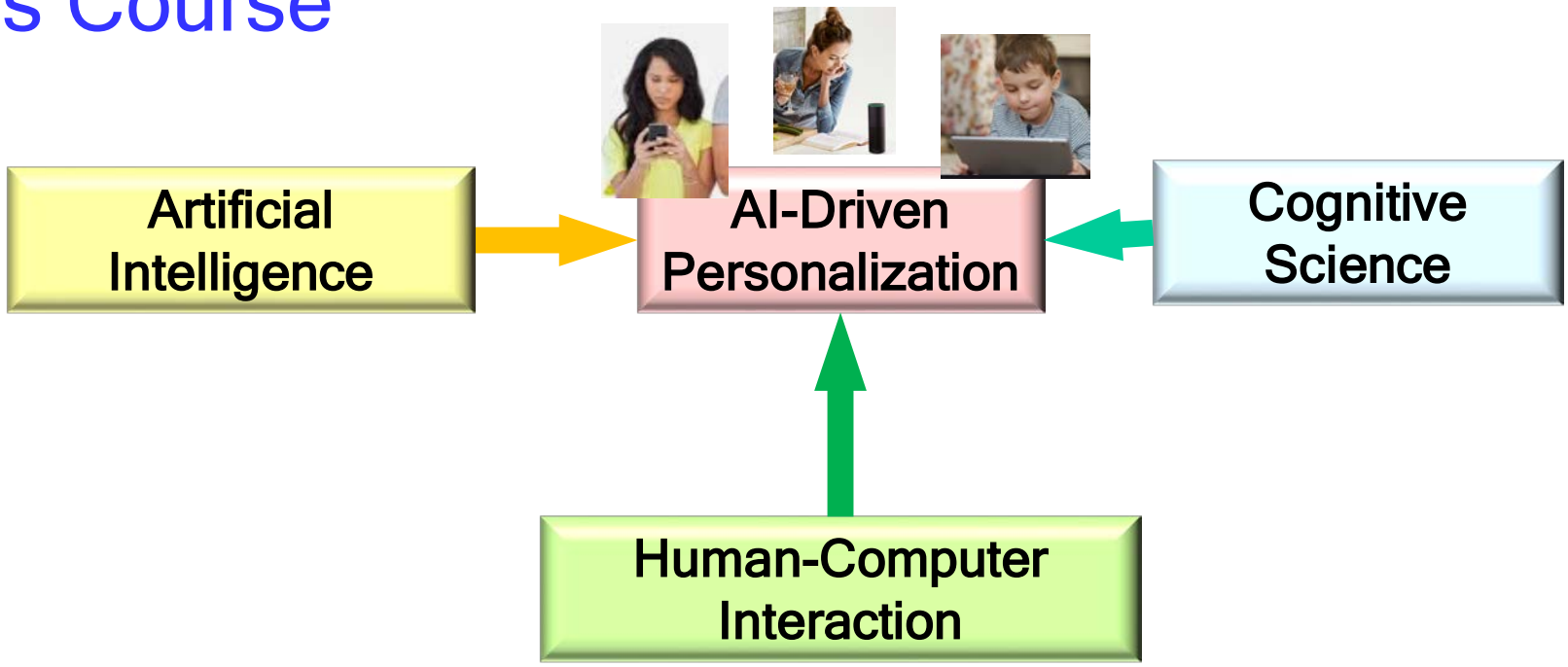
Jameson paper

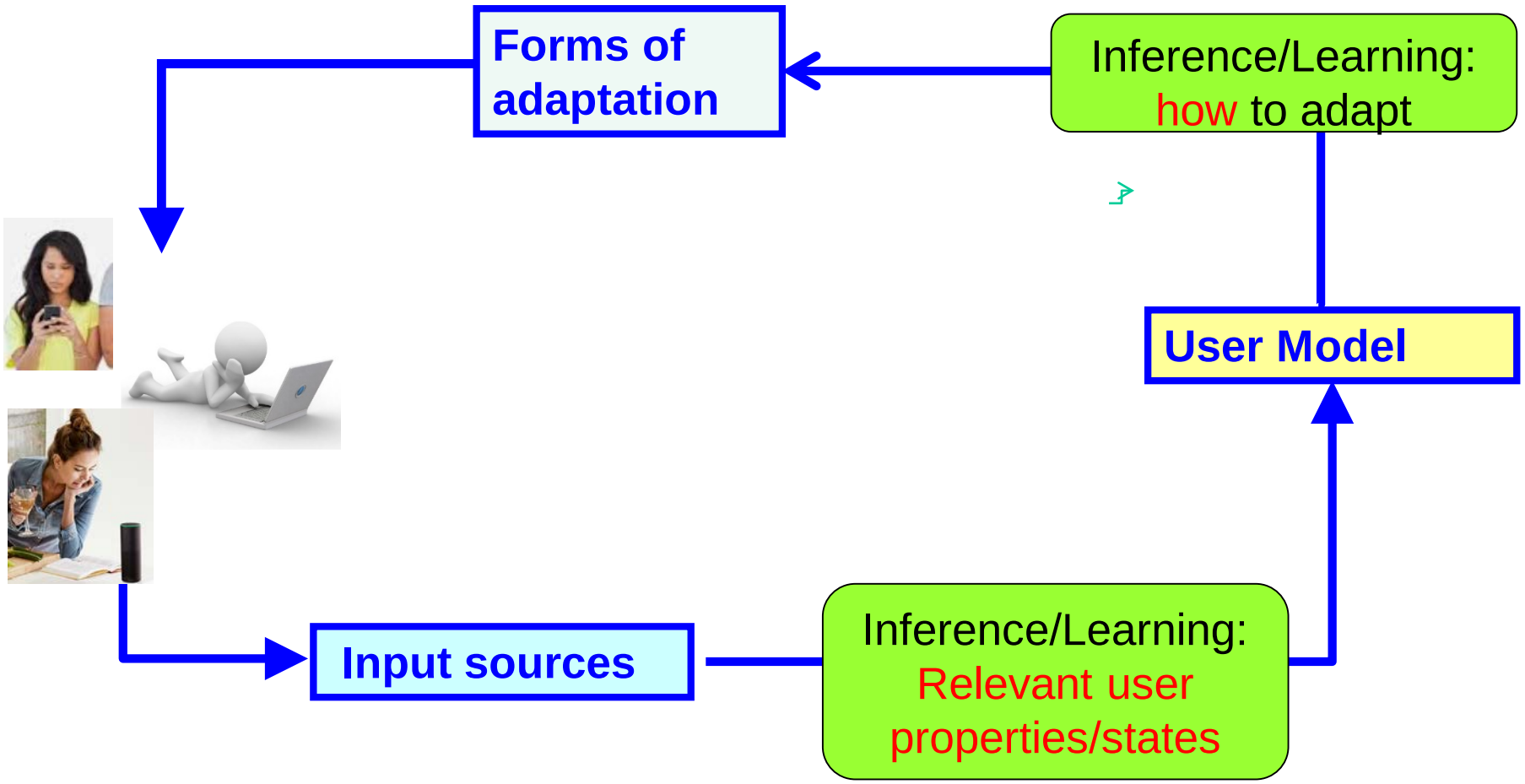
This Course



- 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 know as User-Adaptive-Interaction (UAI)

Adaptation Cycle

- Adapt behavior to user *U* on the basis of nontrivial inferences from information about *U*



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)

