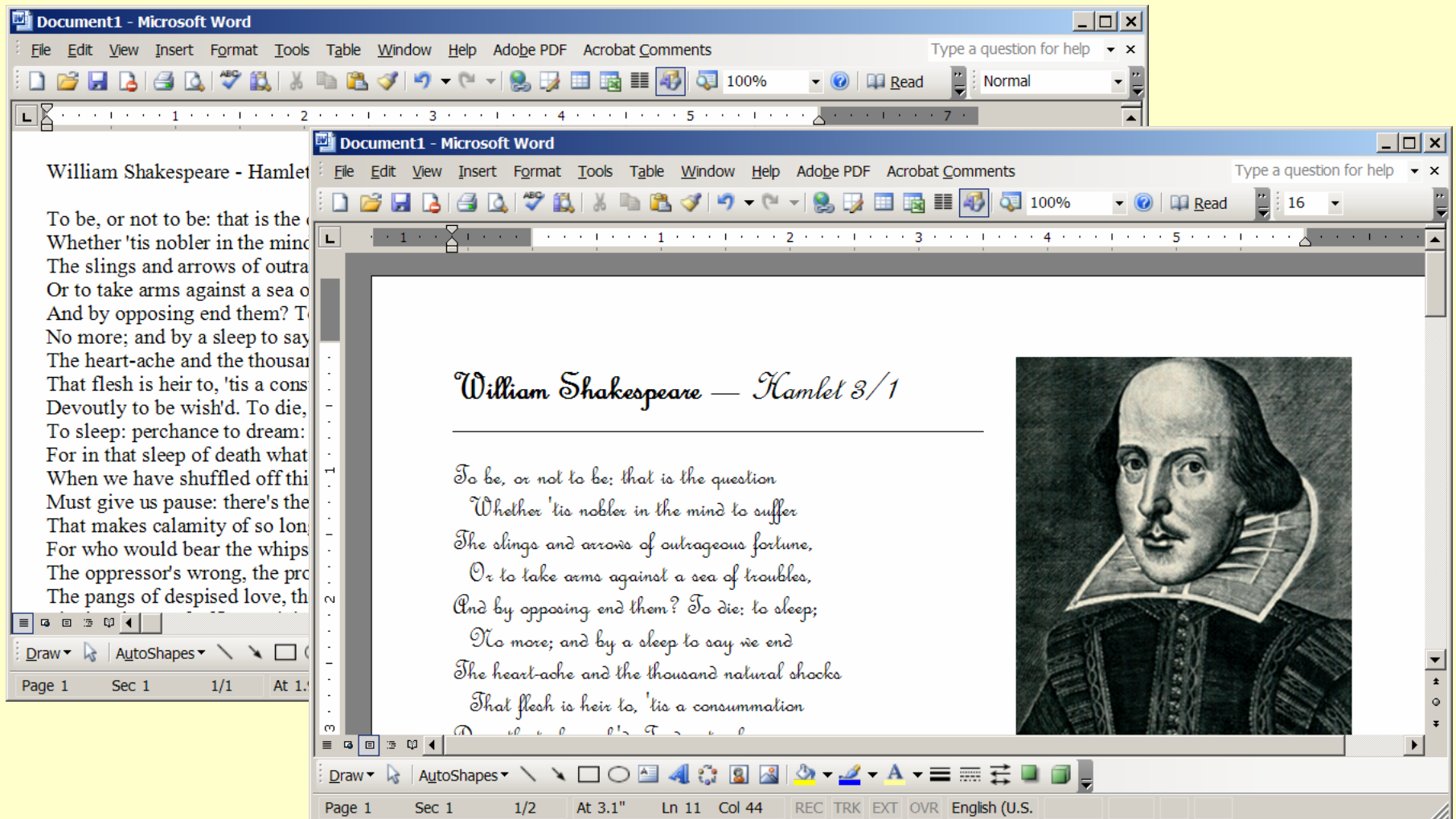
# Hurdles in Human-Computer Interaction

- ❑ Long menus with many options can be **intimidating**, but hiding infrequently used commands may **frustrate** users.



# Hurdles in Human-Computer Interaction

- Computers can break your **train of thought** while you figure out how to accomplish a task, such as formatting text.





# Hurdles in Human-Computer Interaction

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- If **non-standard terminology** is employed in software, even experts may have trouble learning it.
- For example, in standard mathematical notation, we might have:

$$f(t) = \int_0^t \sqrt{1+x^3} dx \quad f(1)?$$



# Hurdles in Human-Computer Interaction

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- Another approach: involve **domain experts** during development
  - Expert representatives of the target user community
  - Knowledge of the notations, terminology, rules of problem domain
  - Aware of specific needs, culture, background, skills of end-users
  
- Allows customization by **problem domain**
  - e.g. AutoCAD drafting software by Autodesk, Inc. is available in many customized flavours for specific industries:
    - AutoCAD Electrical
    - AutoCAD Mechanical
    - ... many others!
    - Autodesk Architectural Desktop
    - Autodesk Civil Design

# Hurdles in Human-Computer Interaction

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- Even when employing experts in an advisory capacity, some sources of negative emotions may remain
  - **Different users** may behave differently
    - May not be properly represented by domain experts
  - Emotional states may vary with **working situation**
    - May not be known during design phase

# Software Shaping Workshop (SSW)

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## □ Software Shaping Workshop methodology

