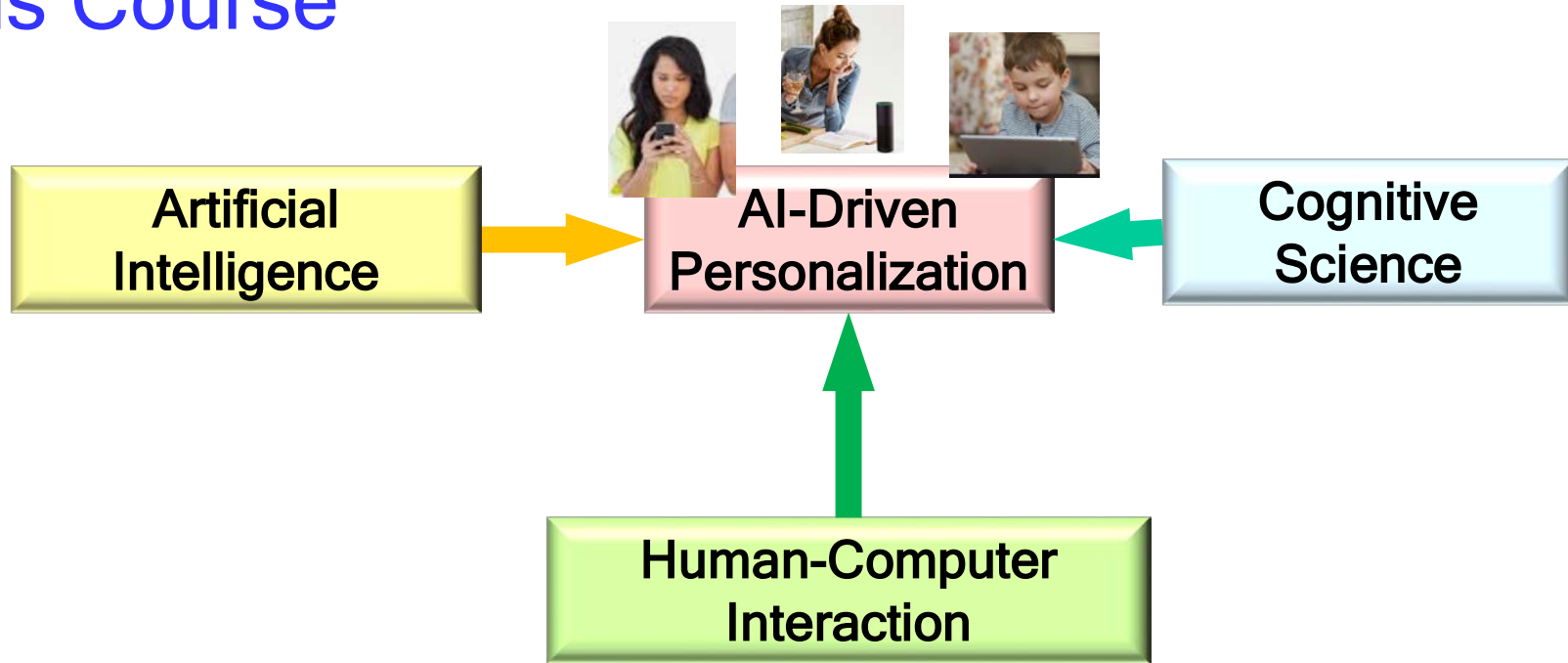


Jameson paper

This Course



- ❑ Create AI-driven interactive systems that support **personalized** interaction by
 - capturing a user's **specific needs/states/abilities**
 - **adapting** the interaction accordingly
 - while preserving **transparency**, user **control** and **trust**
- ❑ AI-driven interactive is also known as **User-Adaptive-Interaction (UAI)**

Why UAI?

Why UAI?

- High functionality applications: feature overload
 - E.g. word processors, media editors, learning-management systems



Hard to design them to work well for each individual user

- Specialized applications where personalization is highly valuable
 - web-browsing, recommender systems, e-commerce,
 - education, health
 - computer-supported collaborative work
 - digital entertainment, social media
- And users often **do not know/want** to personalize (**customize**) their application

Overview

- Functions and Forms of UAI
- Components
- Usability and Evaluation

Reference paper: A. Jameson. "Adaptive Interfaces and Agents" in *Human-Computer Interface Handbook*, eds J.A. Jacko and A. Sears, 2008. (pointer in reading list)

UAI: Functions and Forms (some)

Functions

Support
System
Use

Support
Info Aquisition/
Decision Making

Support
Learning

Support
Collaboration

Support
Entertainment

Take Over
Routine
Tasks

Adapt
the
Interface

Advice
on
System
Usage

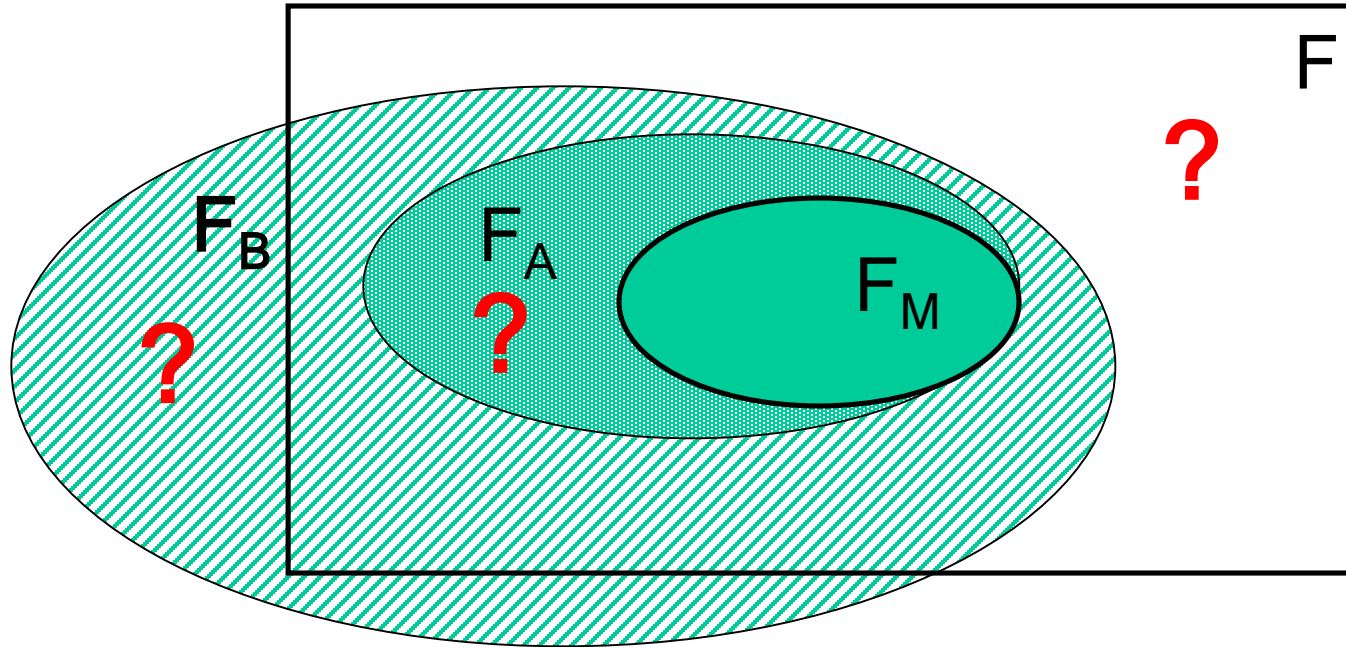
Retrieve Info/
Recommend Objects

Tailor
Info
Presentation

Advice
on
task

Forms of Adaptation

Support System Use: High Functionality Applications



□ F = All functionalities **available** in the application

■ F_M = functionalities the user has **mastered**

■ F_A = functionalities the user is **aware of** but does not use

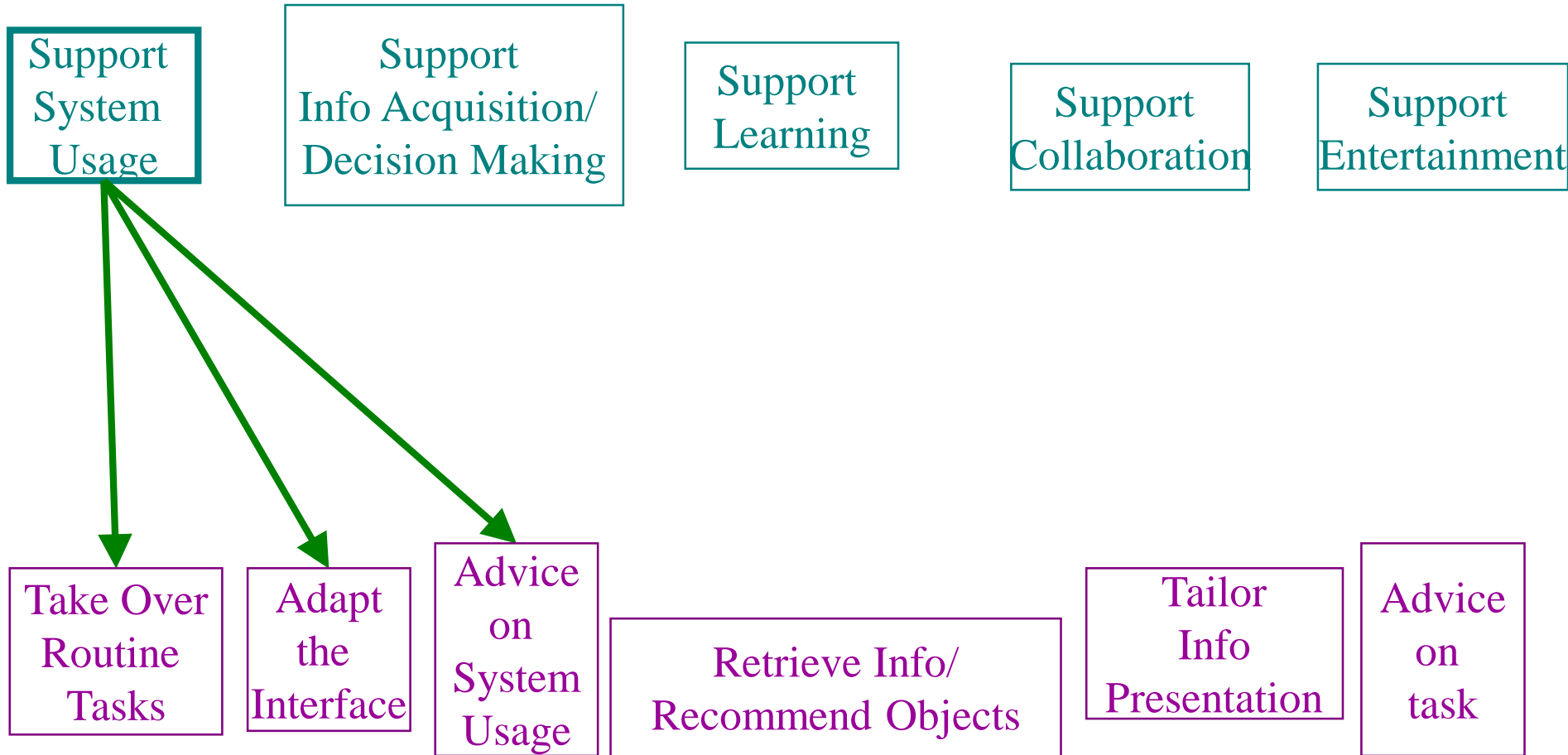
■ F_B = functionalities the user **believes** are available

Support System Use: Some Forms of Adaptation

- ❑ Give advice on system usage
 - e.g. suggest unknown or seldom used functionalities
 - **on demand** or **unsolicited**
- ❑ Adapt the interface itself
- ❑ Take over routine tasks