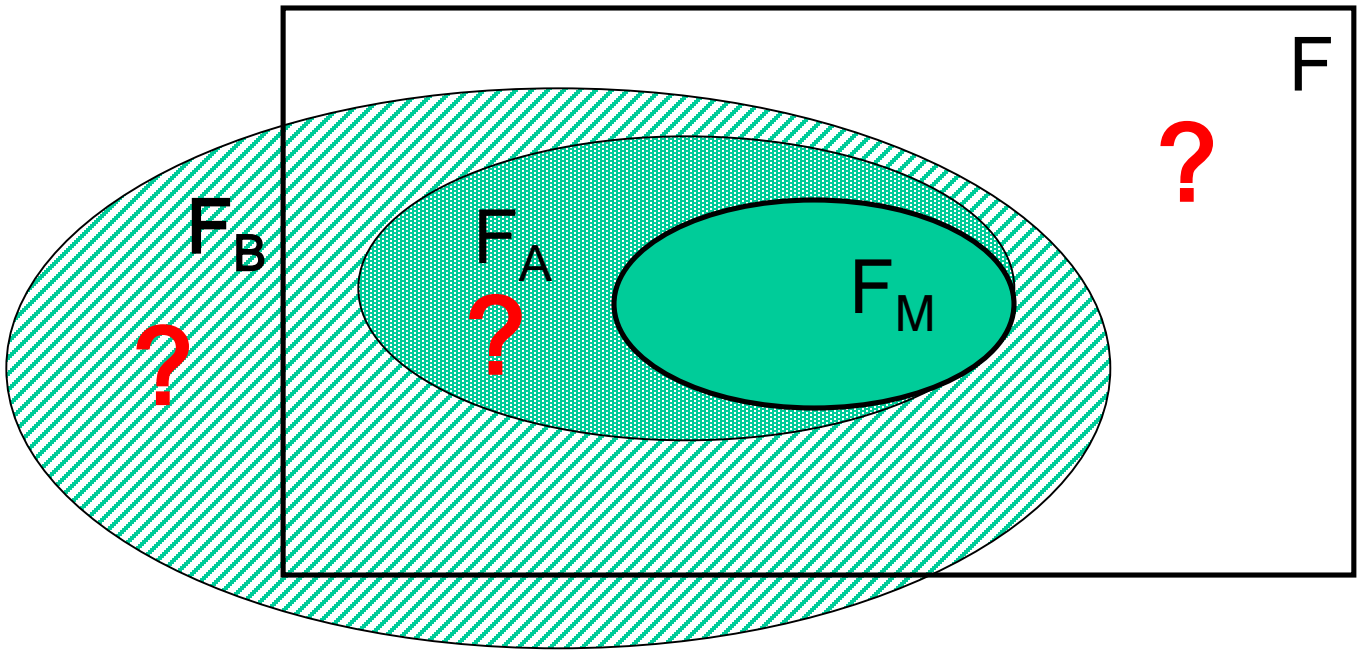
Functions

- Support System Use
- Support Info Aquisition/ Decision Making
- Support Learning
- Support Collaboration
- Support Entertainment

Forms of Adaptation

- Take Over Routine Tasks
- Adapt the Interface
- Advice on System Usage
- Retrieve Info/ Recommend Objects
- Tailor Info Presentation
- Advice on task

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

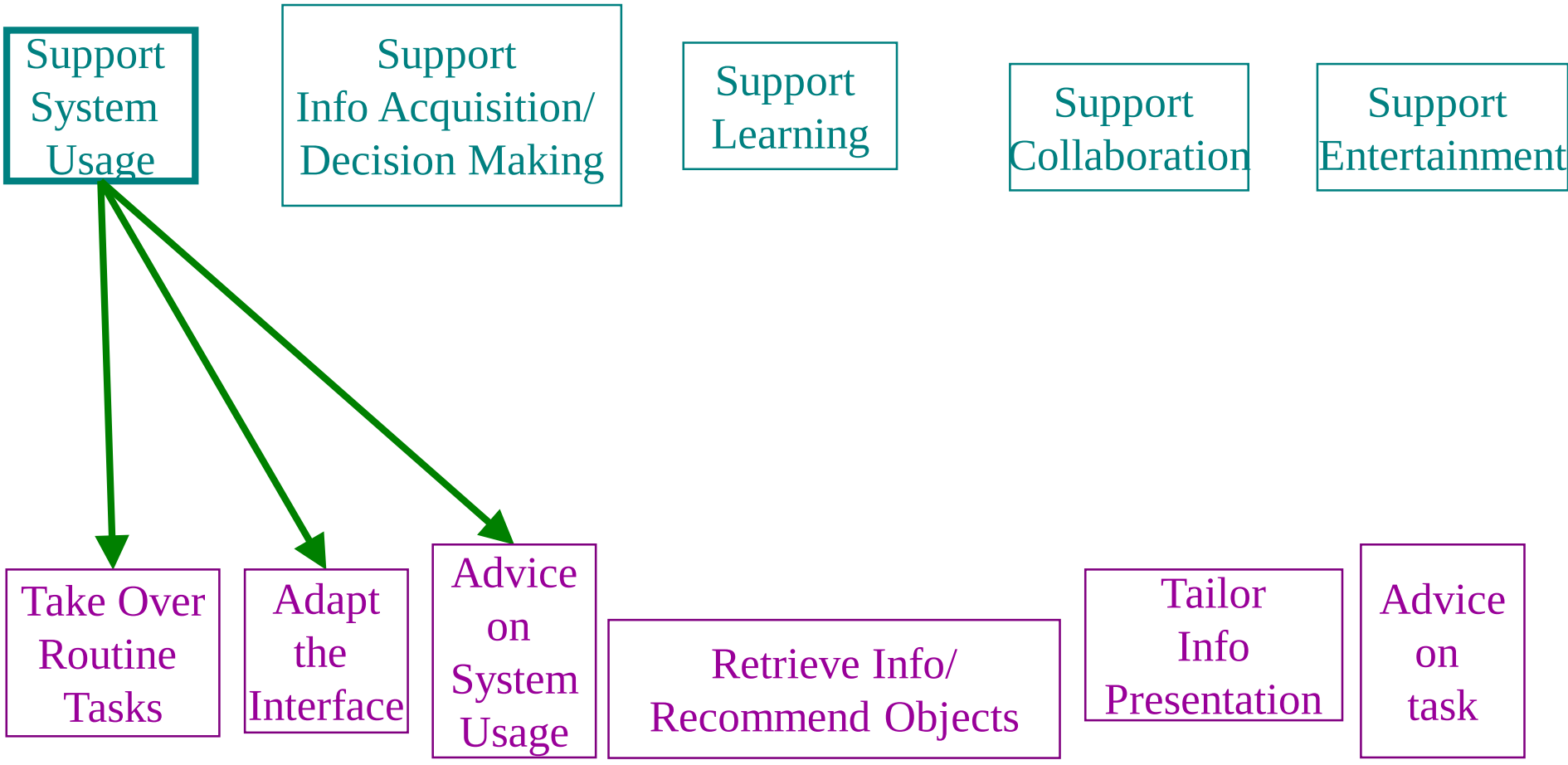
F_B = functionalities the user believes are available

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

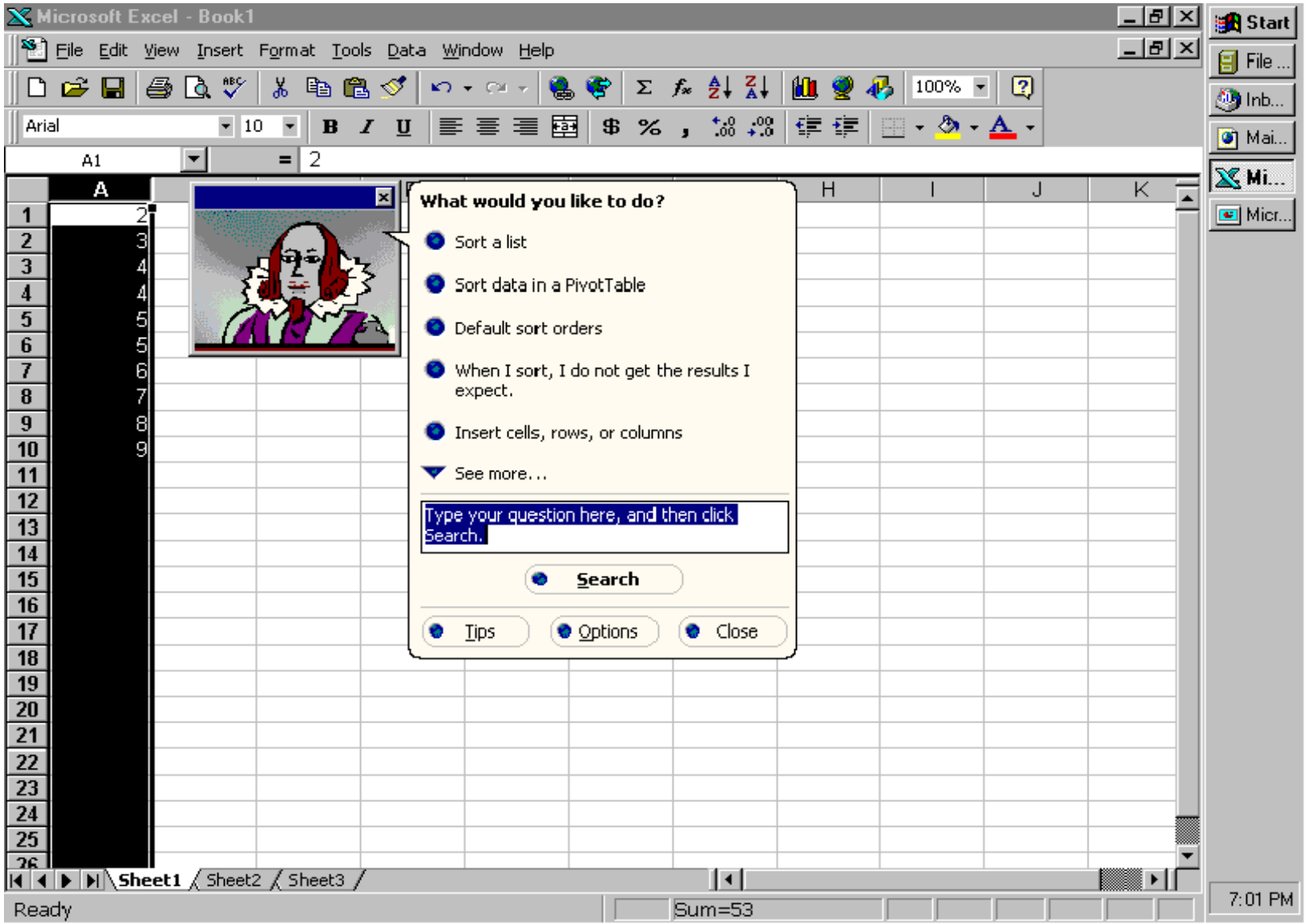
UAI: Functions and Forms (some)