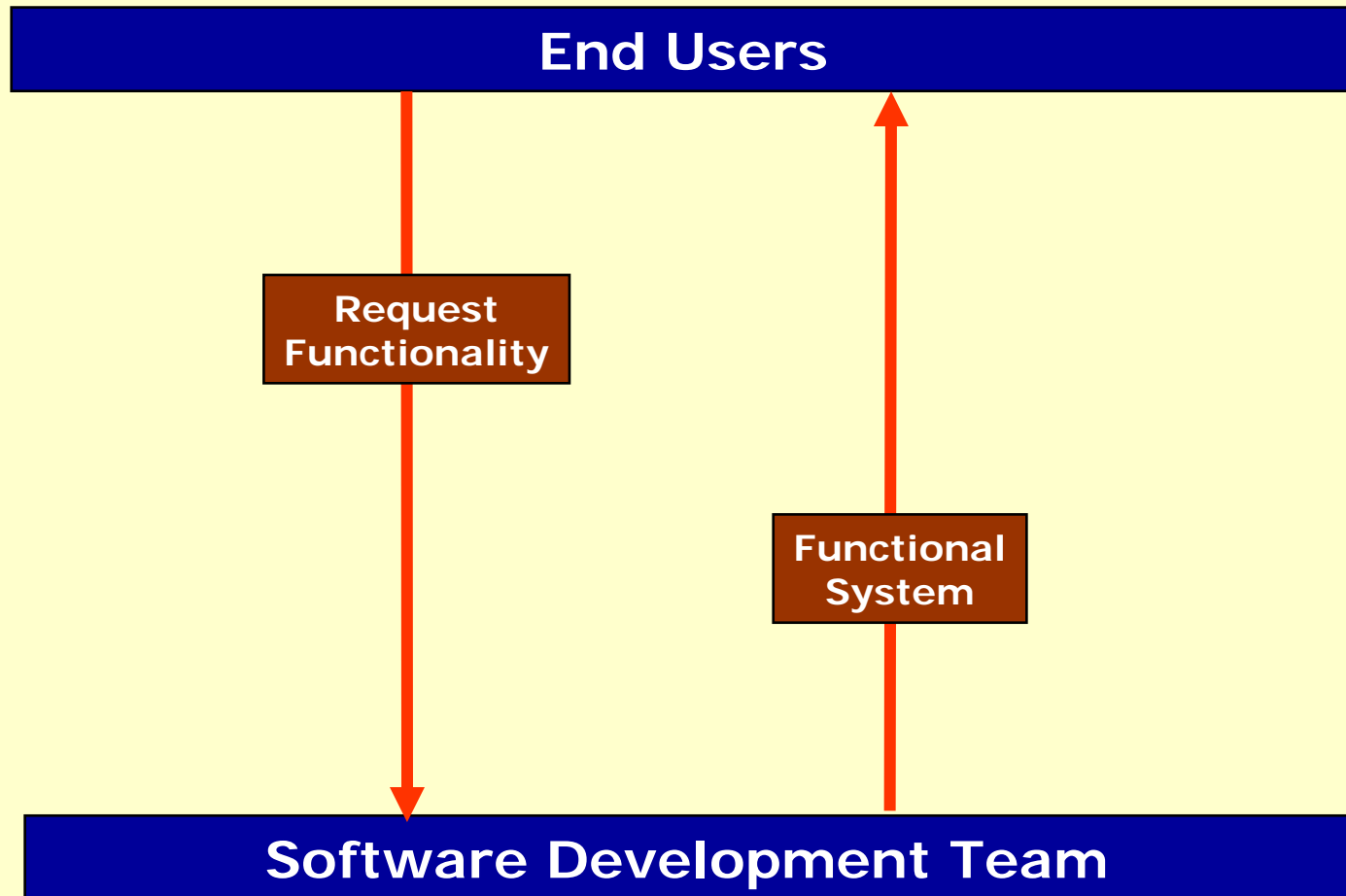
- *Shape*: an object or tool to be created or customized
- *Workshop*: the working environment of an artisan or blacksmith

## □ Hierarchical or multi-level approach

- Software designers create functional building blocks of system
- Software designers then create interfaces for domain experts
- Domain experts create interfaces for end-users
- “Meta-Design”
- “Network of Workshops”

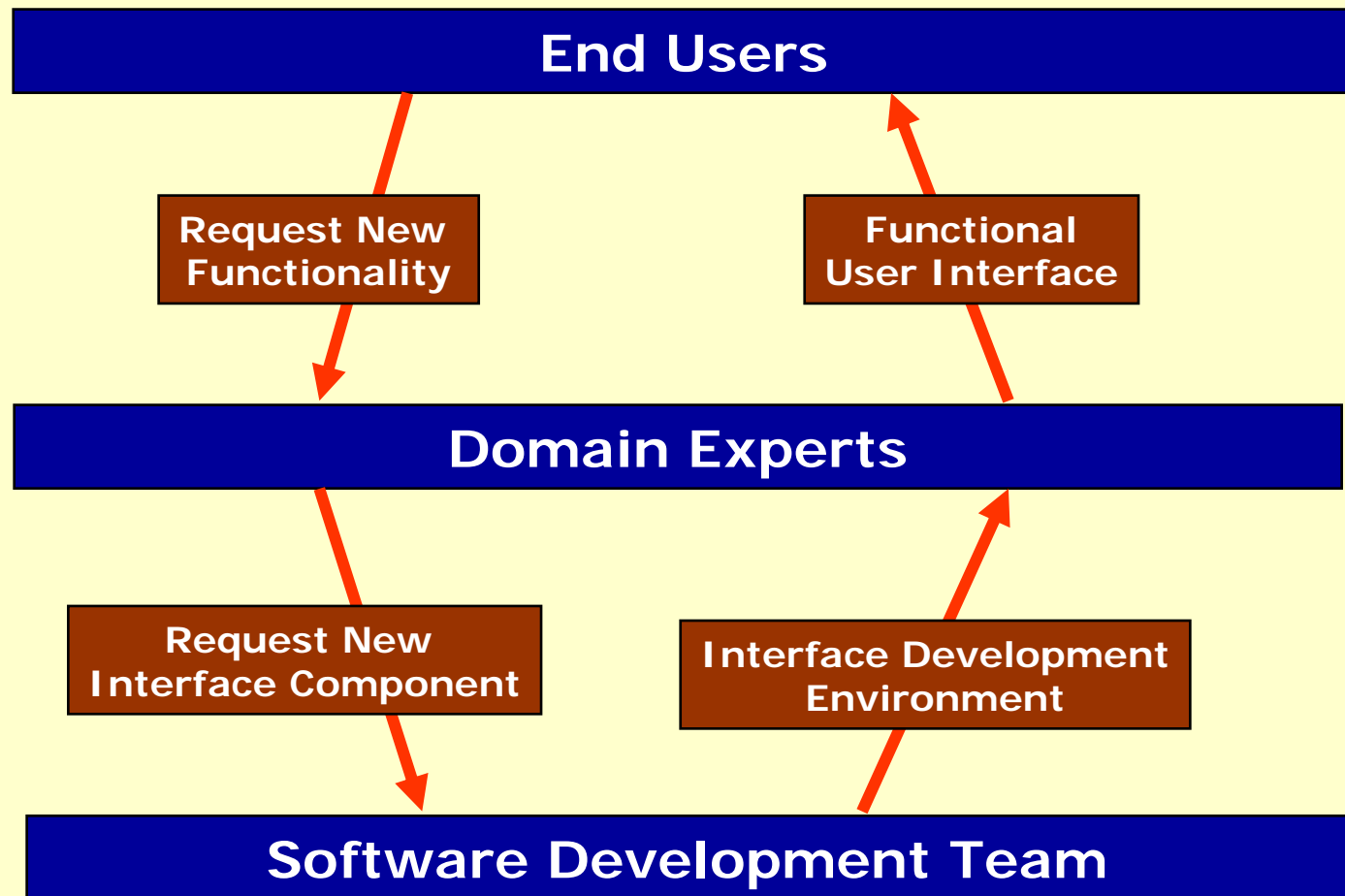
# Software Shaping Workshop (SSW)