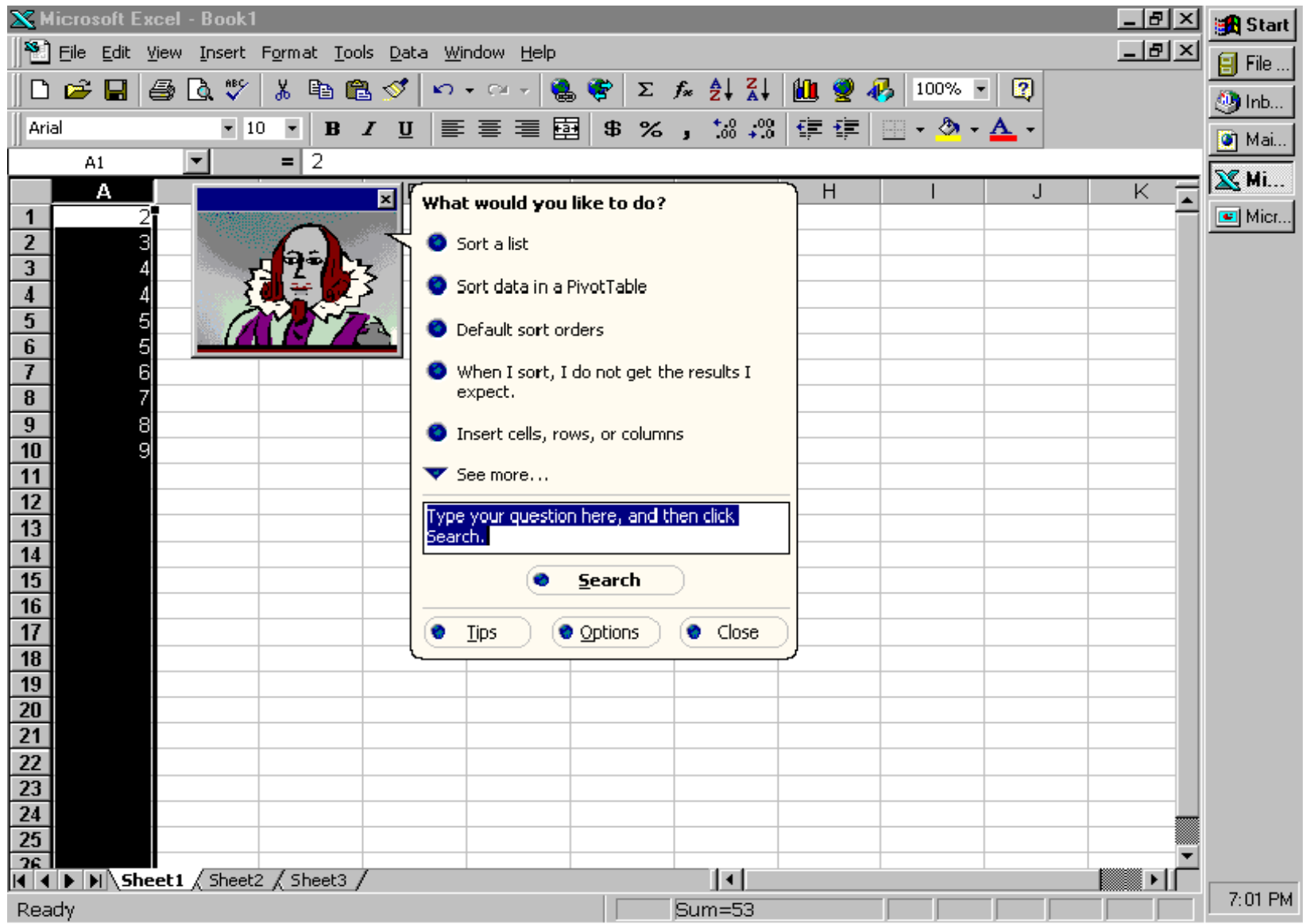
UAI: Functions and Forms (some)

Functions



Forms of Adaptation

Give Advice on System Usage: the Microsoft Office Assistant



The screenshot displays the Microsoft Excel 2003 interface. The title bar reads "Microsoft Excel - Book1". The menu bar includes "File", "Edit", "View", "Insert", "Format", "Tools", "Data", "Window", and "Help". The toolbar contains various icons for file operations, editing, and calculations. The status bar at the bottom shows "Ready" and "Sum=53".

The Microsoft Office Assistant dialog box is open, titled "What would you like to do?". It features a cartoon character of a woman with red hair and a white collar. The dialog box contains the following text and options:

- Sort a list
- Sort data in a PivotTable
- Default sort orders
- When I sort, I do not get the results I expect.
- Insert cells, rows, or columns
- See more...

Below the list is a text input field with the placeholder text "Type your question here, and then click Search." and a "Search" button. At the bottom of the dialog box are three buttons: "Tips", "Options", and "Close".

Advice on System Usage: Recommend Commands to IDE Users

Gasparic, Janes, Ricci, Zanellati: GUI Design for IDE Command Recommendations. IUI 2017: 595-599

Open Resource
ctrl + shift + r

1)

Enables quick finding and opening of project resources.

Usage example of Open Resource:

```
1 package yourproject;
2
3 public class HelloWorld {
4
5     public static void main(String[] args) {
6
7     }
8
9
10 }
11
```

Open Resource

Select an item to open (? = any character, * = any string):

GUI

Matching items:

GUIHelloWorld.java

yourproject/src/yourproject

Show In Open With Open

2)

[Step-by-step guide video](#)

Why is it recommended to me?

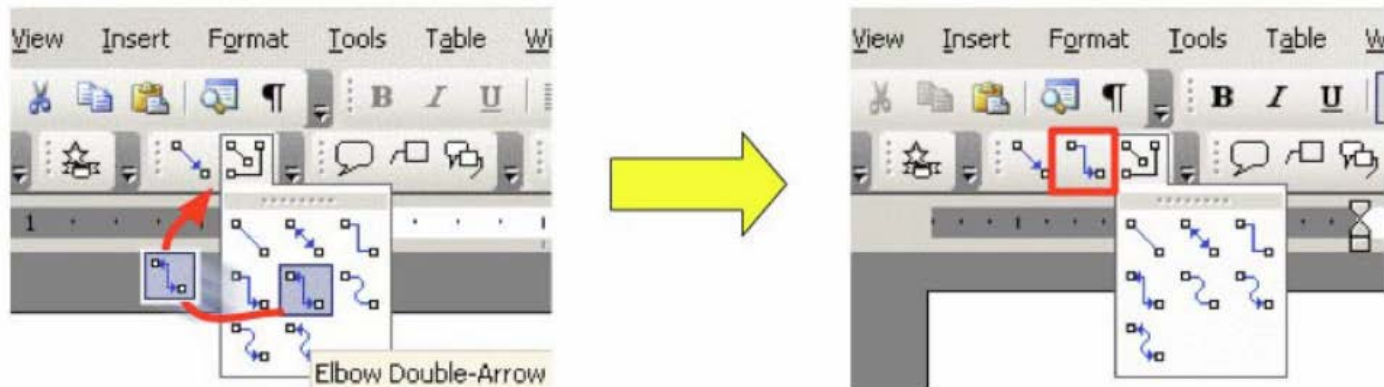
Open Resource is used by 48% of competent users who are interacting with the IDE in a similar way as you. It is often used in JSP-HTML editor when users are editing Java methods.

3)

Adapting the Interface: Promote Most Relevant Commands



(a)

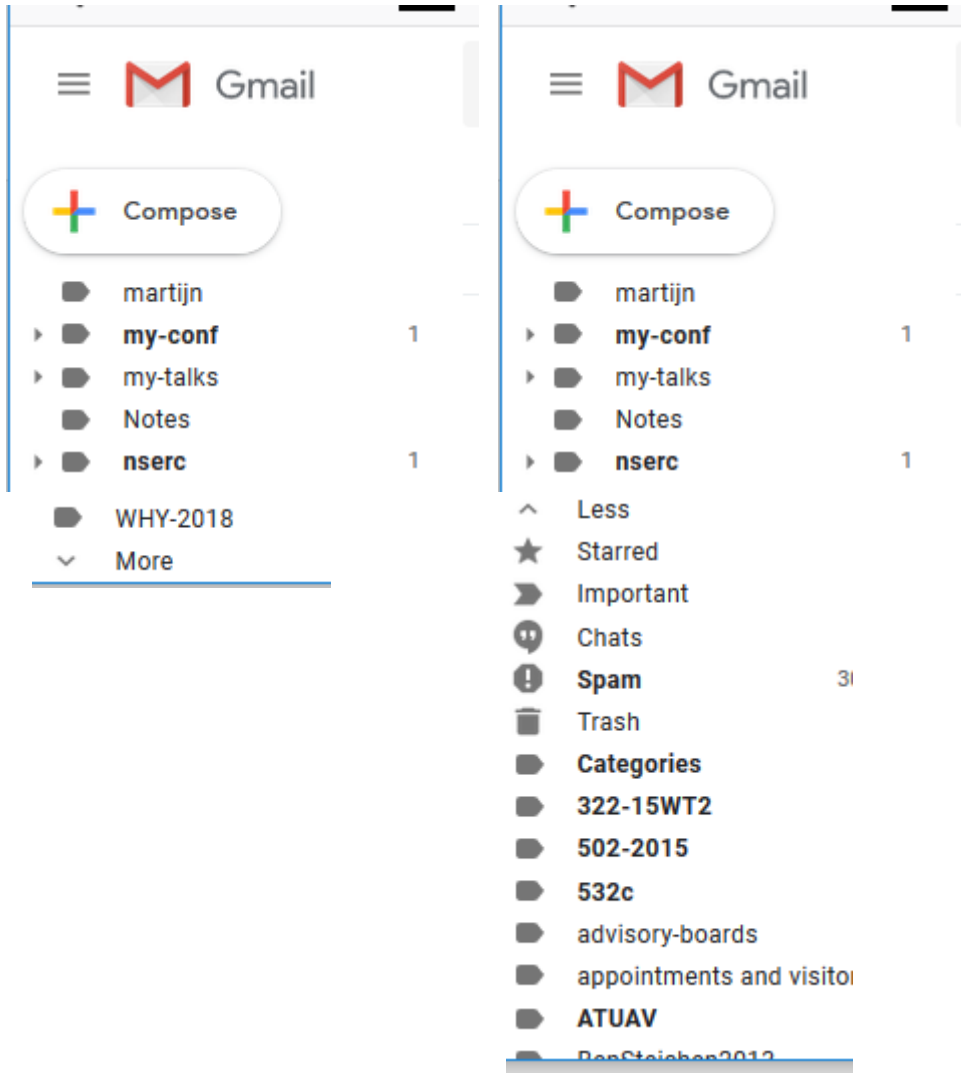


(b)

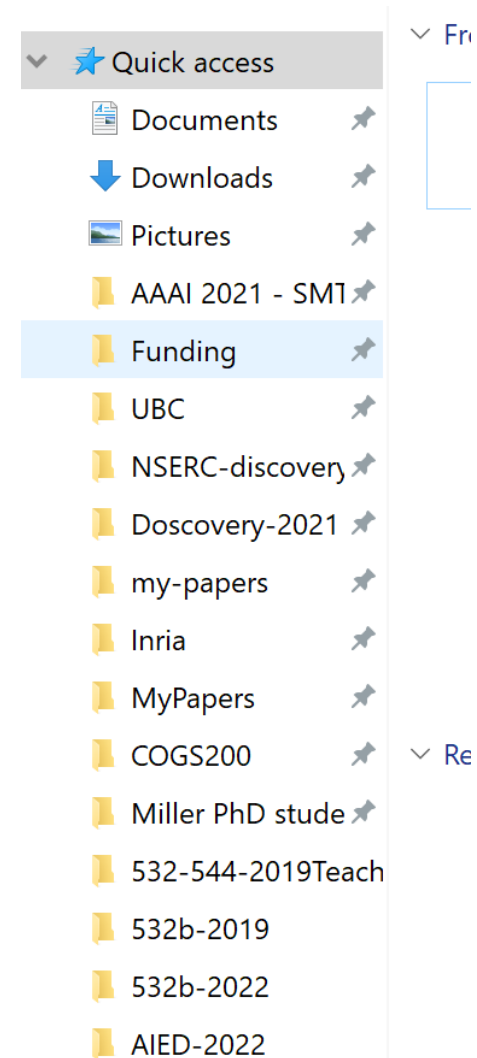
Gajos, Czerwinski, Tan, Weld: Exploring the design space for adaptive graphical user interfaces. AVI 2006: 201-208

Adapting the interface:

Gmail Folder List



Windows "Quick Access"