Functions



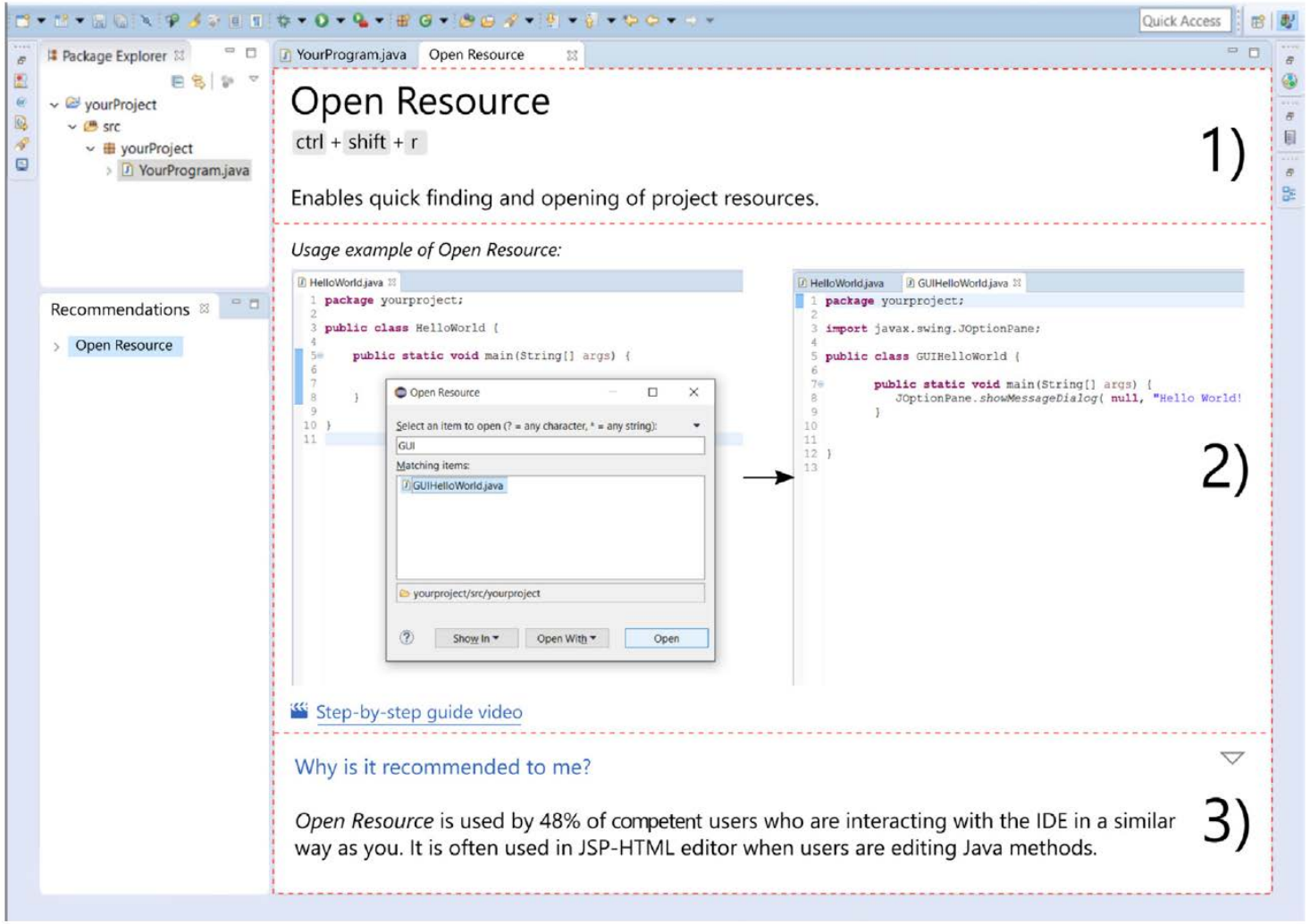
Forms of Adaptation

Give Advice on System Usage: the Microsoft Office Assistant

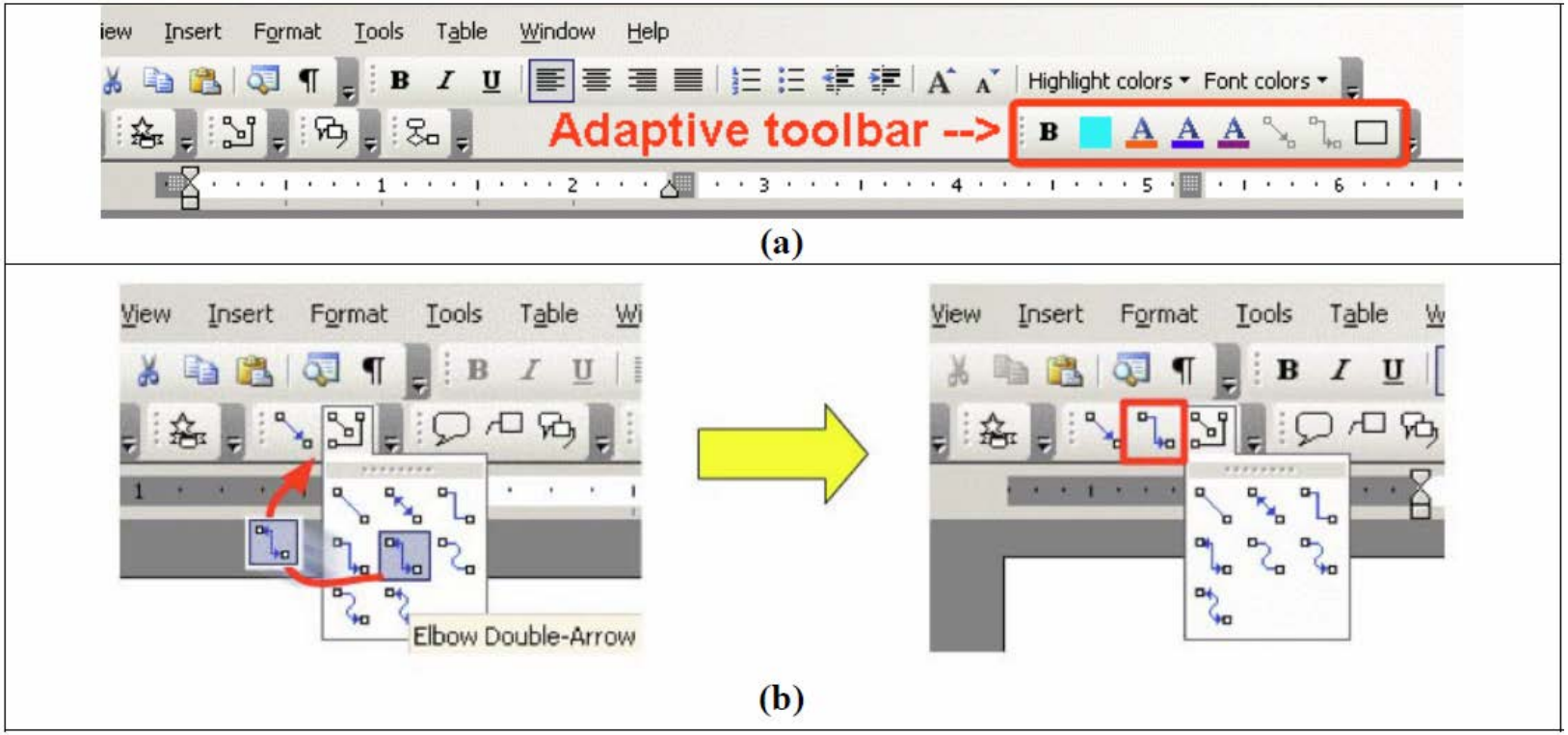


Advice on System Usage: Recommend Commands to IDE Users

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