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# Software Shaping Workshop (SSW)

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# Software Shaping Workshop (SSW)

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- The SSW methodology:
  - adopts the notation and terminology of the target audience
  - allows different views to different users of same community
  - allows expert users to actively participate in design process
  - encourages component reusability



# Software Shaping Workshop (SSW)

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- The SSW methodology:
  - guarantees gentle learning curve
    - Users only see options they need and understand
    - Evolves as users' needs change, but avoids big jumps in complexity
  - allows different levels of participation, e.g.:
    1. Set parameters or configuration
    2. Integrate components
    3. Add new components
  - does not require domain experts to become programmers!

# Application: Factory Automation

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## □ ETA Consulting

- Produces **factory automation** software for control of industrial robots by assembly line workers
- End-users request functional changes
  - *End-users:* assembly line operators, production managers
- Software developers implement new software versions

# Application: Factory Automation

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## □ Case Study:

- Apply Software Shaping Workshop methodology
- Add an intermediate domain expert: **Mechanical engineers**
  - Domain experts in manufacturing and automation
  - Not software development experts

# Application: Factory Automation

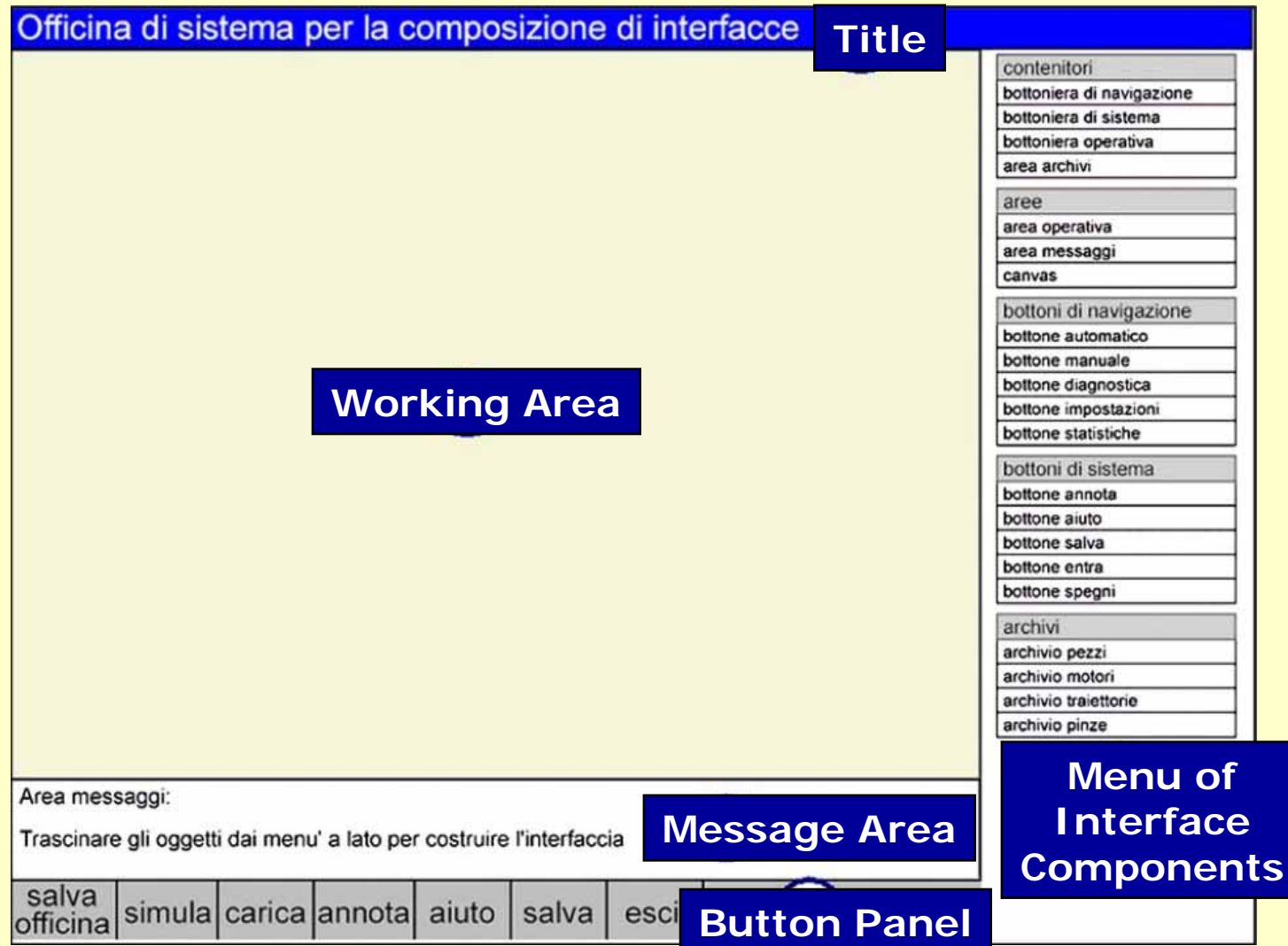
“Pick-and-place” industrial robot used in manufacturing assembly lines