Adapting the Interface: Appearance

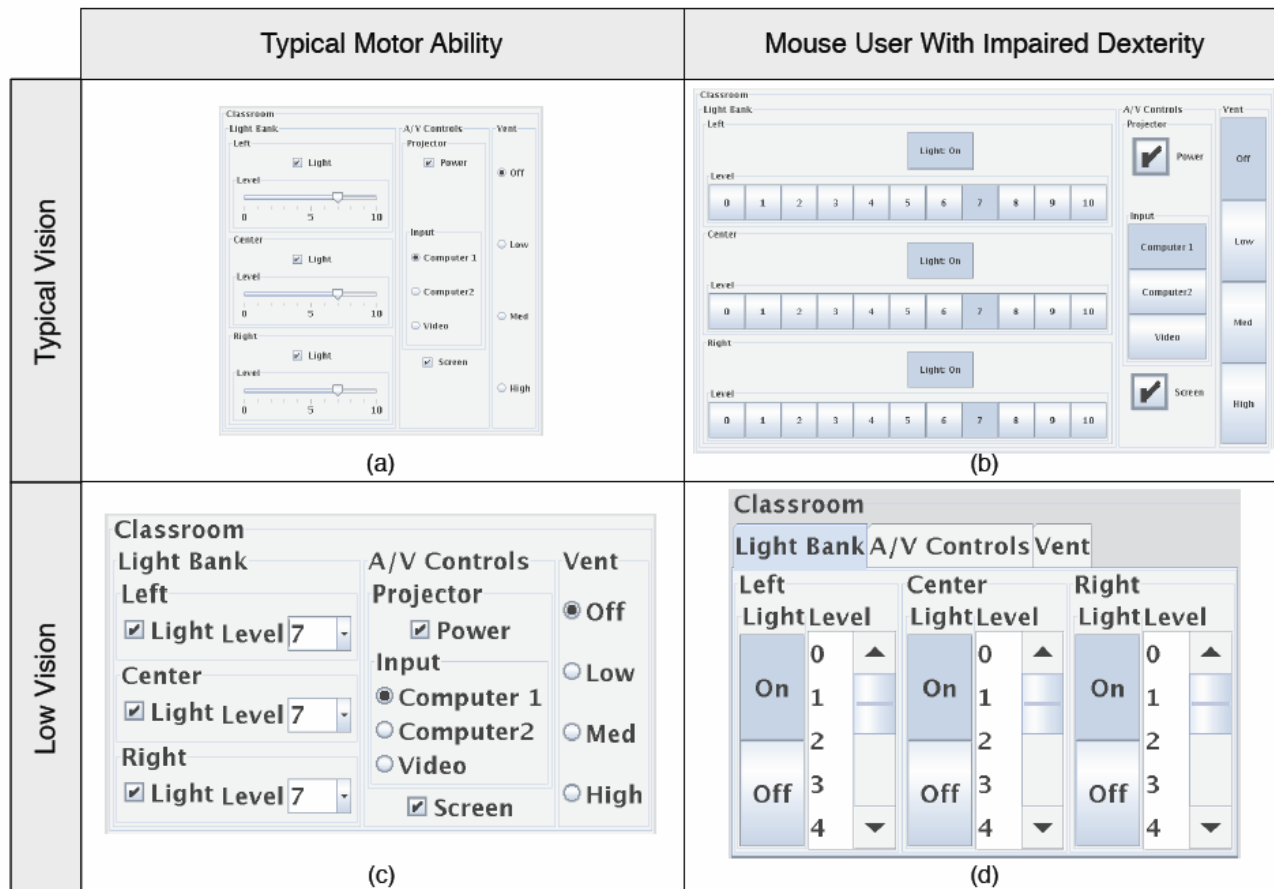


Figure 1: Four GUIs automatically generated under the same size constraints for four different users: (a) a typical mouse user, (b) a mouse user with impaired dexterity, (c) a low vision user and (d) a user with a combination of low vision and impaired dexterity. All but (a) were generated using SUPPLE++ described herein.

Taking over routine tasks: PAL

(Personalized Assistants that Learn)

- Large research initiative sponsored by USA - DARPA to devise all-encompassing personalized assistance

The screenshot displays the 'Emma - emma status' application window. On the left, the 'Enter meeting details' section shows a meeting titled 'emma status' scheduled for Friday, June 13, 2008, from 9:00 am to 10:30 am in Conference Room EJ256. The host is Pauline Berry, and participants include Neil Yorke-Smith and Bart Peintner. Below this, the 'Details for Selected Candidate Event' section provides a summary of the meeting. At the bottom left, 'Ranked Event Candidates' lists several time slots for Friday, with the 9:30 am to 10:30 am slot selected. The main area is a calendar grid for June 2008, showing various meetings and busy periods. A 'Participants' list at the bottom right indicates that Pauline Berry is 'Indifferent', Bart Peintner is 'Interested', and Neil Yorke-Smith is 'Interested'. A message at the bottom right states 'Finished searching for schedules'.

Ptime System for Scheduling Assistance (Berry et al, Knowl. Inf. Syst. 52(2): 379-409 (2017))

- PAL generated several commercial applications, including SIRI

Why UAI?

- High functionality applications: feature overload
 - E.g. word processors, media editors, learning-management systems



Hard to design them to work well for each individual user

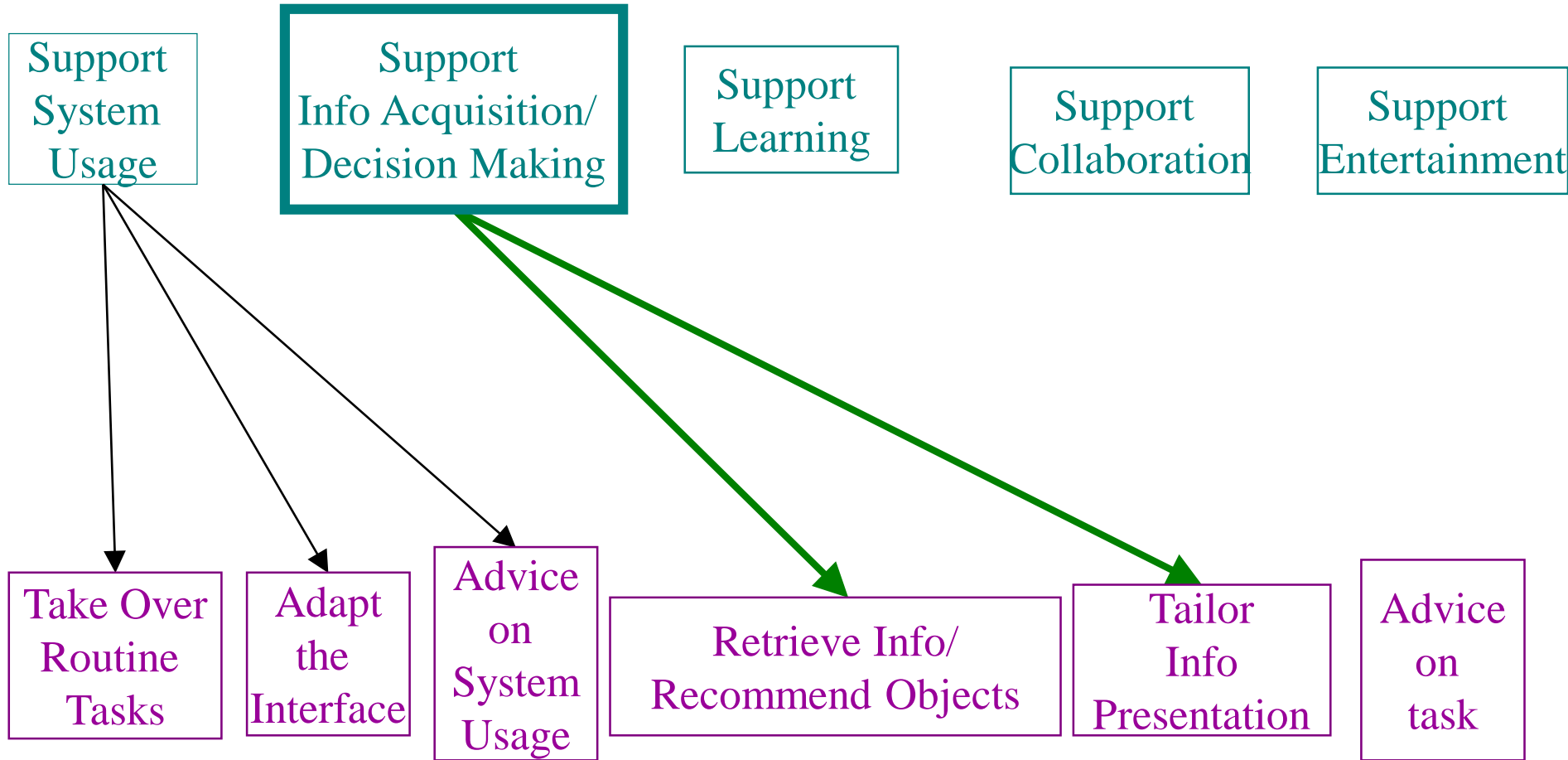
- Specialized applications where personalization is highly valuable
 - web-browsing, recommender systems, e-commerce,
 - education, health
 - computer-supported collaborative work
 - digital entertainment, social media
- And users often **do not know/want** how to personalize (**customize**) their application

Web Browsing, recommender systems, e-commerce applications

- Adaptivity as a solution to the problem of *information overload*
 - Supporting **Info Acquisition** and **Decision Making**
- Some forms of adaptation
 - Retrieve relevant information/ recommend objects
 - Tailor the information presentation

UAI: Functions and Forms (some)

Functions



Forms of Adaptation

Finding Information



google



All

News

Maps

Videos

Images

More

Settings

Tools

About 25,270,000,000 results (0.43 seconds)

Top stories



Smart speakers just a fad? Think again. The year ahead for Alexa, Goo...

CBC.ca

2 days ago



Anker's Roav Bolt is a USB car charger with Google Assistant built...

The Verge

2 hours ago



Apple burns Google in giant billboard touting privacy at CES

The Hamilton Spectator

1 day ago



→ More for google

Recommending objects: MovieLens

movieLens helping you find the *right* movies

Welcome conati | [Logout](#)
You've rated 15 movies.

★★★★★ = Must See
★★★★☆ = Will Enjoy
★★★★☆ = It's OK
★★★☆☆ = Fairly Bad
★★☆☆☆ = Awful

[Home](#) | [Manage Buddies](#) | [Your Preferences](#) | [Help](#)

Found 15 movies | Domain: **Ratings** | Genres: **All** | Dates: **All**
[Show Printer-Friendly List](#) | [Suggest a Title](#)

Page 1 of 1

Predictions for you	Your Ratings	Movie Information	Wish List
★★★★★	5.0 stars	Adventures of Priscilla, Queen of the Desert, The (1994) DVD, info imdb Comedy, Drama	<input type="checkbox"/>
★★★★★	5.0 stars	Almost Famous (2000) DVD, VHS, info imdb Comedy, Drama	<input type="checkbox"/>
★★★★★	5.0 stars	Some Like It Hot (1959) DVD, info imdb Comedy, Crime	<input type="checkbox"/>
★★★★★	5.0 stars	To Die For (1995) info imdb Comedy, Drama	<input type="checkbox"/>
★★★★☆	4.5 stars	Bullets Over Broadway (1994) info imdb Comedy	<input type="checkbox"/>
★★★★	4.0 stars	In the Name of the Father (1993) info imdb Drama	<input type="checkbox"/>
★★★★	4.0 stars	To Kill a Mockingbird (1962) info imdb Drama	<input type="checkbox"/>
★★★★	3.5 stars	Erin Brockovich (2000) DVD, VHS, info imdb Drama	<input type="checkbox"/>
★★★★	3.5 stars	Mask of Zorro, The (1998) DVD, info imdb Action, Adventure, Romance	<input type="checkbox"/>
★★★★	3.5 stars	Mummy, The (1999) DVD, info imdb Action, Adventure, Horror, Thriller	<input type="checkbox"/>
★★★★	3.5 stars	Striptease (1996) DVD, info imdb Comedy, Crime	<input type="checkbox"/>
★★★	3.0 stars	High Fidelity (2000) DVD, VHS, info imdb Comedy	<input type="checkbox"/>
★★★	3.0 stars	Talented Mr. Ripley, The (1999) DVD, VHS, info imdb Drama, Mystery, Thriller	<input type="checkbox"/>
★★☆	2.5 stars	Patriot, The (2000) DVD, VHS, info imdb Action, Drama, War	<input type="checkbox"/>
★	1.0 stars	Green Mile, The (1999) DVD, VHS, info imdb Drama, Thriller	<input type="checkbox"/>

Windows taskbar: Start, Palm Desktop, cascade - Sec..., 532b-2003, Local Disk (C:), Microsoft Phot..., intro-class.ppt, Download Man..., Re: info on Qu..., movieLens, 3:25 PM

Recommending Objects: Ads!

E.g. Google/Gmail ads

How Gmail ads work


When you open Gmail, you'll see ads that were selected to show you the most useful and relevant ads. The process of selecting and showing personalized ads in Gmail is fully automated. These ads are shown to you based on your online activity while you're signed into Google. We will not scan or read your Gmail messages to show you ads.

Tailoring Information Presentation: SETA (Ardissono & Goy, 2000)


Url: <http://silk.d.unito.it:8081/setaZone/newShellnegoziio.SnMgr?action=next&next=facile> Arg correlati


[phones](#) [answering machines](#) [fax](#) [multi-line phones](#) [switchboards](#)

4 - **Facile**




Lit. 108000

 [put Facile in the cart](#)


 [Technical info](#)

- The size of the item is: 150x70x210 ([help](#))
- It is available in the following colors: grey, black ([help](#))
- The initial message of the answering machine can be at most 60 seconds long ([help](#))
- It stores the received messages using a secure technology, which enables you to listen to them without rewinding the tape ([help](#))
- The answering machine stores messages lasting, all together, at most 25 minutes ([help](#))


 [more information](#)

Tailor Information Presentation: SETA


7 - Facile



Lit. 108000




[put Facile in the cart](#)



[technical info](#)

- **Message storage on digital memory** ([help](#))
- **Maximum length of the initial message: 60 sec.** ([help](#))
- **Maximum length of the stored messages: 25 min.** ([help](#))
- **Available colors: grey, black** ([help](#))
- **Size: 150x70x210** ([help](#))
- **Exhausted Memory warning message** ([help](#))
- **Filtering function** ([help](#))
- **Led** ([help](#))
- **Possibility to remotely listen to messages and delete them** ([help](#))
- **Memo facility** ([help](#))



[more information](#)

Figure 14. Detail of a presentation page describing the “Facile” answering machine, tailored to an expert user.