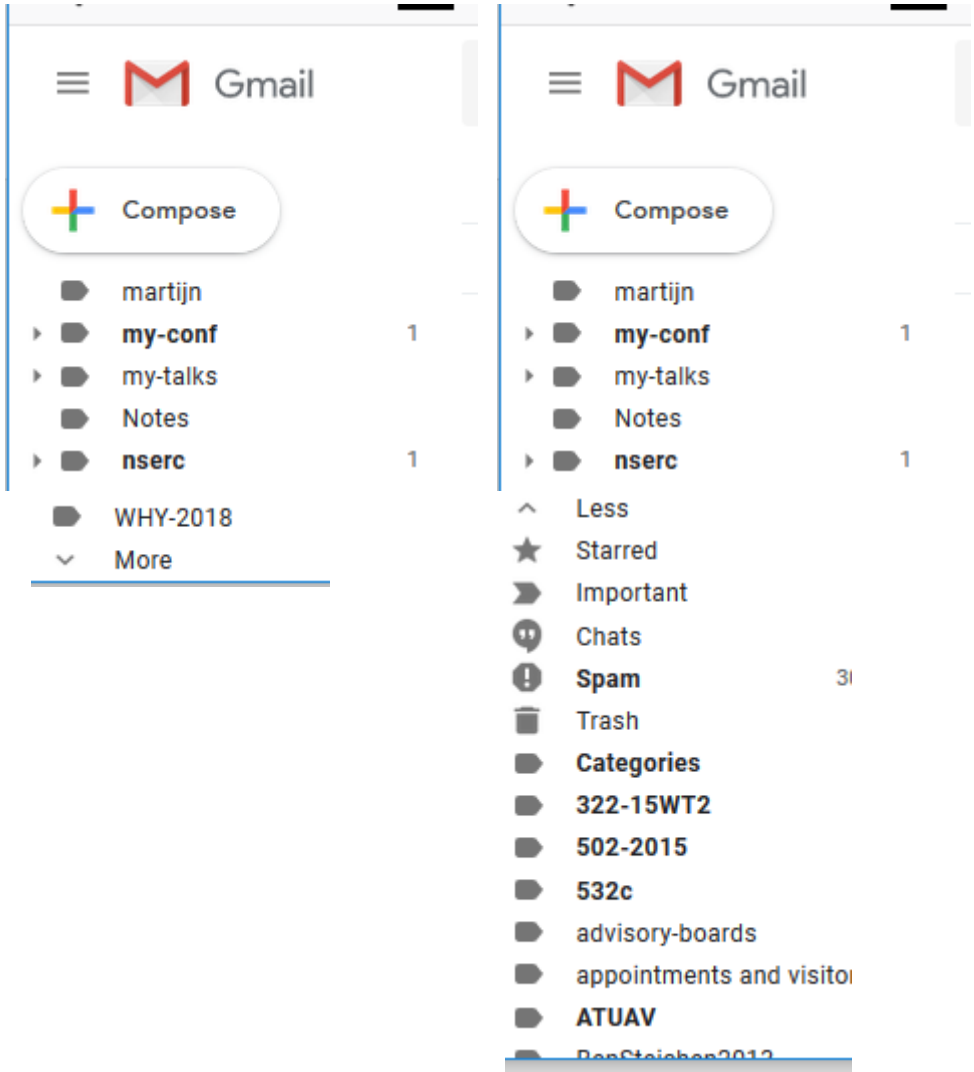
Adapting the Interface: Promote Most Relevant Commands



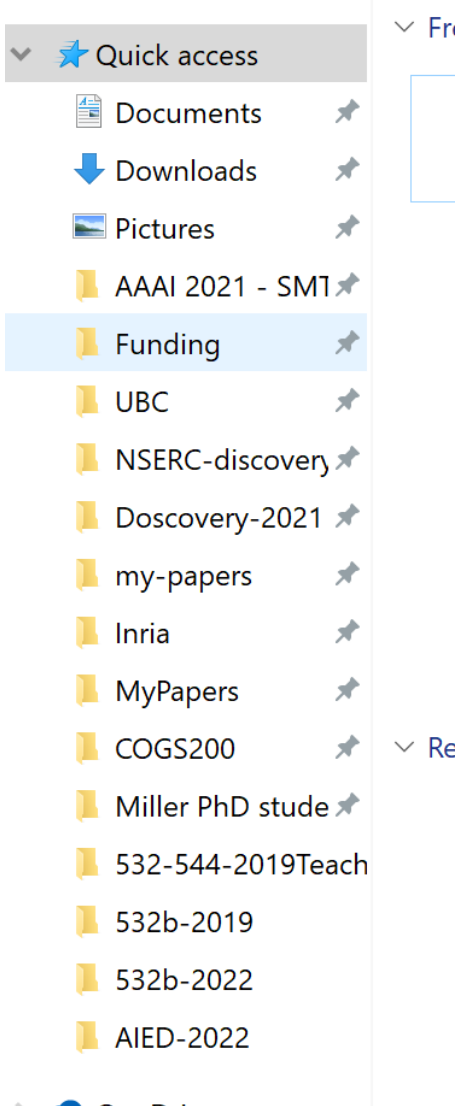
Gajos, Czerwinski, Tan, Weld: Exploring the design space for adaptive graphical user interfaces. AVI 2006: 201-208

Adapting the interface:

Gmail Folder List



Windows “Quick Access”