- Multiple axes
- May have “grip” for component placement, or welding torch, other tools
- Functions controlled by assembly line workers



# Application: Factory Automation

- Environment for building interfaces for assembly line operators



# Application: Factory Automation

Officina di sistema per la composizione di interfacce

**Buttons**

**Button Panel**

Automatico Manuale

**Canvas**

area messaggi

**Archive Area**

**Message Area**

contenitori	
aree	
bottoni di navigazione	
bottoni di sistema	
archivi	

Area messaggi:  
Area messaggi, va posizionata su di una canvas

salva officina simula carica annota aiuto salva esci

# Application: Factory Automation

Officina di sistema per la composizione di interfacce



contenitori
bottoniera di navigazione
bottoniera di sistema
bottoniera operativa
area archivi
aree
area operativa
area messaggi
canvas
bottoni di navigazione
bottone automatico
bottone manuale
bottone diagnostica
bottone impostazioni
bottone statistiche
bottoni di sistema
bottone annota
bottone aiuto
bottone salva
bottone entra
bottone spegni
archivi
archivio pezzi
archivio motori
archivio traiettorie
archivio pinze

Area messaggi:

salva officina   simula   carica   annota   aiuto   salva   esci


# Application: Factory Automation

**Robot Operation Modes**

Automatic Manual Diagnostics Plan (?) Statistics


**Working Area**

Macchina ETA




**Robot Configuration**

Tool




Engine



Trajectory

Gripper



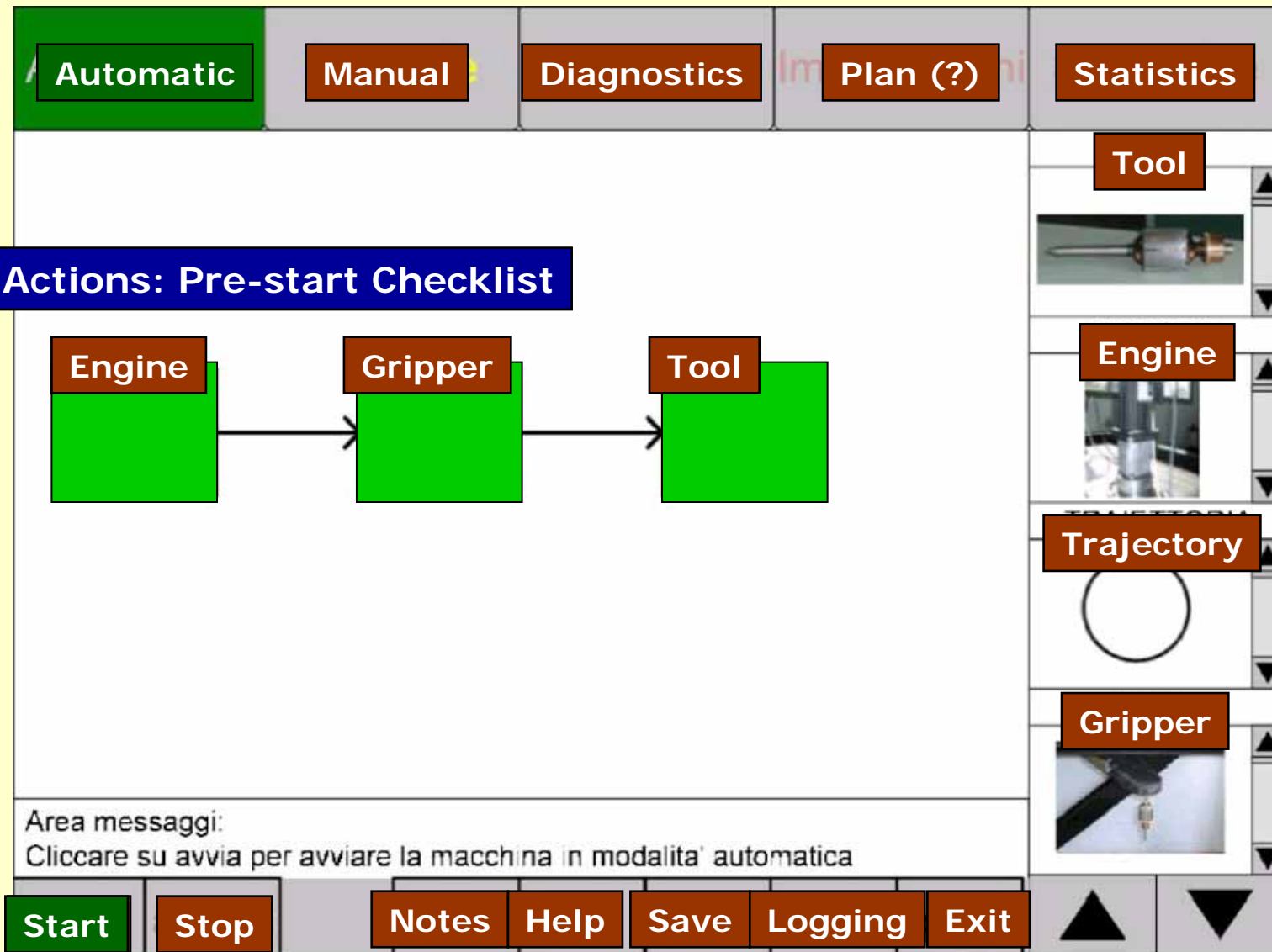
Area messaggi:  
Si attiva il modo di funzionamento manuale della macchina