Support to Learning/Training

- Which forms of adaptation are relevant?

Support
Learning

Take Over
Routine
Tasks

Adapt
the
Interface

Advice
on
System
Usage

Retrieve Info/
Recommend Objects

Tailor
Info
Presentation

Advice
on
task

Forms of Adaptation

AutoTutor (Graesser et al 2000, 2010)

- Helps students learn a variety of topics by guiding them in question-answering dialogues

The screenshot displays the AutoTutor software interface. At the top, a menu bar includes 'File', 'Edit', 'Session', 'Plugins', and 'Help'. Below the menu, a question is posed: 'How does the operating system interact with the word processing program when you create a document?'. On the left side, there is a 3D-rendered female avatar with short dark hair, wearing a blue blazer. To the right of the avatar is a diagram of a computer system. The diagram shows a monitor, keyboard, and mouse. Inside the computer case, there is a 'HARD DISK' at the top, a 'CPU' at the bottom, and a central area labeled 'OS' (Operating System) containing a 'WORD PROCESSING PROGRAM' and a 'DOCUMENT'. A 'ROM' is also shown. Arrows indicate the flow of data and interaction between these components. Below the avatar and diagram, there is a 'Log of previous responses' section containing text about installing a statistics program named 'business stat'. To the right of the log is a text input field with the text 'The operating systems helps you use the word processing pi'. A 'Submit' button is located at the bottom right of the interface.

Andes (Conati et al 2002, Vanlhen et al 2005)

- Provides an interface for students to solve physics problems
- Interactively monitors the student's problem solution and intervenes with adaptive suggestions when the student needs help (**coached problem solving**)

The screenshot shows the ANDES Physics Workbench interface. The main window title is "ANDES Physics Workbench - [P11-2-Solution.fbd]". The menu bar includes "File", "Edit", "Diagram", "Variable", "View", and "Help". The toolbar contains various icons for file operations and physics tools.

The problem text reads: "A 2000-kg car in neutral at the top of a 20-degree inclined driveway 20 m long slips its parking brake and rolls down. Assume that the driveway is frictionless. At what speed will it hit the garage door?"

The answer field is empty, with the text "Answer:" to its left.

Below the text is a diagram of a red car on a 20-degree inclined driveway. The driveway is labeled "20 m" and "20°". To the left of the diagram is a free-body diagram for the car, showing a green circle representing the car with a red arrow pointing up labeled "N", a green arrow pointing down labeled "Fw", and a green circle labeled "c".

At the bottom of the main window, there is a text box that says: "Think about what you need to do in order to have a complete free body diagram for the car." Below this text are two buttons: "Explain further" and "Hide".

On the right side of the interface, there is a "Variables" panel with a table:

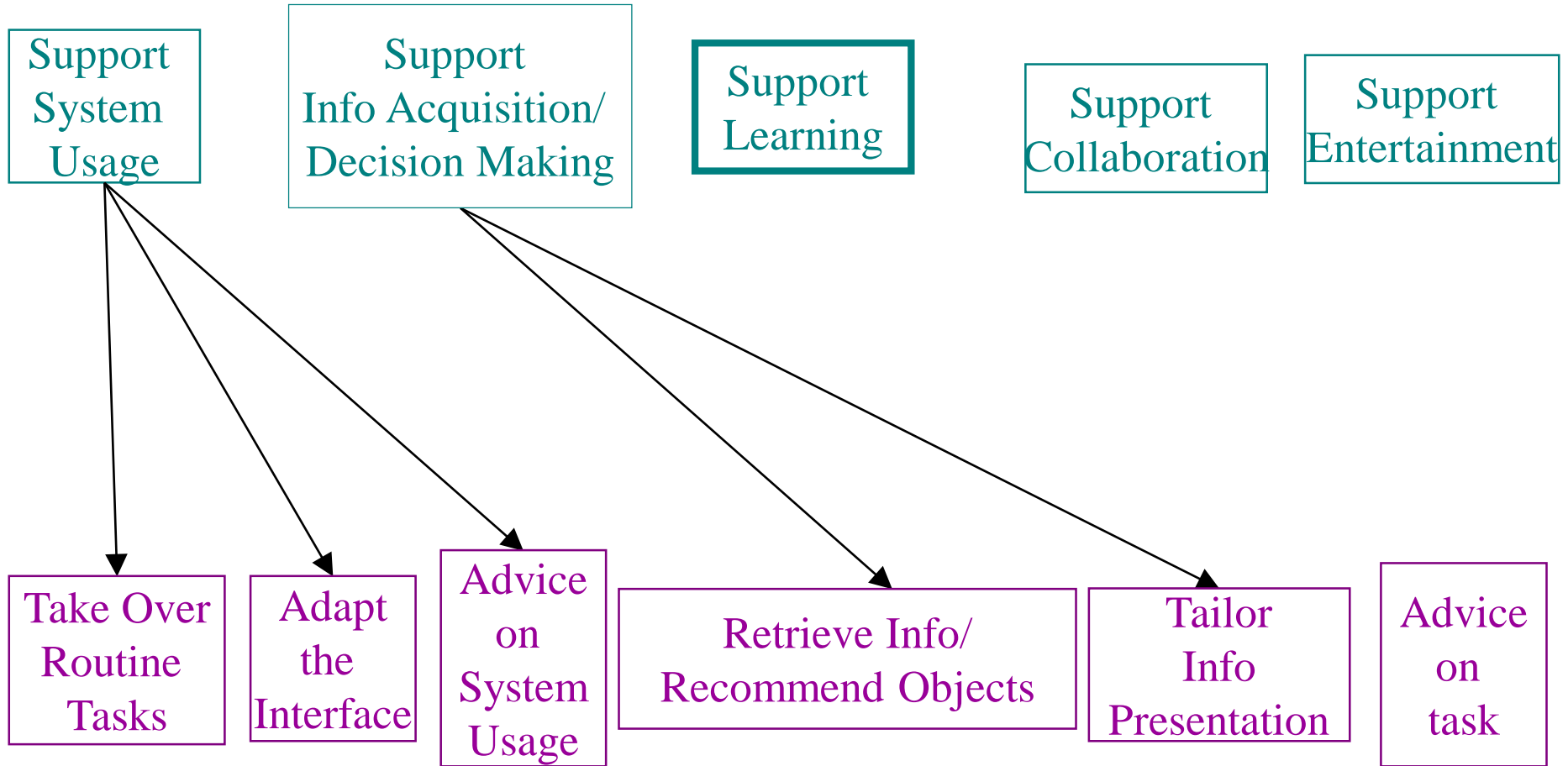
Name	Definition	X-Comp	Y-Comp
☺ T0	car starts rolling		
☺ T1	car hits garage door		
✓ mc	mass of car		
✓ Fw	magnitude of the Weight For...		

Below the variables panel is a list of seven empty input fields. The first field contains the equation $F_w = mc * g$ in green text.

At the bottom of the interface, there is a status bar with the text "For Help, press F1" on the left, a "NUM" button, and a timer showing "00:02:11".

UAI: Functions and Forms (some)

Functions



Forms of Adaptation

Support to Learning/Training

- Most forms of adaptations are relevant
 - Provide help on both **interface usage** and **learning tasks**
 - Take over routine tasks **not crucial for learning**
 - Adapt the interface to facilitate learning
 - Help finding information
 - Recommend learning material (lessons, exercises, activities)
 - Tailor content/presentation of learning material

UAI: Functions and Forms (some)

Functions

Support
System
Usage

Support
Info Acquisition/
Decision Making

Support
Learning

Support
Collaboration

Support
Entertainment

Take Over
Routine
Tasks

Adapt
the
Interface

Advice
on
System
Usage

Retrieve Info/
Recommend Objects

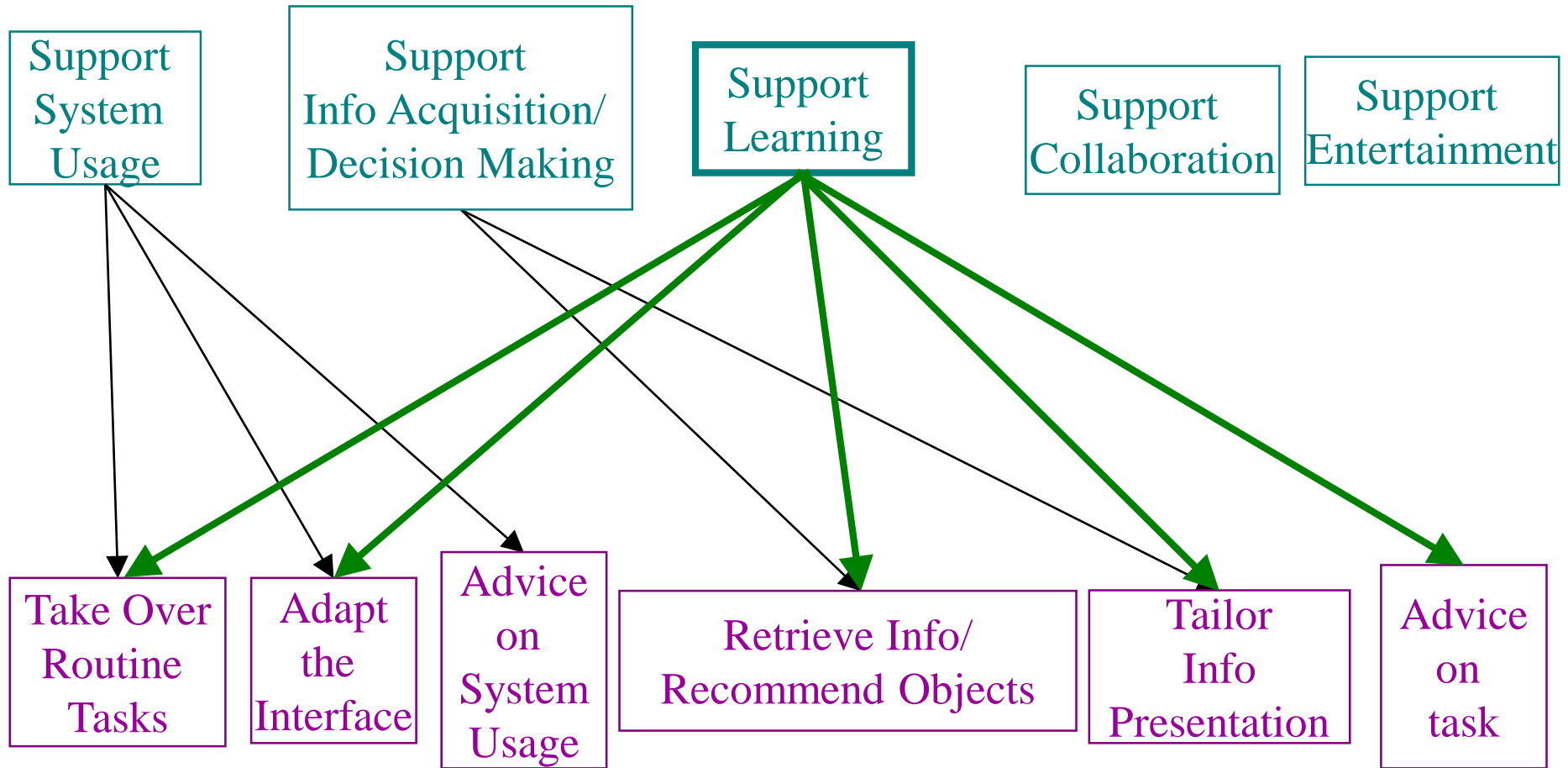
Tailor
Info
Presentation

Advice
on
task

Forms of Adaptation

UAI: Functions and Forms (some)