Adapting the Interface: Appearance

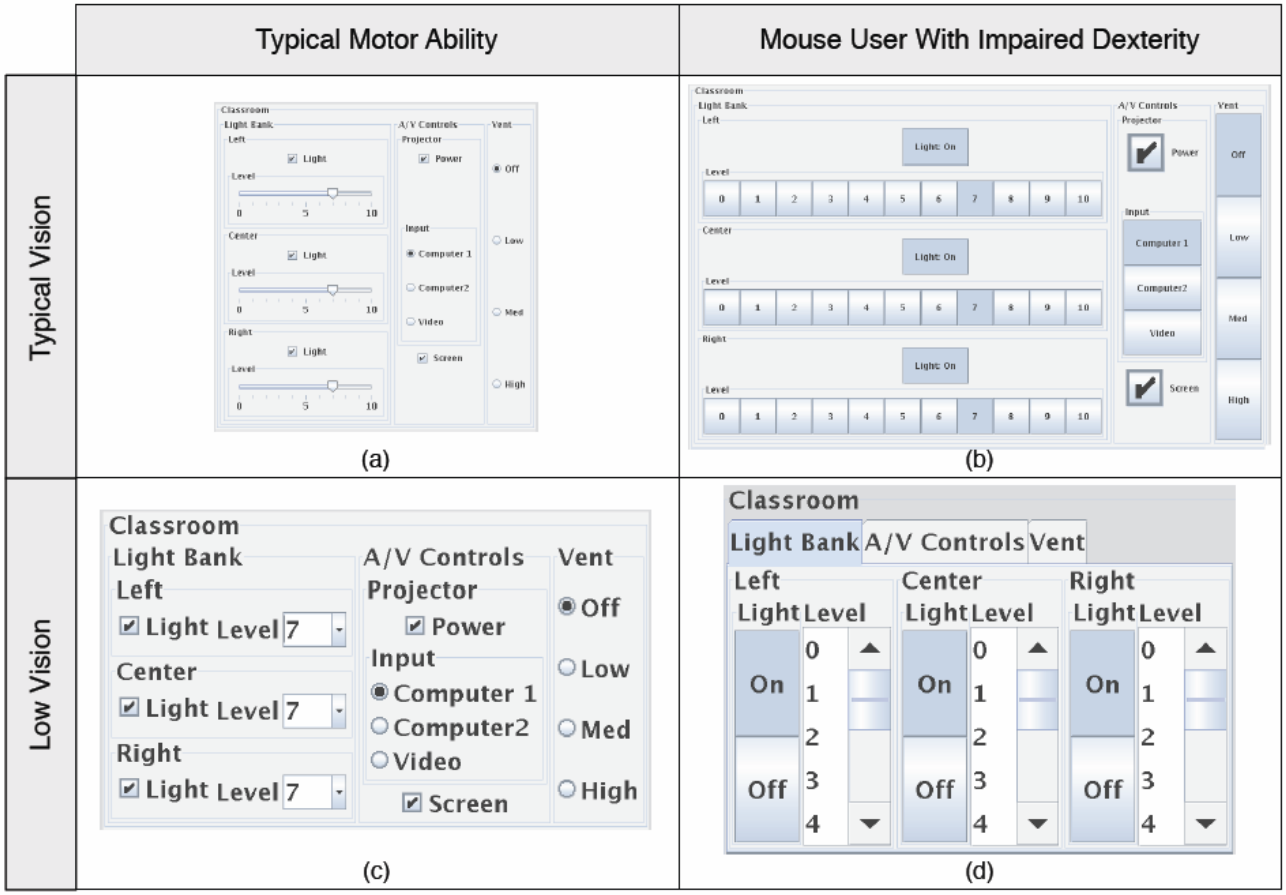


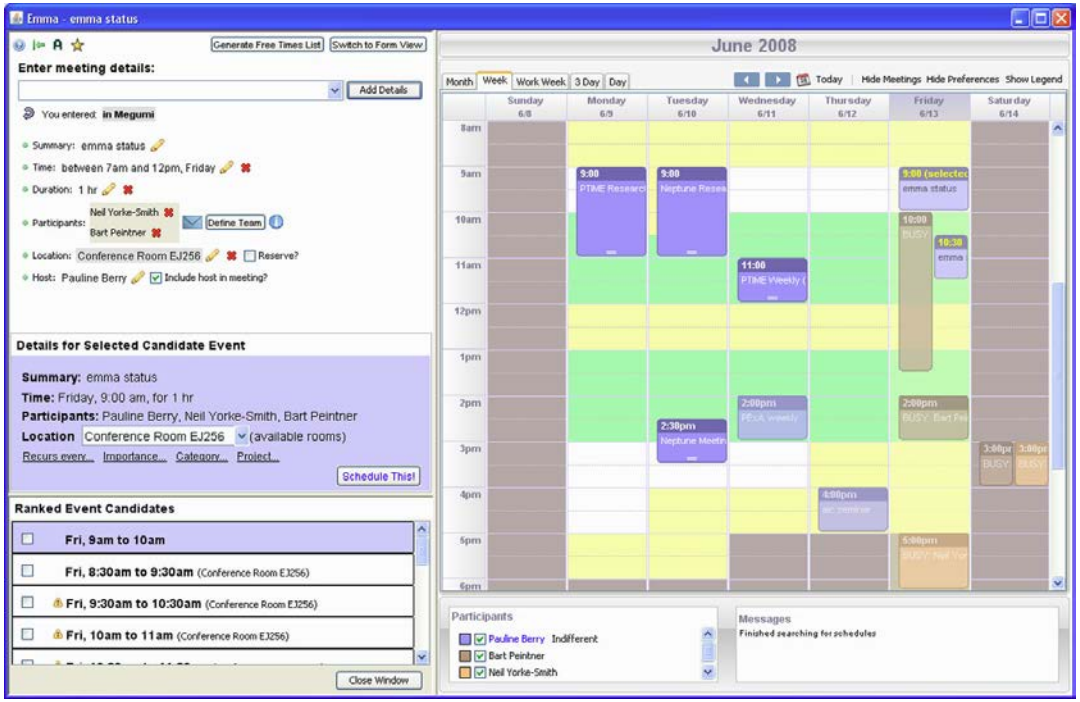
Figure 1: Four GUIs automatically generated under the same size constraints for four different users: (a) a typical mouse user, (b) a mouse user with impaired dexterity, (c) a low vision user and (d) a user with a combination of low vision and impaired dexterity. All but (a) were generated using SUPPLE++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

Gajos, Wobbrok, Weld: Automatically generating user interfaces adapted to users' motor and vision capabilities. UIST 2007: 231-240

Taking over routine tasks: PAL

(Personalized Assistants that Learn)

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



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?

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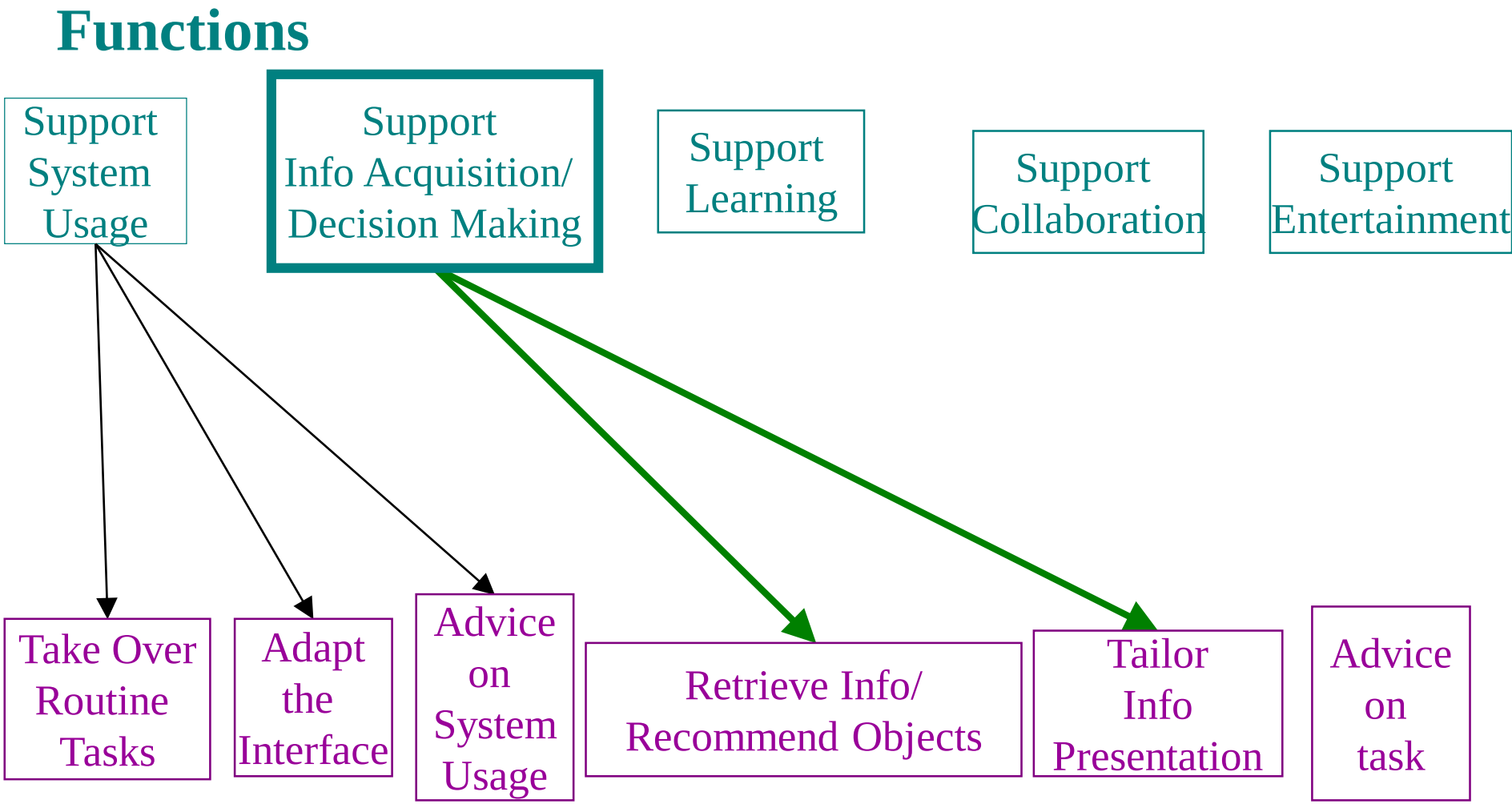
- And users often do not know/want how to personalize (customize) their application

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)