**Message Area**

**Button Panel** Notes Help Save Logging Exit



# Application: Factory Automation



# Application: Factory Automation

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- These functional interfaces promote correct **perception** and **interpretation**
  - User Interface exploit users' knowledge
    - familiar terminology: e.g. tools, grippers, engines, trajectories
    - familiar icons: e.g. pictures of tools to be selected
    - Reduce **disorientation** resulting from unfamiliar terms
  - Realistic context for manufacturing environment
    - e.g. Push "Start" button to start machine
    - Doesn't break users' **continuity of thought** with complex menus
  - Doesn't turn engineers into programmers, rather engineers provide **semantics** (meaningful context)

# Application: Radiology

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## □ Case Study:

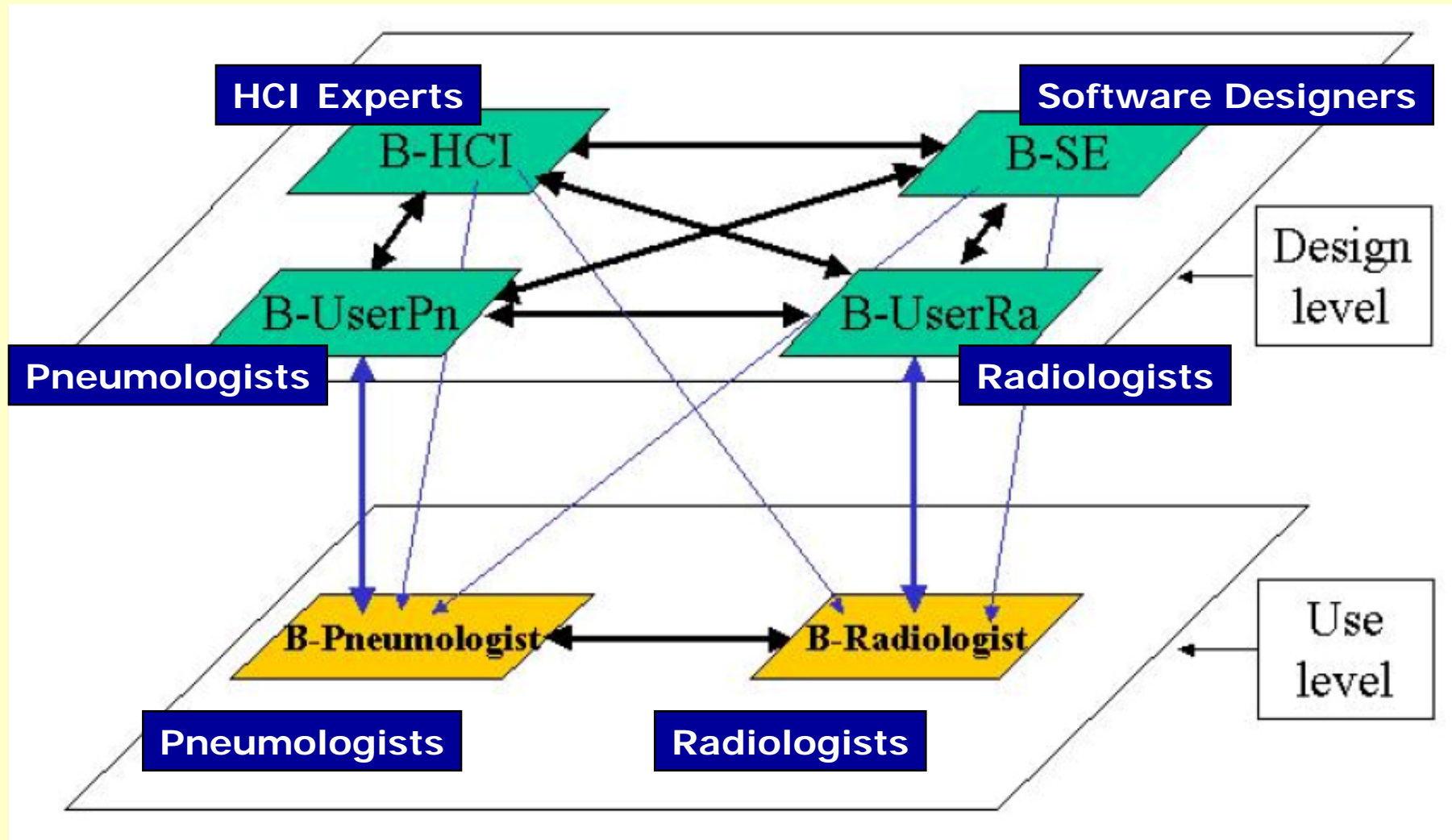
- Medical doctors need to collaborate on chest x-rays
  - *Radiologist*: an expert in analyzing x-rays
  - *Pneumologist*: an expert in diagnosing pneumonia

## □ Scenario:

- Radiologist examines the x-ray and finds a suspicious area
- Radiologist annotates his suspicions and alerts pneumologist
- Pneumologist examines the x-ray and performs diagnosis

# Application: Radiology

- Two applications are developed:



# Application: Radiology

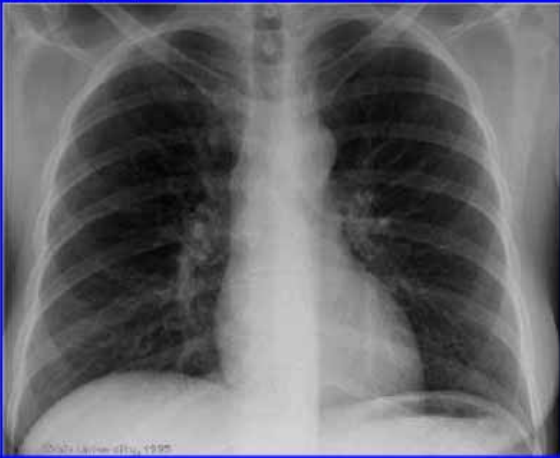
C:\Tony\EUD-Net\BANCO\caso medicale\Bradion1\index.html - Microsoft Internet Explorer

File Modifica Visualizza Preferiti Strumenti ? Indirizzo y\EUD-Net\BANCO\caso medicale\Bradion1\index.html Vai

Indietro Cerca Preferiti Multimedia

This application is based on ideas and software tools born as a collaboration of the [CNR](#) Institutes [CNUCE](#) and [ITIM](#). Now is developed and tested with DEA of [University of Brescia](#). Please, do not use them without due acknowledgement.