Functions



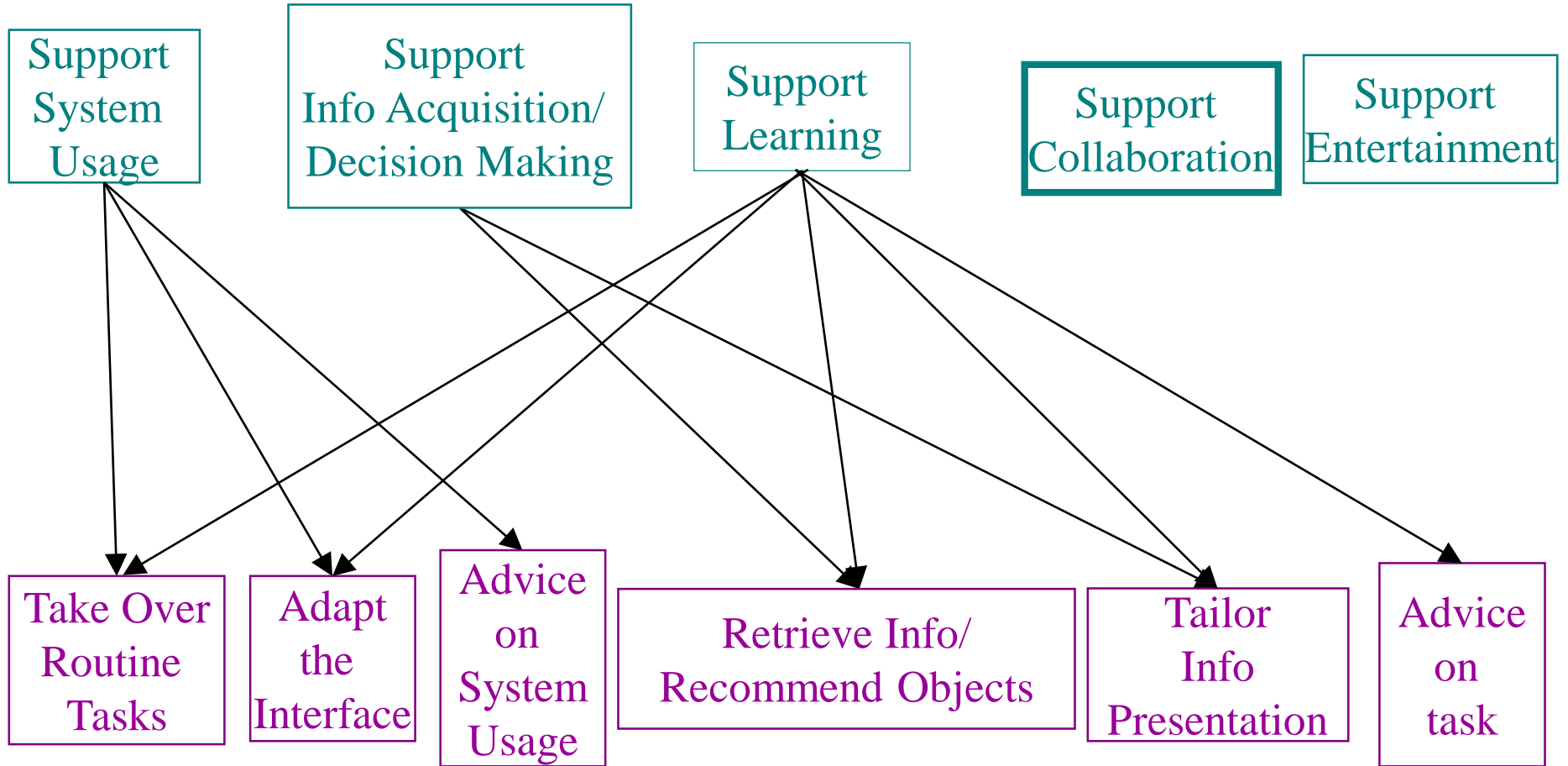
Forms of Adaptation

Support Collaboration

- Help people interact effectively
 - Computer-Supported Collaborative Work (CSCW)
 - Computer-Supported Collaborative Learning (CSCL)
- Specific forms of adaptation for collaboration?

UAI

Functions



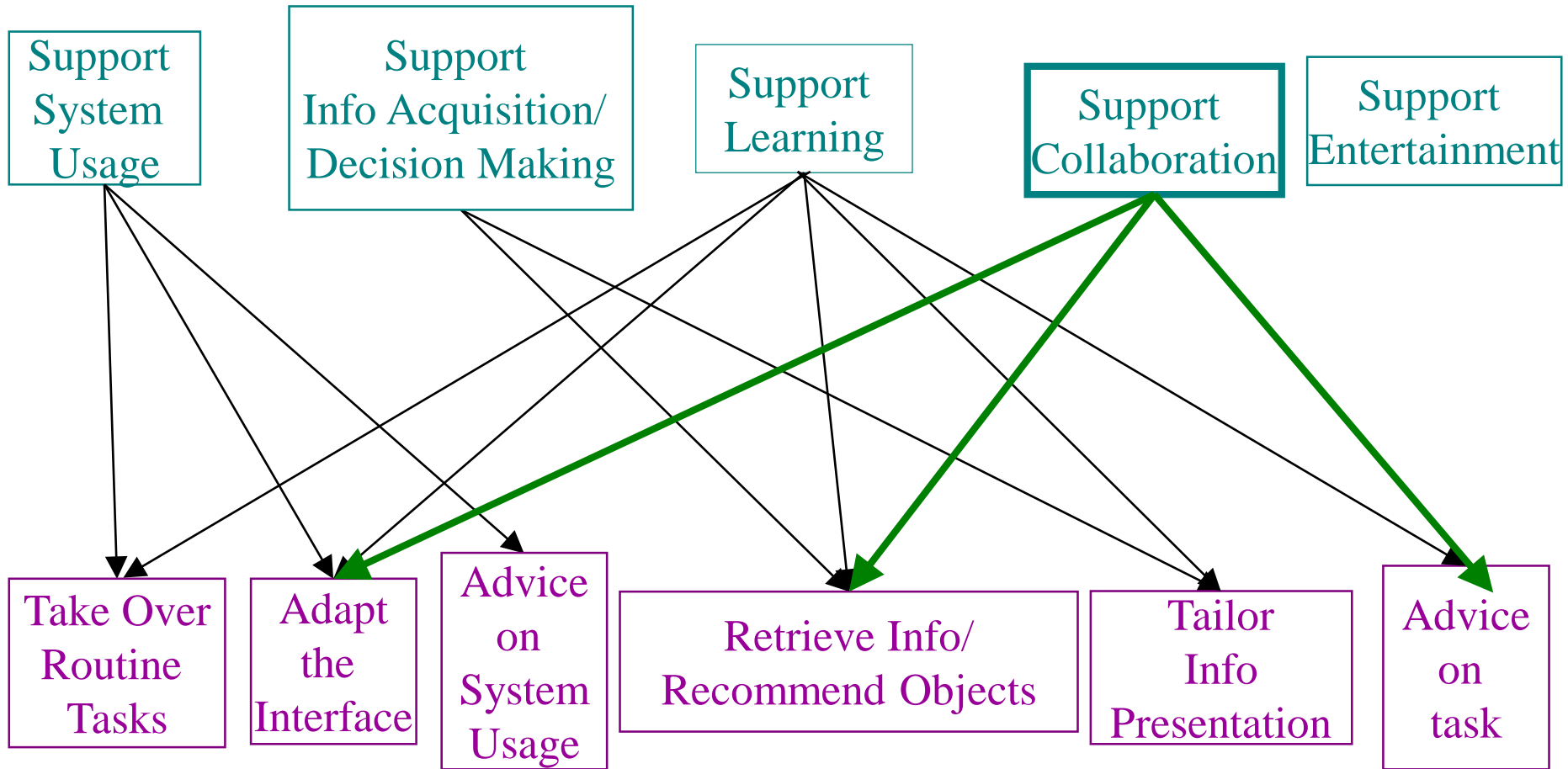
Forms of Adaptation

Support Collaboration

- Recommend suitable collaborators
- Give advice on collaboration process
- Adapt the interface to facilitate collaboration
 - E.g., enforce specific roles

UAI: Functions and Forms (some)

Functions



Forms of Adaptation

Support Entertainment/Social media

□ Explosion of applications

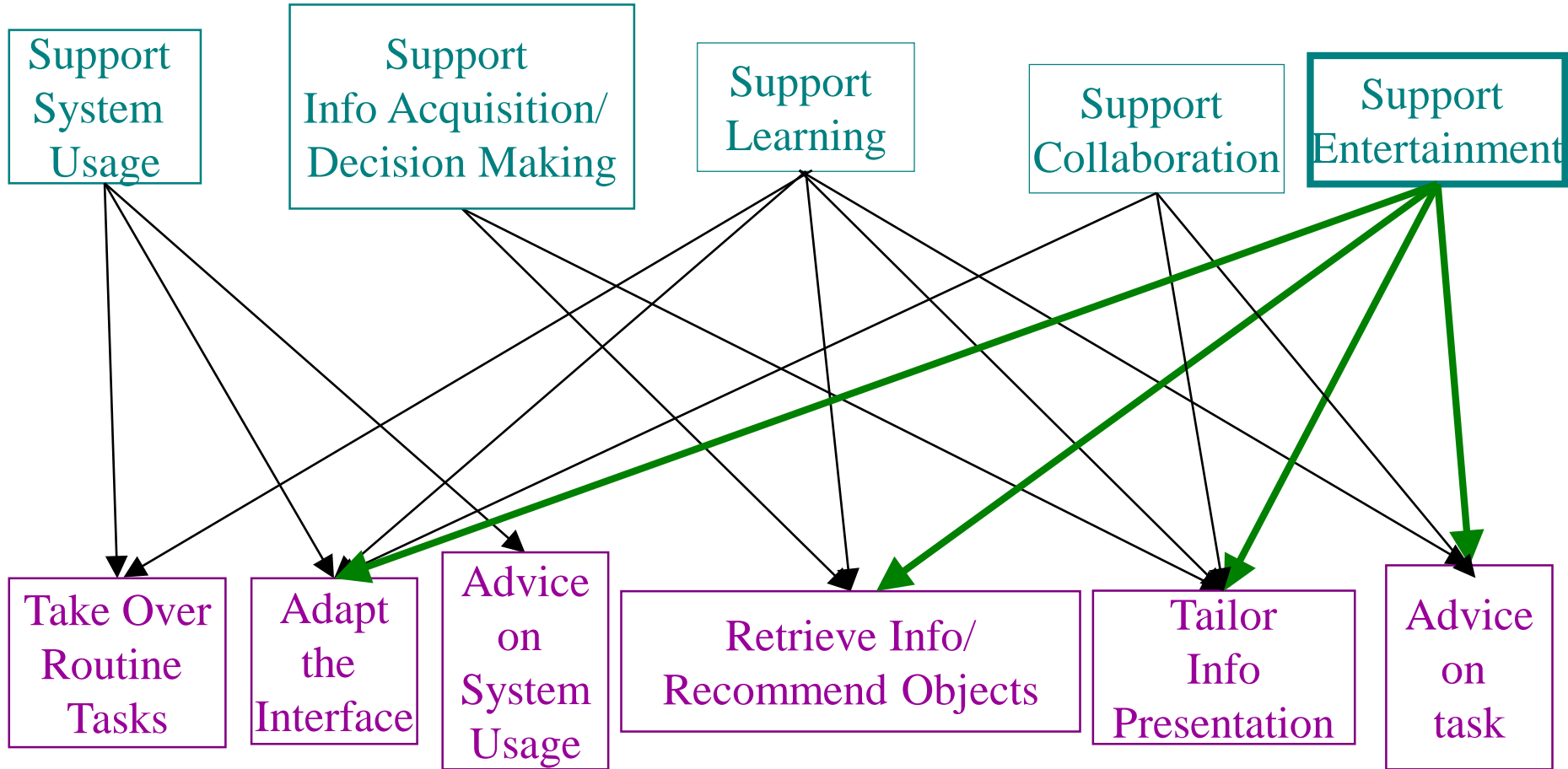
- User-Adaptive Games
- Adaptive TV (e.g. Netflix, Amazon Prime)
- Social Media

□ Again, many forms of adaptation can be relevant

- Recommend games, partners, friends, TV programs, tweets
- Adapt the interface to maintain engagement
- Adapt information presentation
- Advice on task

UAI

Functions



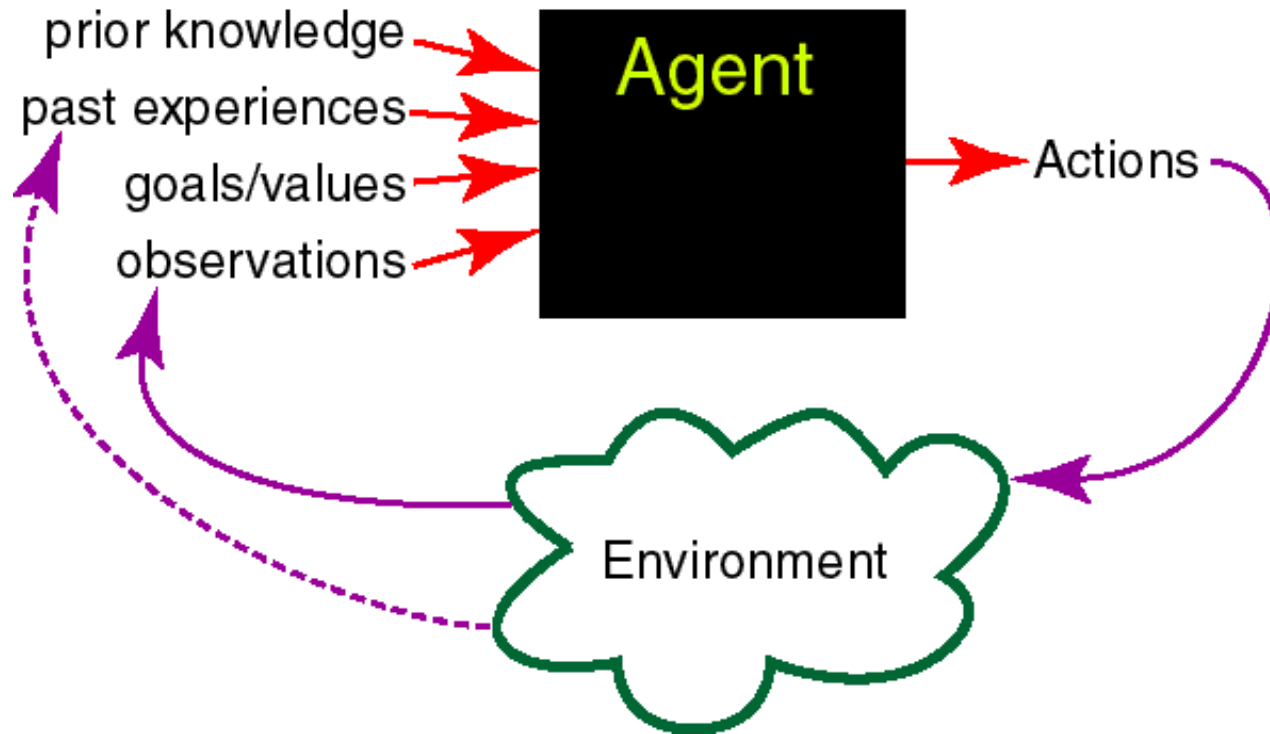
Forms of Adaptation

Overview

- ❑ Functions and Forms of Adaptive IUIs
- ❑ Components
- ❑ Usability and Evaluation