Finding Information

Google

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

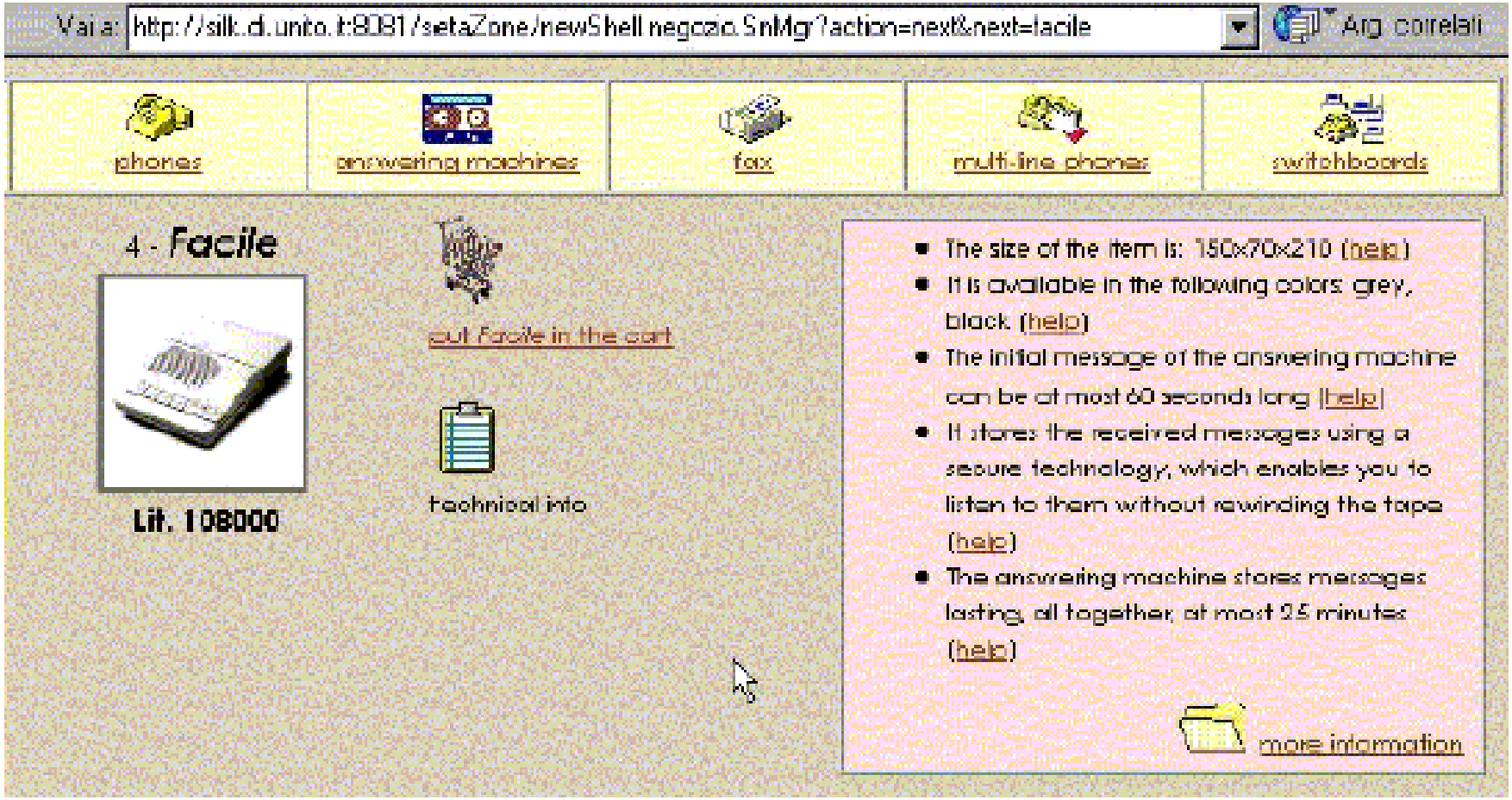
Recommending Objects: Ads!

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)



Tailor Information Presentation: SETA

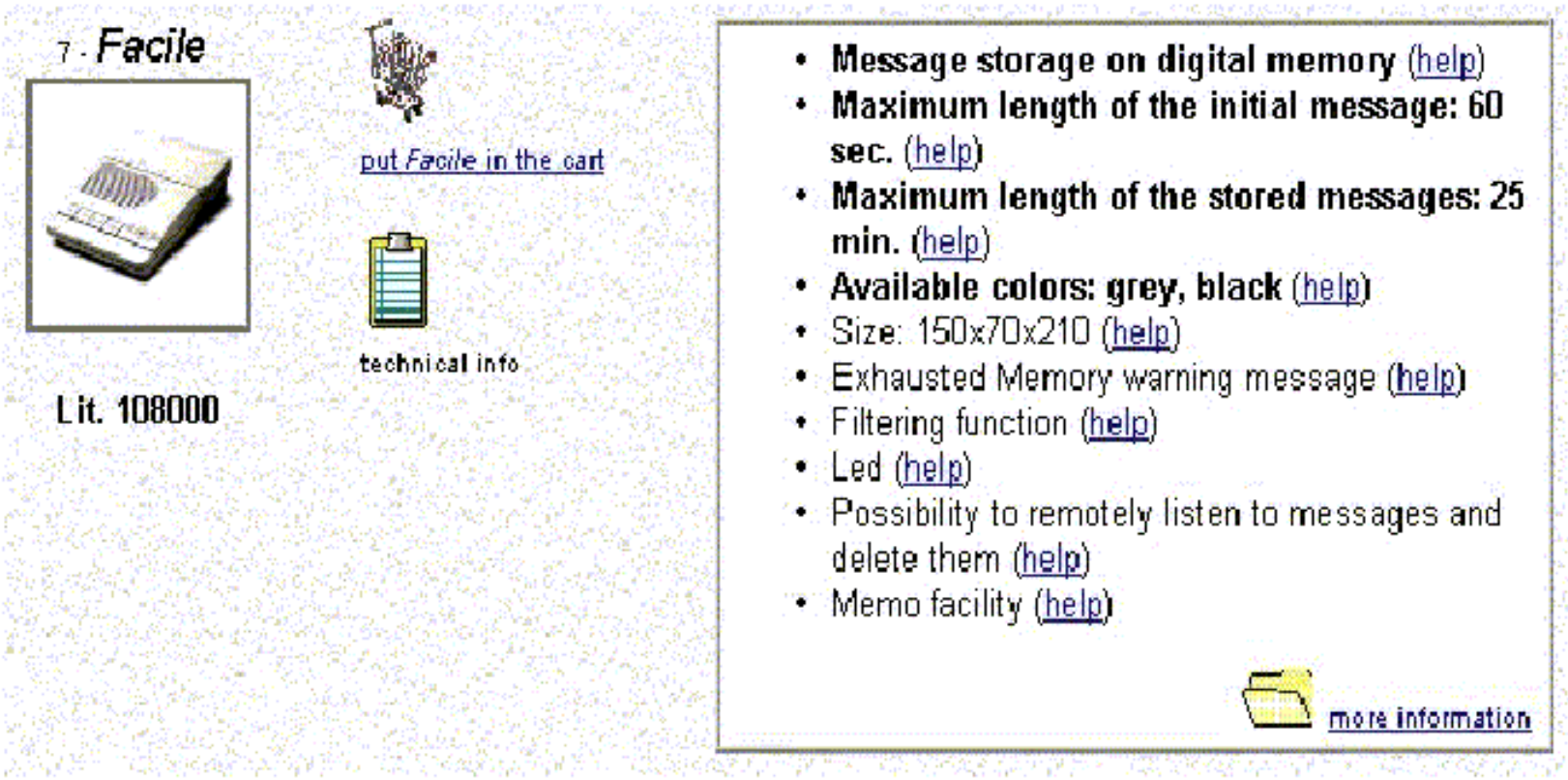
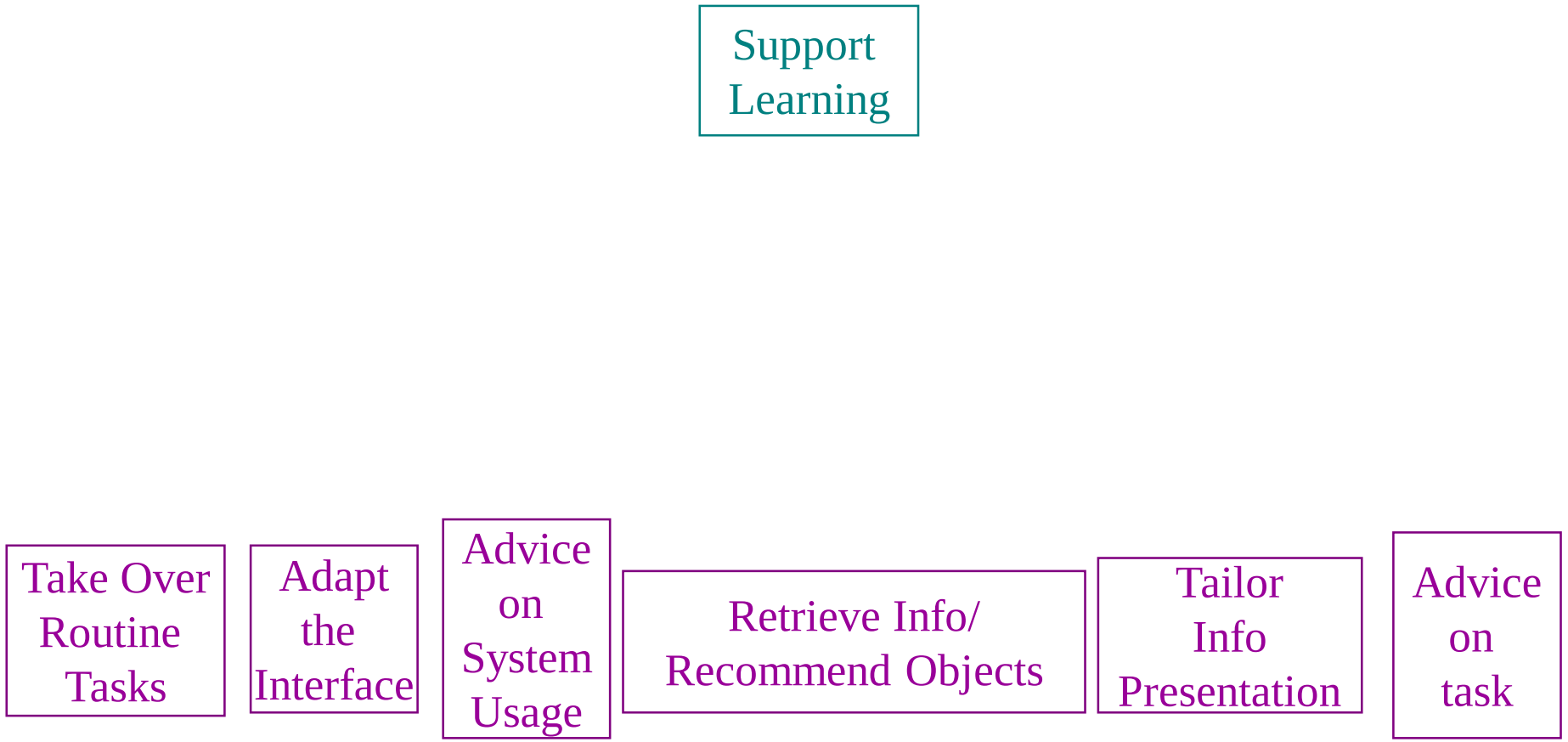