**Patient Siro Rossi**



img 1 Dr. Bianchi

© B-Radiologist

en Radiologist

tools:

images:

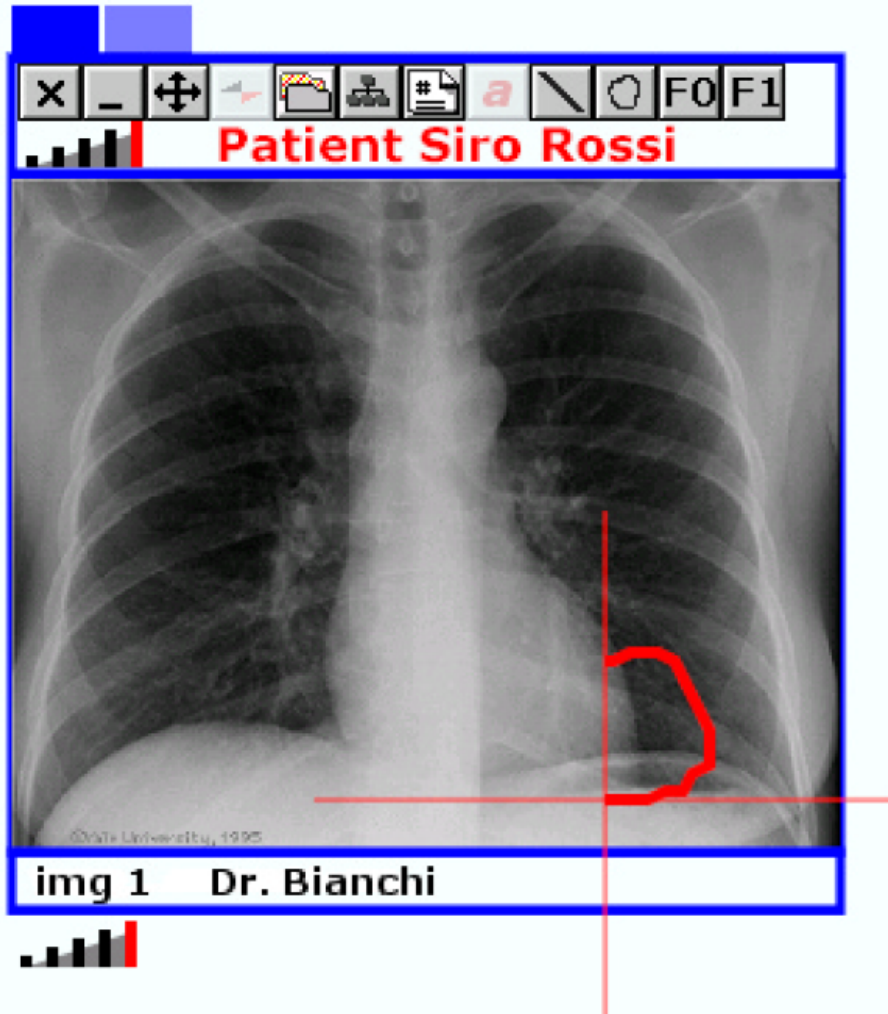
compute:

Risorse del computer

# Application: Radiology

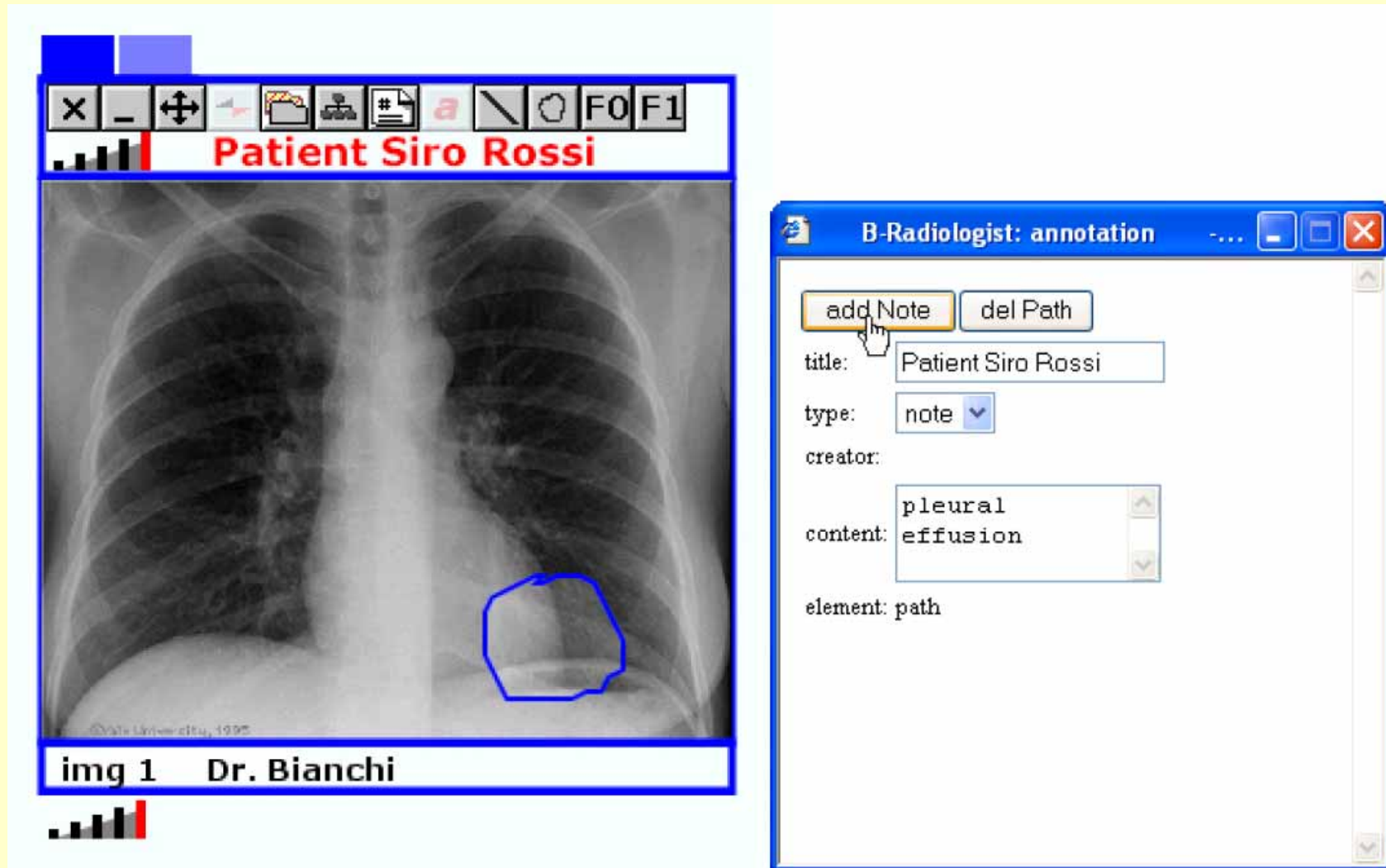
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- The radiologist circles a suspicious area on an x-ray.