Intelligent Agent (Poole and Mackworth 2010)

- Its actions are *appropriate* for its goals and circumstances
 - Including *limited resources*
- It is *flexible* to changing environments and goals
- It *learns* from experience



Representation and Reasoning

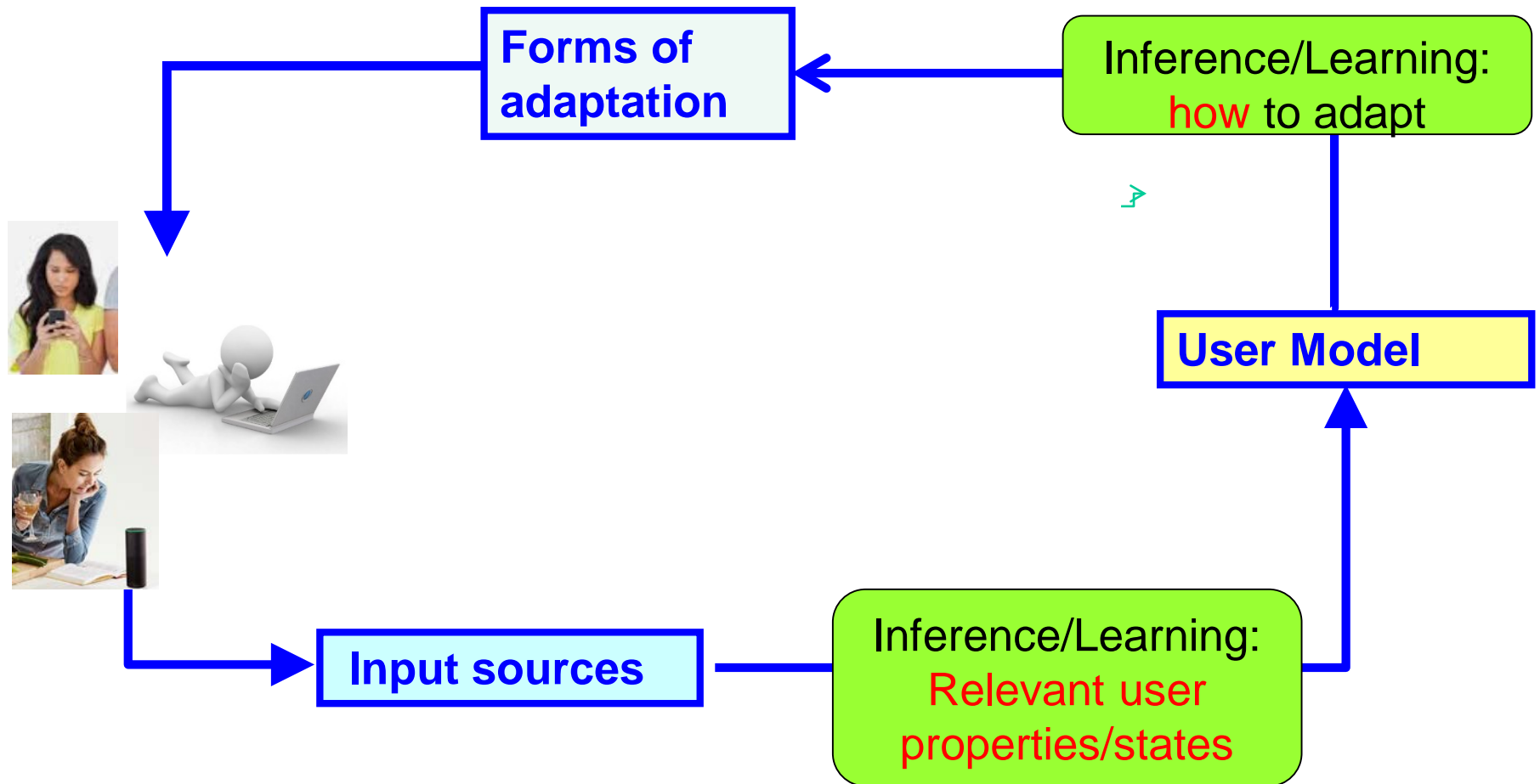
- ❑ To reason about the environment an agent needs to represent it => ***knowledge***
- ❑ One of AI goals: specify techniques to
 - Acquire and represent knowledge about a domain
 - Use the knowledge to solve problems in that domain

Knowledge in UAI

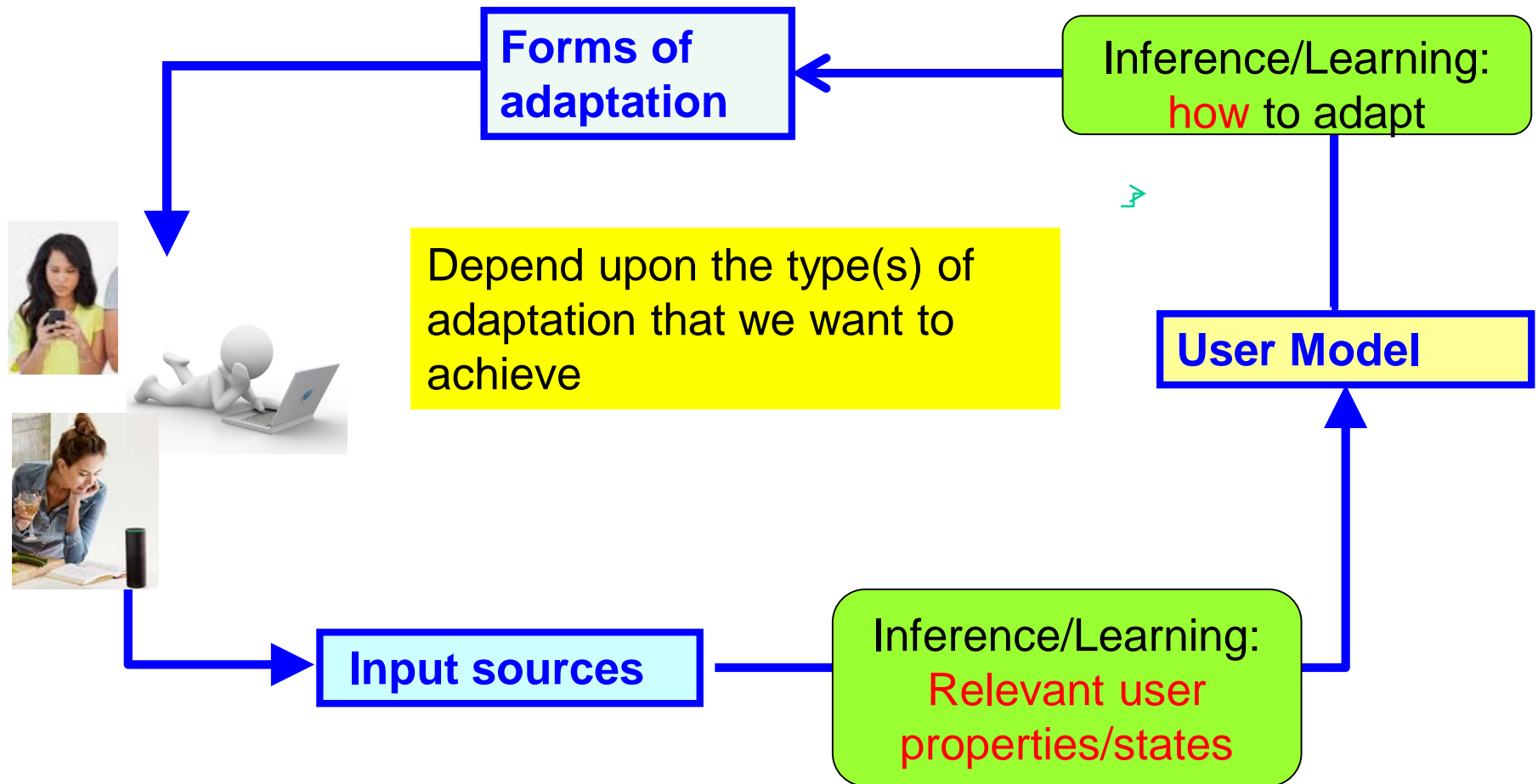
Knowledge in UAI

- ❑ Knowledge about the user (*user model*)
- ❑ Knowledge about the application domain/task (*domain model*)
- ❑ Knowledge about the communication process (*interaction model*)

User Model: Which User Properties Should be Represented?




User Model: Which User Properties are Represented?




Example: SETA


7 - Facile



Lit. 108000



put Facile in the cart




technical info

- **Message storage on digital memory** ([help](#))
- **Maximum length of the initial message: 60 sec.** ([help](#))
- **Maximum length of the stored messages: 25 min.** ([help](#))
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- **Led** ([help](#))
- **Possibility to remotely listen to messages and delete them** ([help](#))
- **Memo facility** ([help](#))


Tailoring the Interaction with Users in Web Stores

41


7 - Facile



Lit. 108000



put Facile in the cart



technical info

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- **Memo facility** ([help](#))

more information

Figure 14. Detail of a presentation page describing the “Facile” answering machine, tailored to an expert user.

SETA: Which User Properties are Represented?

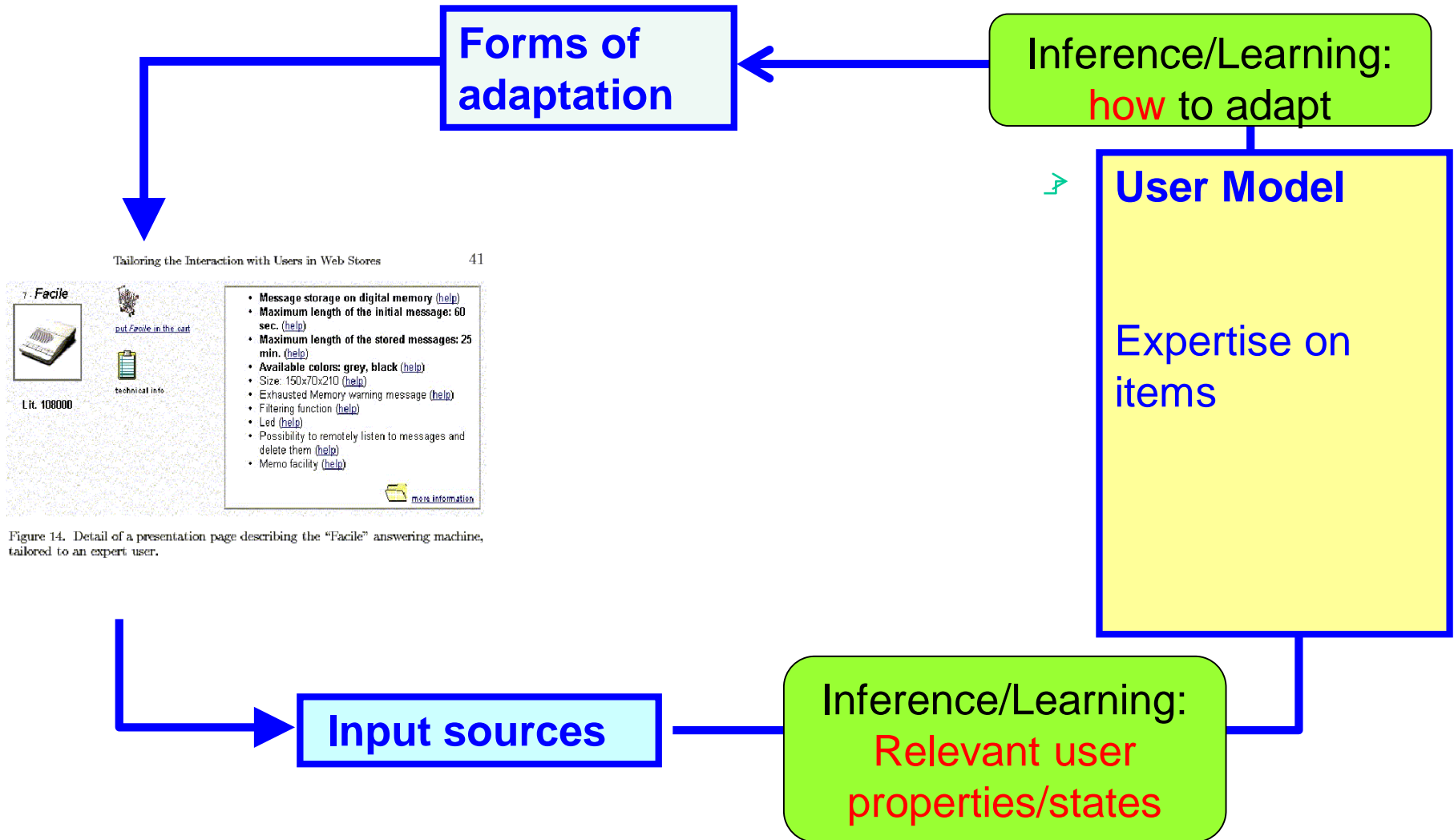


Figure 14. Detail of a presentation page describing the "Facile" answering machine, tailored to an expert user.