Figure 14. Detail of a presentation page describing the "Facile" answering machine, tailored to an expert user.

Support to Learning/Training

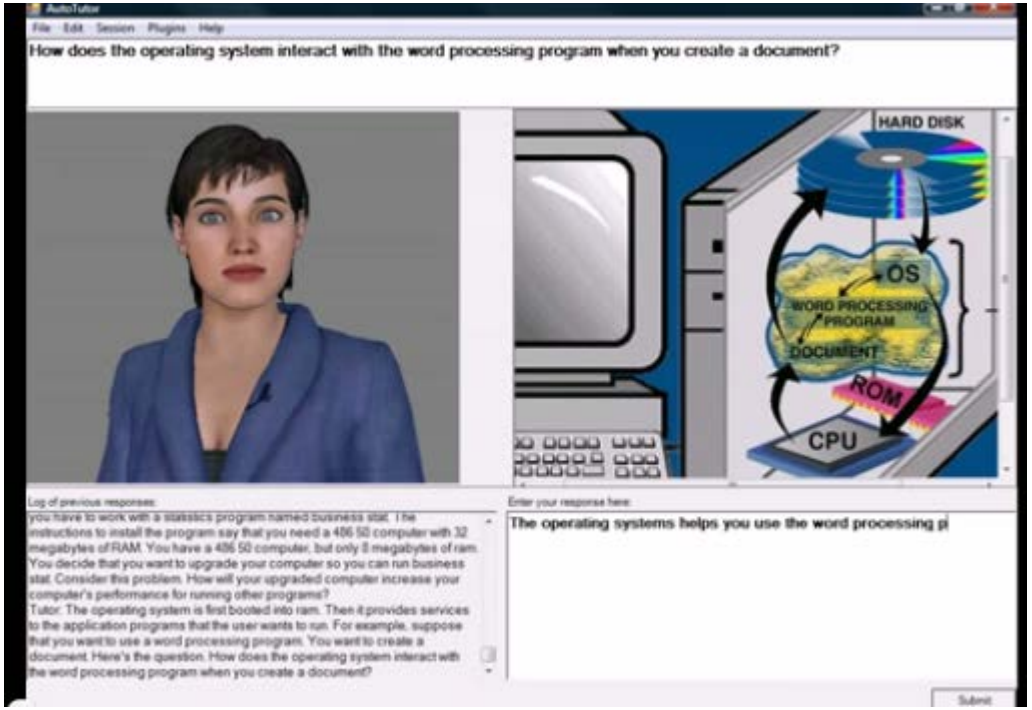
- Which forms of adaptation are relevant?



Forms of Adaptation

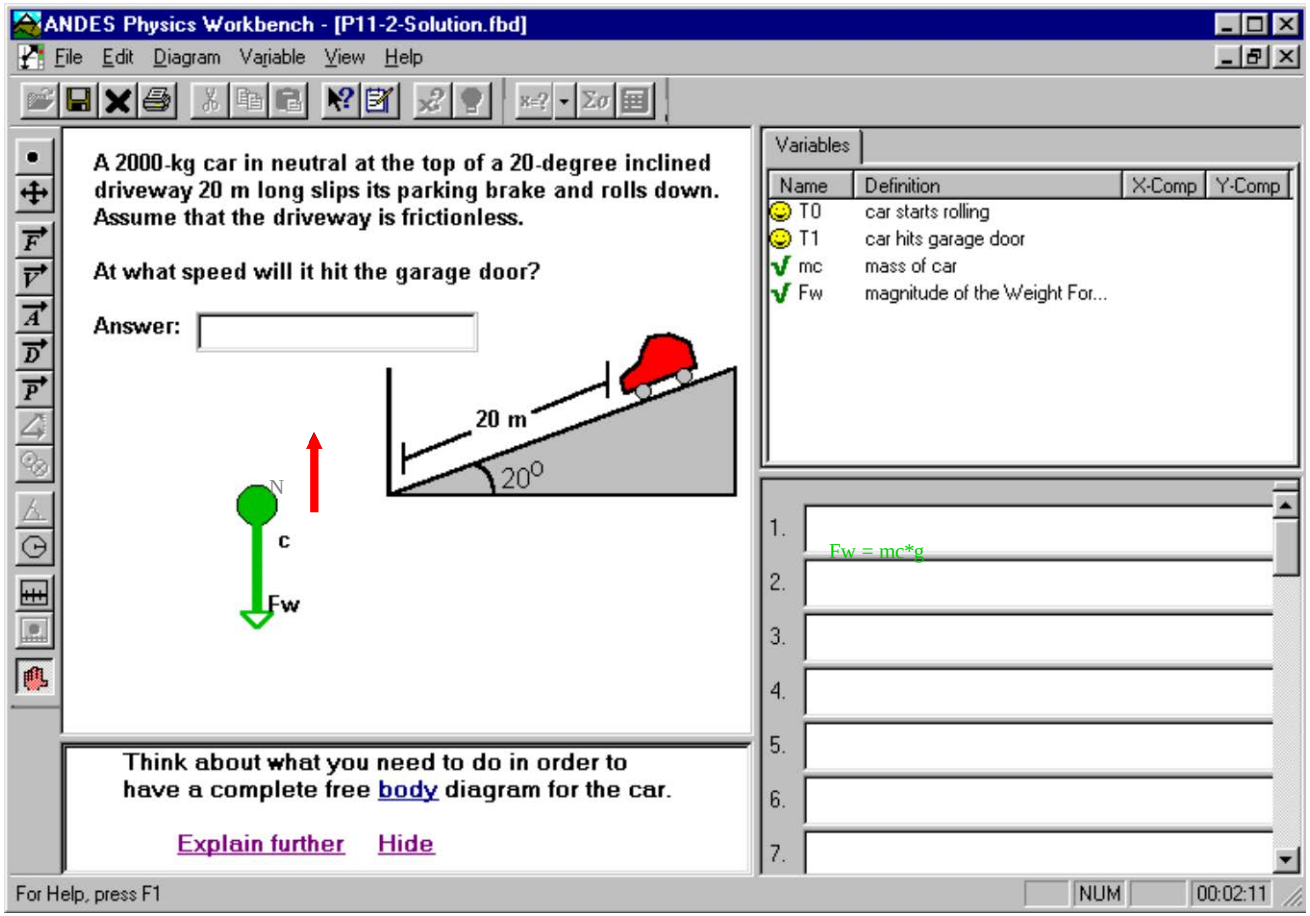
AutoTutor (Graesser et al 2000, 2010)