# Application: Radiology

- The radiologist then adds a note to explain.

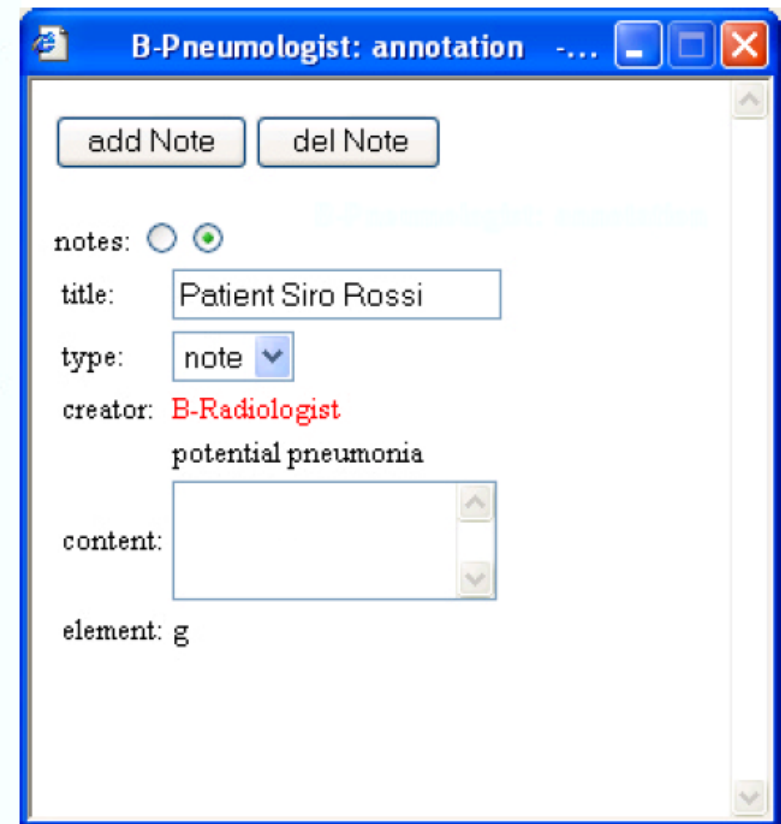
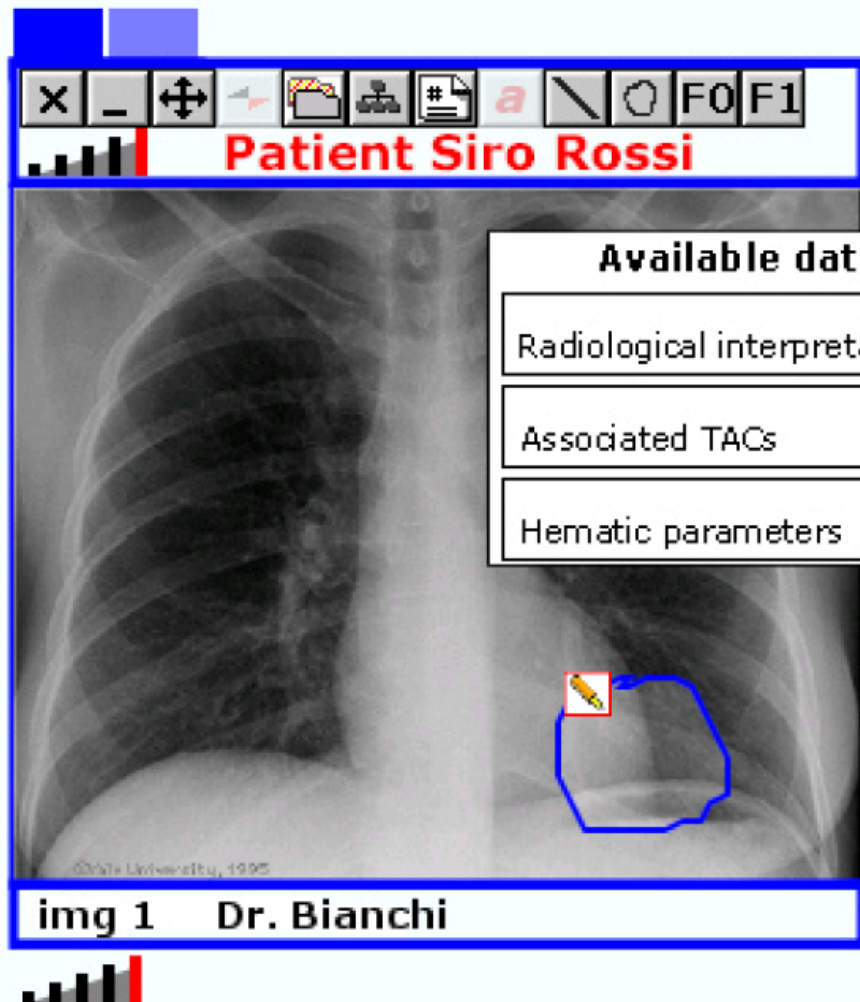