Example: DiamondHelp

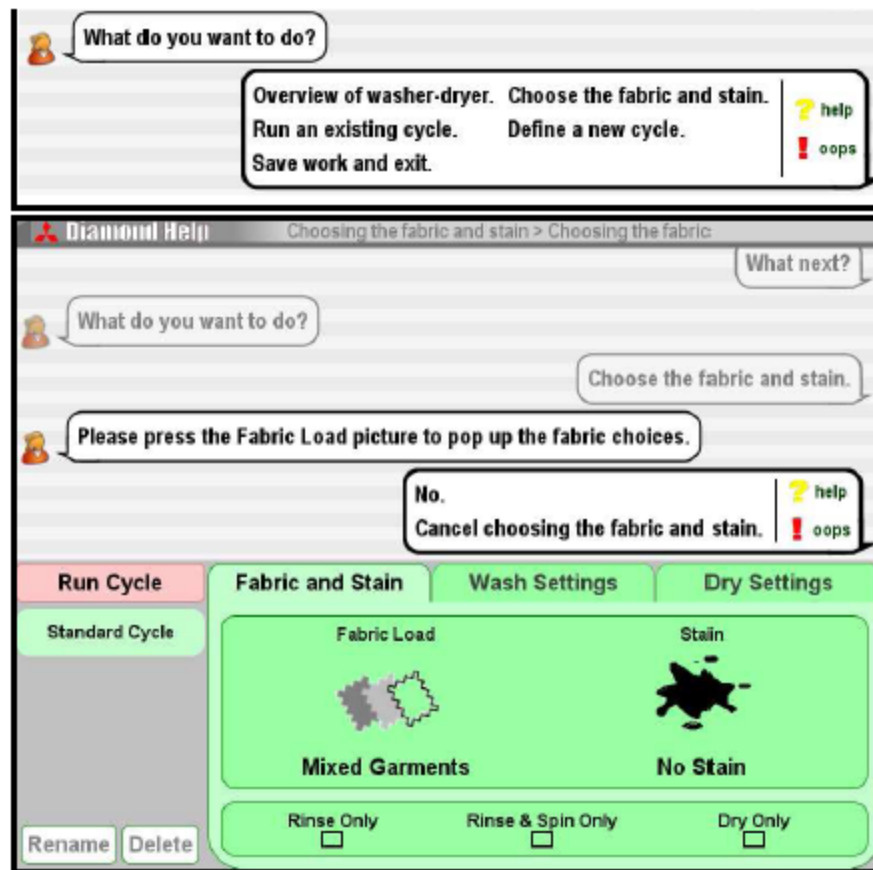


Figure 15.8. Example of collaborative assistance offered by DIAMONDHELP.

DH: Which User Properties are Represented?

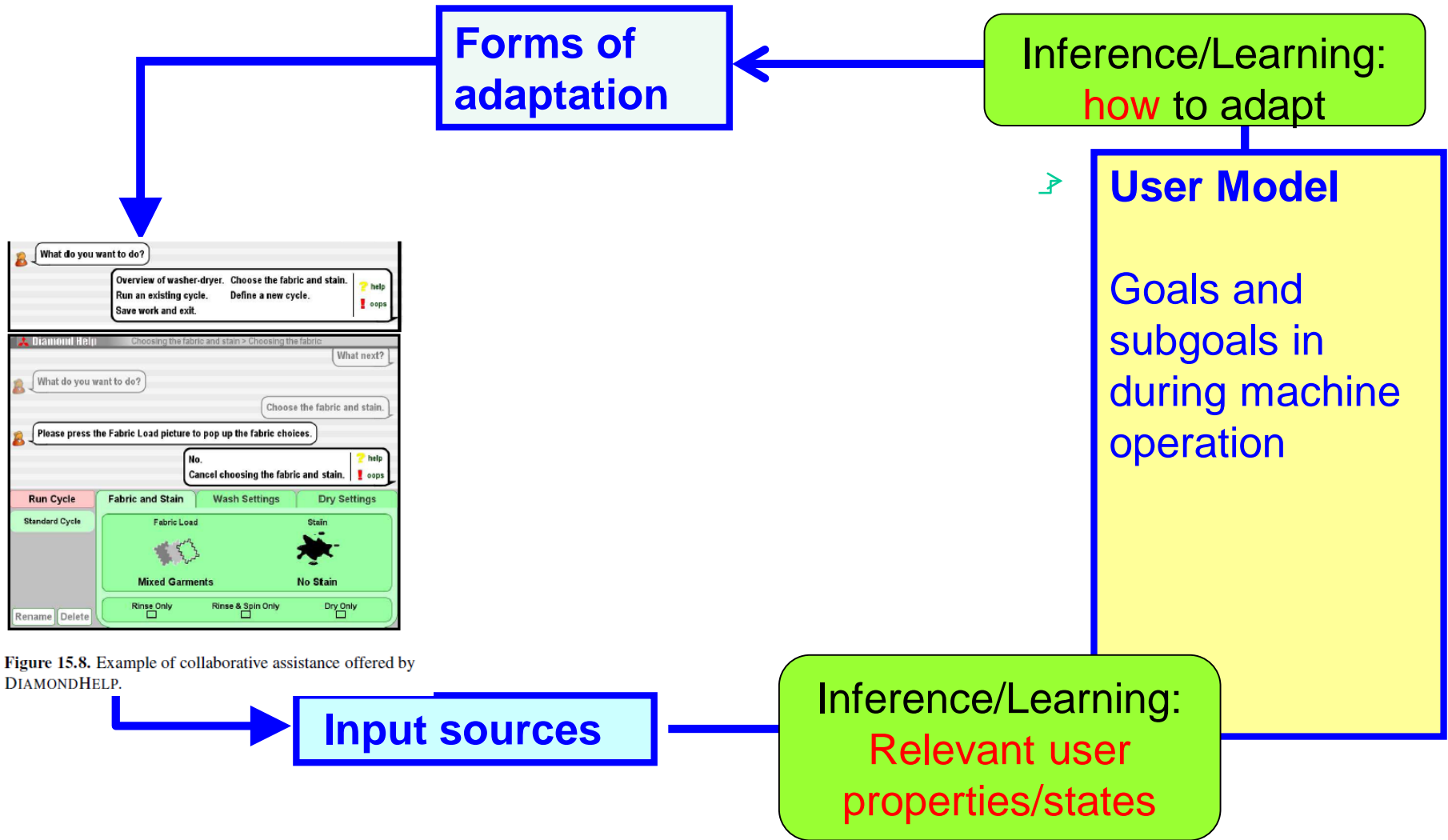
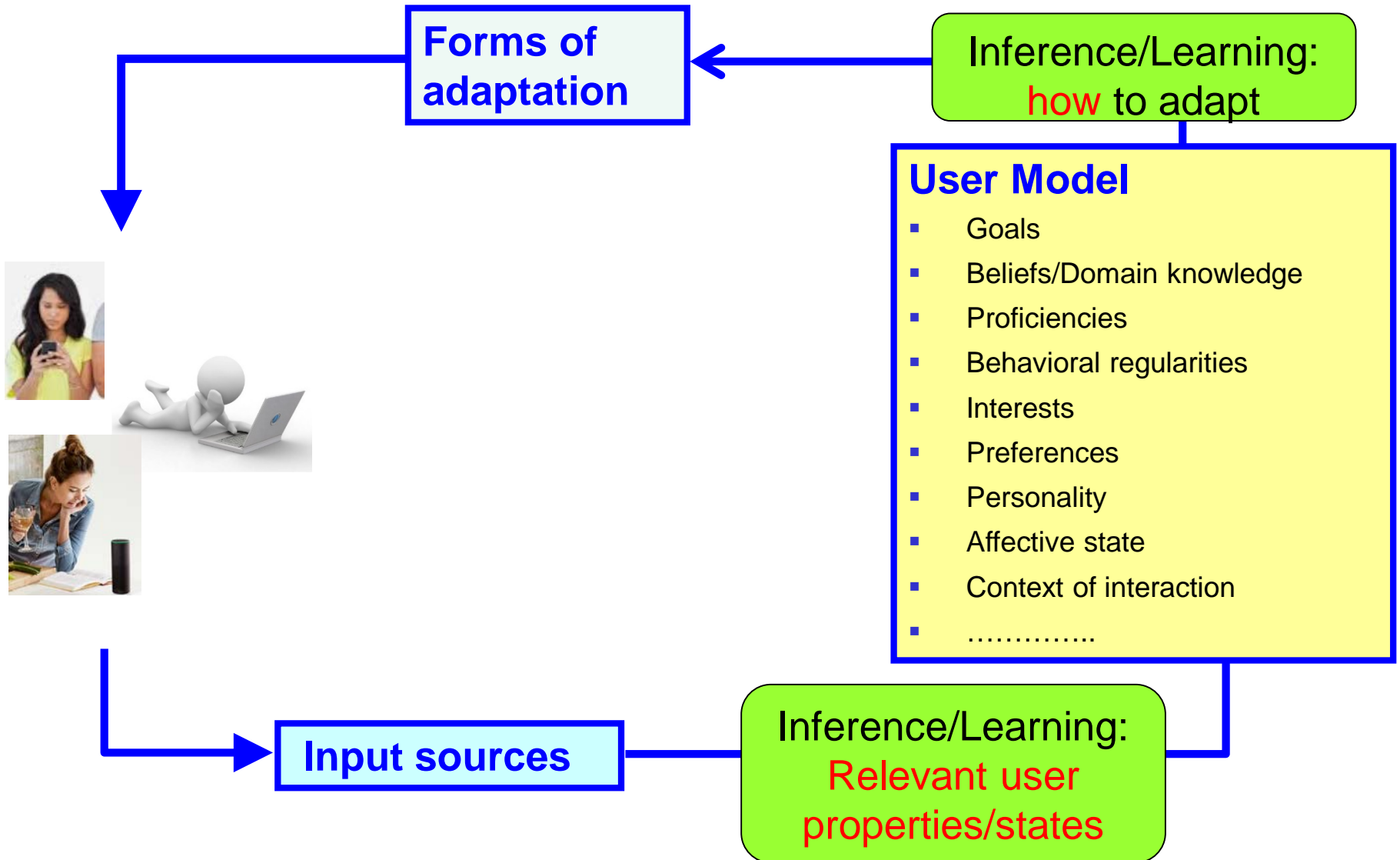


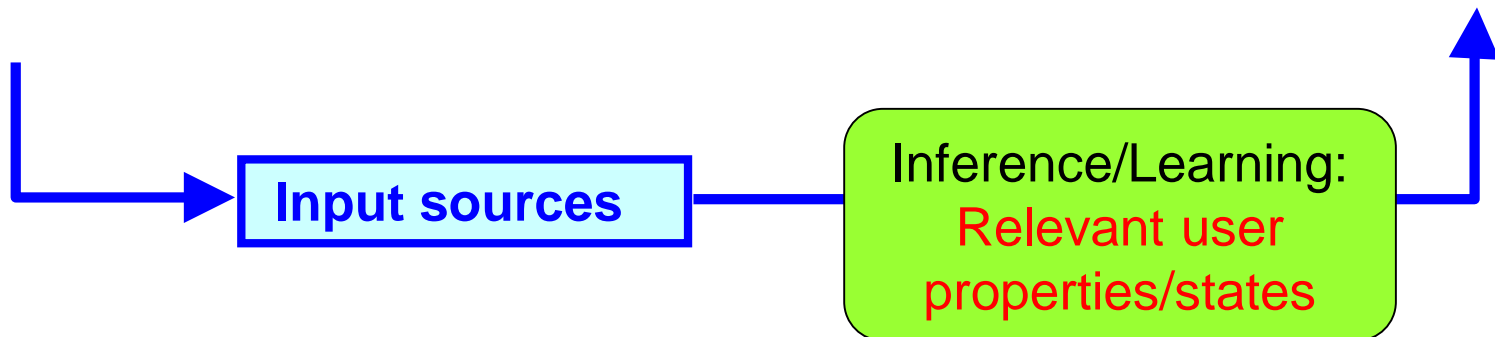
Figure 15.8. Example of collaborative assistance offered by DIAMONDHELP.