The screenshot displays a radiology application interface. On the left, a window titled "Patient Siro Rossi" shows a chest X-ray with a blue polygonal annotation around a region in the lower right lung. The window includes a toolbar with icons for zooming, panning, and other functions, and a status bar at the bottom that reads "img 1 Dr. Bianchi". On the right, a smaller window titled "B-Radiologist: annotation" is open, showing a form for adding a note. The form has two buttons: "add Note" (highlighted with a mouse cursor) and "del Path". Below the buttons, the form fields are: "title: Patient Siro Rossi", "type: note" (with a dropdown arrow), "creator:" (empty), "content: pleural effusion" (with a text area and scrollbars), and "element: path".



# Application: Radiology

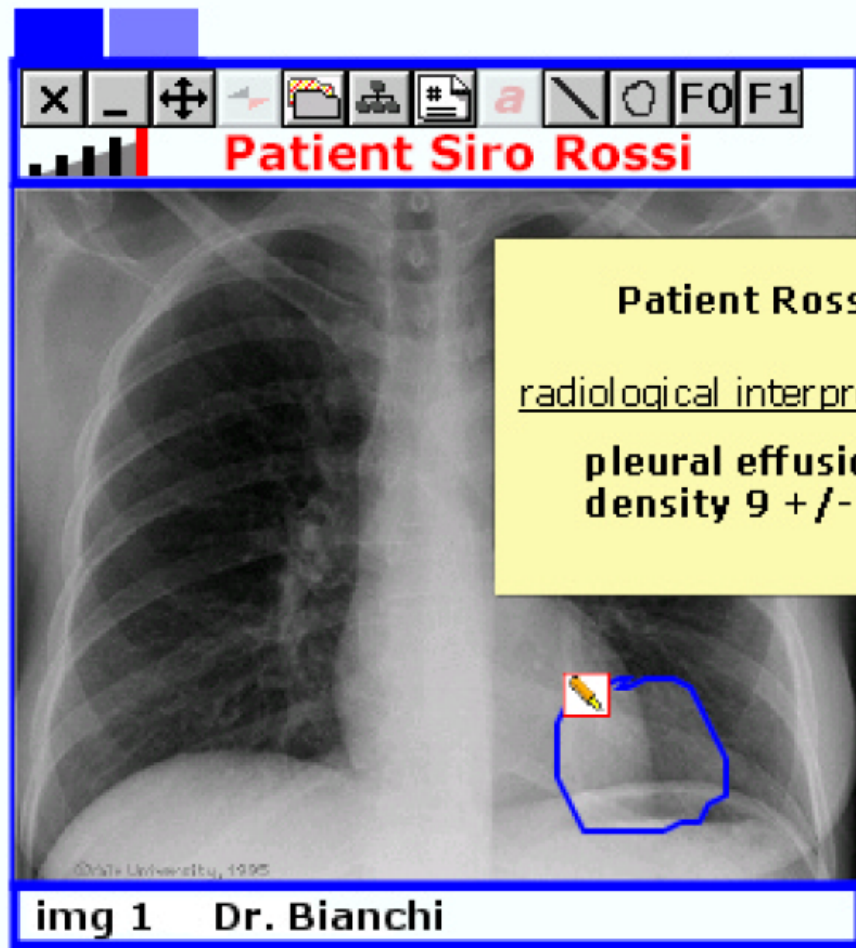
- The pneumologist accesses this information.





# Application: Radiology

- The pneumologist then performs a diagnosis.



The screenshot shows a window titled "B-Pneumologist: annotation" with a toolbar at the top containing "add Note" and "del Note" buttons. Below the toolbar, there are two radio buttons for "notes:". The "title" field contains "Patient Siro Rossi". The "type" dropdown menu is set to "note". The "creator" field is "B-Radiologist". The "content" field contains "pneumonia". The "element" field is "g".

## Application: Radiology

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- ❑ Software designers don't need to learn medical terms
- ❑ Medical doctors don't need to learn software design
- ❑ Facilitates collaboration between interested parties
- ❑ Users only see the software options they need
- ❑ "Light" applications with reusable components

# Conclusions

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- ❑ SSW methodology allows domain experts to participate in design process
- ❑ Facilitates communication between users, experts and software designers
- ❑ Methodology has been implemented for “real world” environments
  - *Industrial robotics:* assembly line manufacturing
  - *Medicine:* radiology (Analyzing Chest X-Rays)
  - *Earth sciences:* geology (Sattelite Images of Glaciers)

# References

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- ❑ G. Fischer, "Beyond 'Couch Potatoes': From Consumers to Designers and Active Contributors," *First Monday*, 7(12), 2002, [[http://firstmonday.org/issues/issue7\\_12](http://firstmonday.org/issues/issue7_12)].
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- ❑ Maplesoft (Waterloo Maple Inc.), "Maple" Software, 2004. Maple example modified from: Department of Mathematics, "Maple Examples," University of Utah, 1995, [<http://www.math.utah.edu/lab/ms/maple>].
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