Which User Properties are Represented?



User Model: Acquisition

User's input + inference/learning mechanisms



User's input

□ Explicit

- Self-reports (personal characteristics, proficiencies, interests)
- Tests
- Evaluations of specific objects

□ Non Explicit

- Naturally occurring actions (e.g., mouse clicks, scrolling..)
- Low level measures of psychological states (e.g. facial expressions, eye-gaze, hart rate).
- Low-level measures of context (e.g., position via GPS)

Acquisition mechanisms

□ Knowledge-Based (or Expert-Based)

- Define rules (deterministic or probabilistic) to identify relevant user properties based on existing theories/knowledge

□ Data-Based

- Learn relevant user features from data (e.g. labeled or unlabelled example behaviors)

□ Hybrid

Knowledge-Based Example

A computer tutor can use expert-defined rules to infer student's knowledge of a particular topic from her correct or incorrect answers, or from knowledge of related topics

If answer to question X is correct

Then there is a probability $p(c)$ that the user knows topic T

If answer to question X is incorrect

Then there is a probability $p(i)$ that the user knows topic T

Knowledge-Based Example

ACT-R Models for Intelligent Tutoring Systems

Eq: $5x+3=30$; Goals: [Solve for x]

- Rule: To solve for x when there is only one occurrence, unwrap (isolate) x.

Eq: $5x+3=30$; Goals: [Unwrap x]

- Rule: To unwrap ?V, find the outermost wrapper ?W of ?V and remove ?W

Eq: $5x+3=30$; Goals: [Find wrapper ?W of x; Remove ?W]

- Rule: To find wrapper ?W of ?V, find the top level expression ?E on side of equation containing ?V, and set ?W to part of ?E that does not contain ?V

Eq: $5x+3=30$; Goals: [Remove "+3"]

- Rule: To remove "+?E", subtract "+?E" from both sides

Eq: $5x+3=30$; Goals: [Subtract "+3" from both sides]

- Rule: To subtract "+?E" from both sides

Eq: $5x+3-3=30-3$

Data-based example

Agent that helps users discriminate which newsgroup (or tweeter) postings to read and which ones to skip

	Action	Author	Thread	Length	Where
e1	skips	known	new	long	home
e2	reads	unknown	new	short	work
e3	skips	unknown	old	long	work
e4	skips	known	old	long	home
e5	reads	known	new	short	home
e6	skips	known	old	long	work

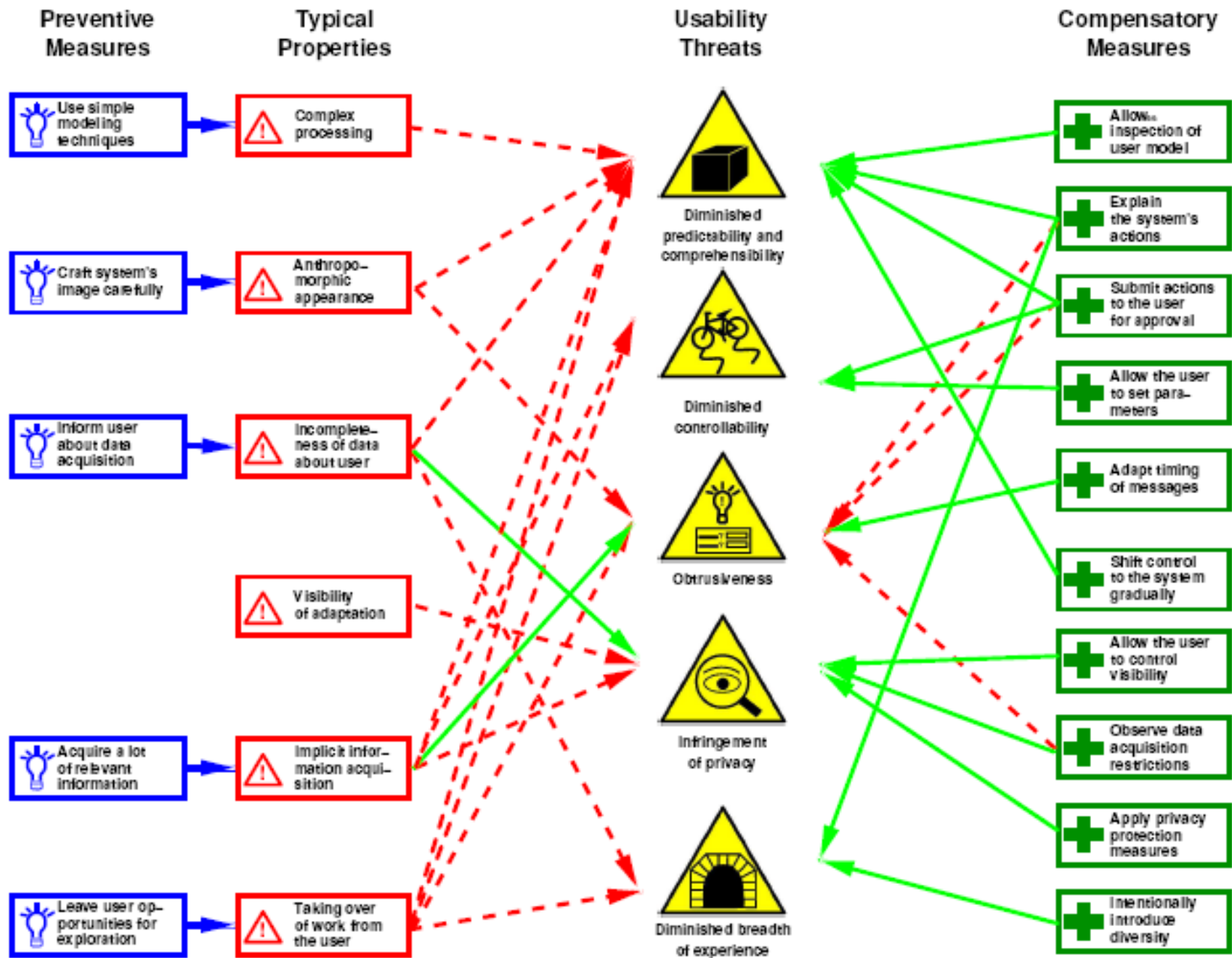
Learn how to classify new postings on property **Action** (*skip, read*) from attributes *Author, Thread, Length, and Where*, based on existing labeled examples

Domain Model

- ❑ *Closed World* (e.g. domain to be taught in educational application)
 - Usually well defined
 - Rich representations are possible
- ❑ *Open World* (e.g. the Web)
 - Ill defined
 - Requires to deal with lower levels of representation

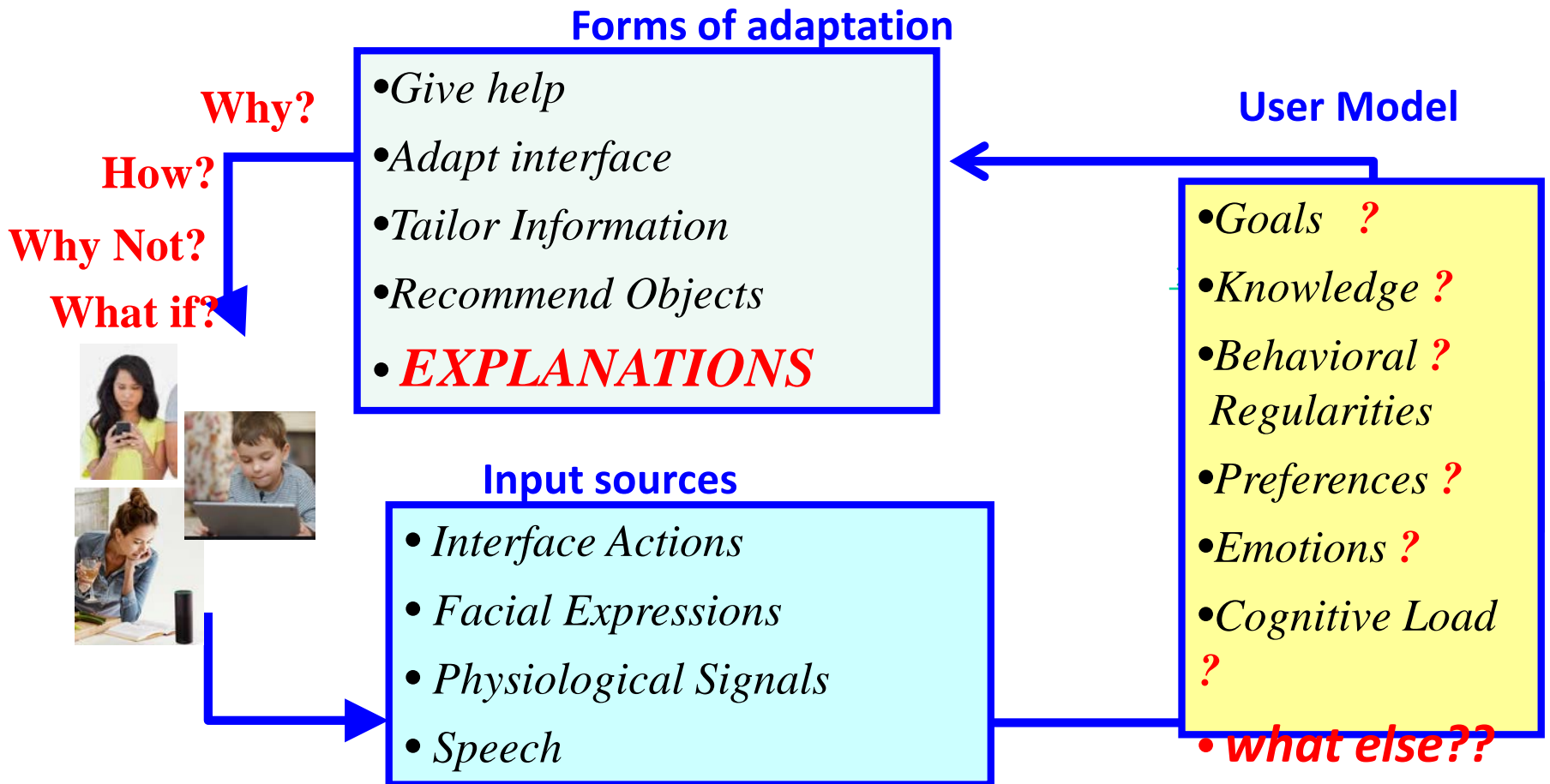
Communication Model

- ❑ How different forms of adaptation are actually implemented in the interface
- ❑ Must follow design principles for usability
 - Predictability and Transparency
 - Controllability
 - Unobtrusiveness
 - Privacy
 - Breadth of Experience



Vision: Personalized XAI

- Intelligent systems that understand to **whom**, **when** and **how** to provide **explanations**
- Good UI tools for users to **access then on demand**



Overview

- ❑ Functions and Forms of Adaptive IUIs
- ❑ Components
- ❑ Usability and Evaluation

Evaluation of Adaptive UI

□ For performance and user satisfaction

- Wizard of Oz Studies
- Simulations using data from a non-adaptive system
- Controlled studies
- Field Studies

Some Topics

- Supporting System Use:
 - Taking Over Routine Tasks
 - Providing Help
 - Tailoring the Interface
- Adaptive Support to Learning
 - Student Modeling
 - Model Tracing and Issue Tracing Tutors
 - Decision Theoretic Tutors
- Supporting Info Acquisition/Decision Making
 - Support for Browsing
 - Recommending Products
 - Adapting Info Presentation
- Explanation, Trust, Transparency, Fairness in UAI
- Conversational Agents
- Modeling and adapting to
 - User Affect
 - Cognitive Measures (cognitive load, attention)
 - Meta-Cognition

Can add specific topics
students are interested in

Next Time

Tu. 18 Mixed-Initiative
Interaction

E. Horvitz. [Principles of Mixed-Initiative User Interfaces](#). CHI '99, 159166

One question | by noon Monday

No summary

Bunt A., Conati C. and McGrenere J. (2007). [Supporting Interface Customization Using a Mixed-Initiative Approach](#). *IUI 2007, International Conference on Intelligent User Interfaces*, 92-101.

One Question and summary by noon Monday

(post questions in Piazza folder "Jan18")

Please take the survey

CPSC 532C/554C 201 2021W2 Topics in Artificial Intelligence - HUMAN-CENTRED AI

[Jump to Today](#)

 Edit

532C / 554C (cross-listed)

Human-Centred AI

Spring 2022

[Cristina Conati](#)

Class Data	Course Description	Coursework	Sample Contents	Schedule and reading	Marking Scheme	Important deadlines
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Survey for students

<https://www.surveymonkey.com/r/BYTVN73>