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

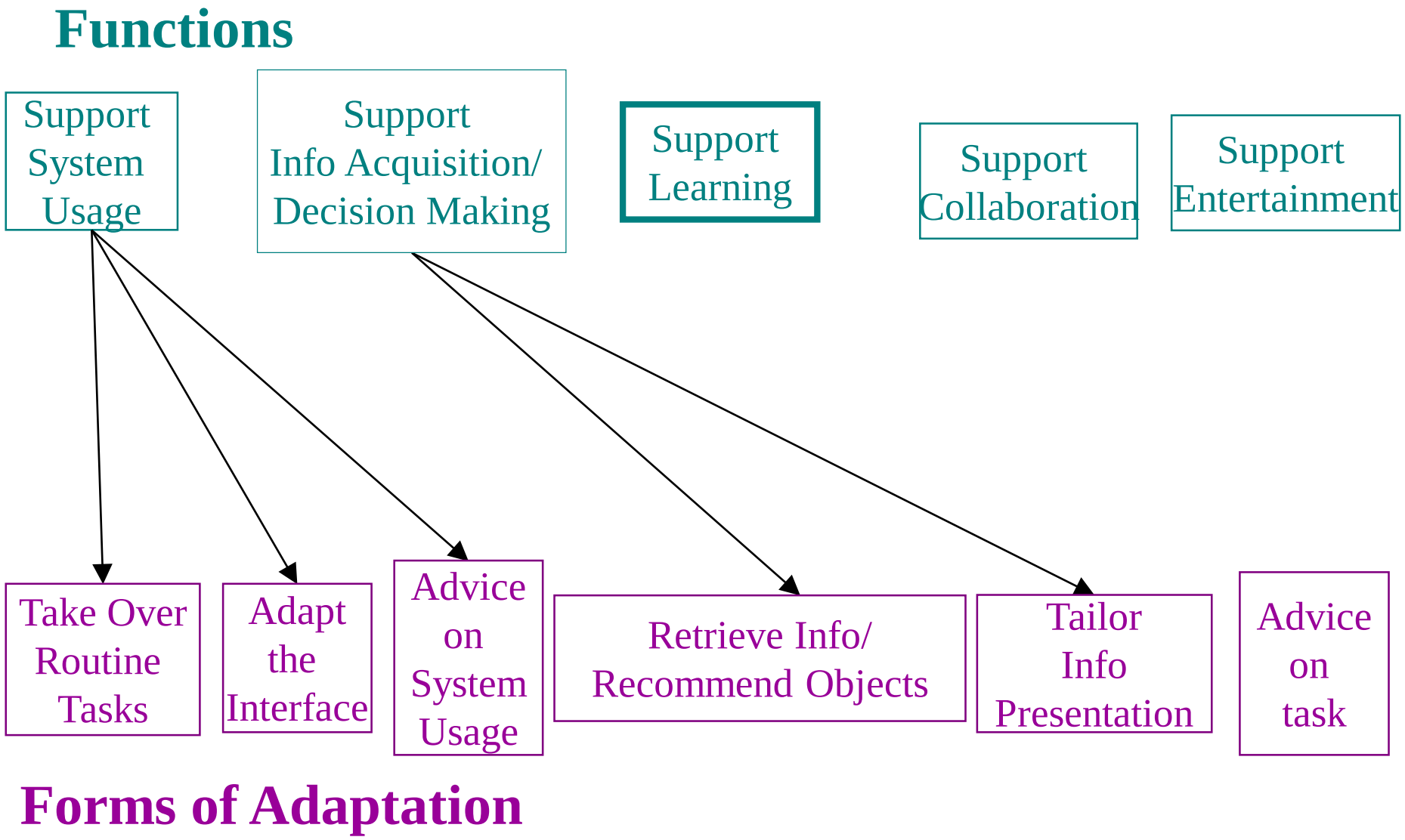


Andes (Conati et al 2002, Vanlhen et al 2005)

- 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**)



UAI: Functions and Forms (some)



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)

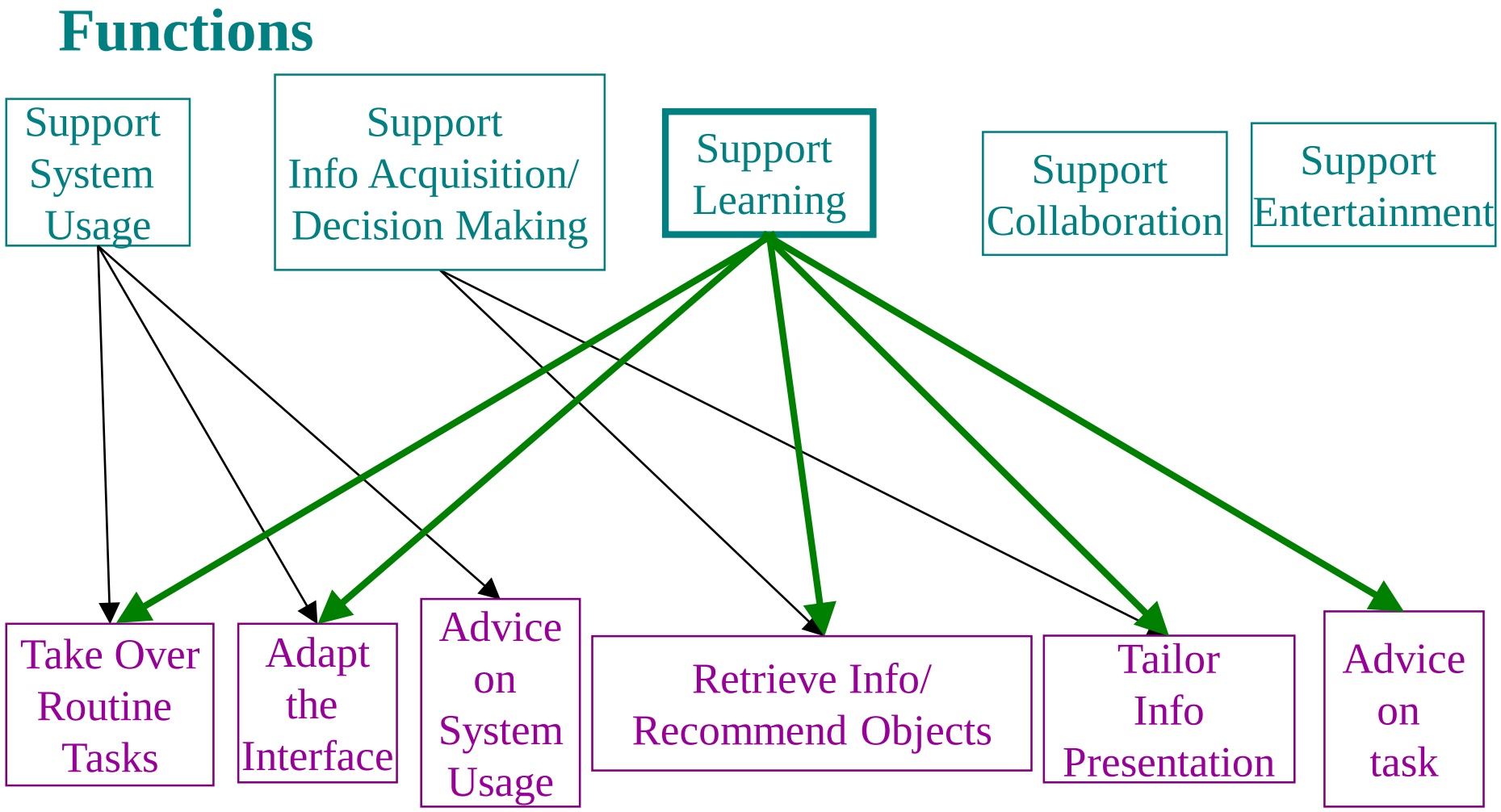
Functions

- 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

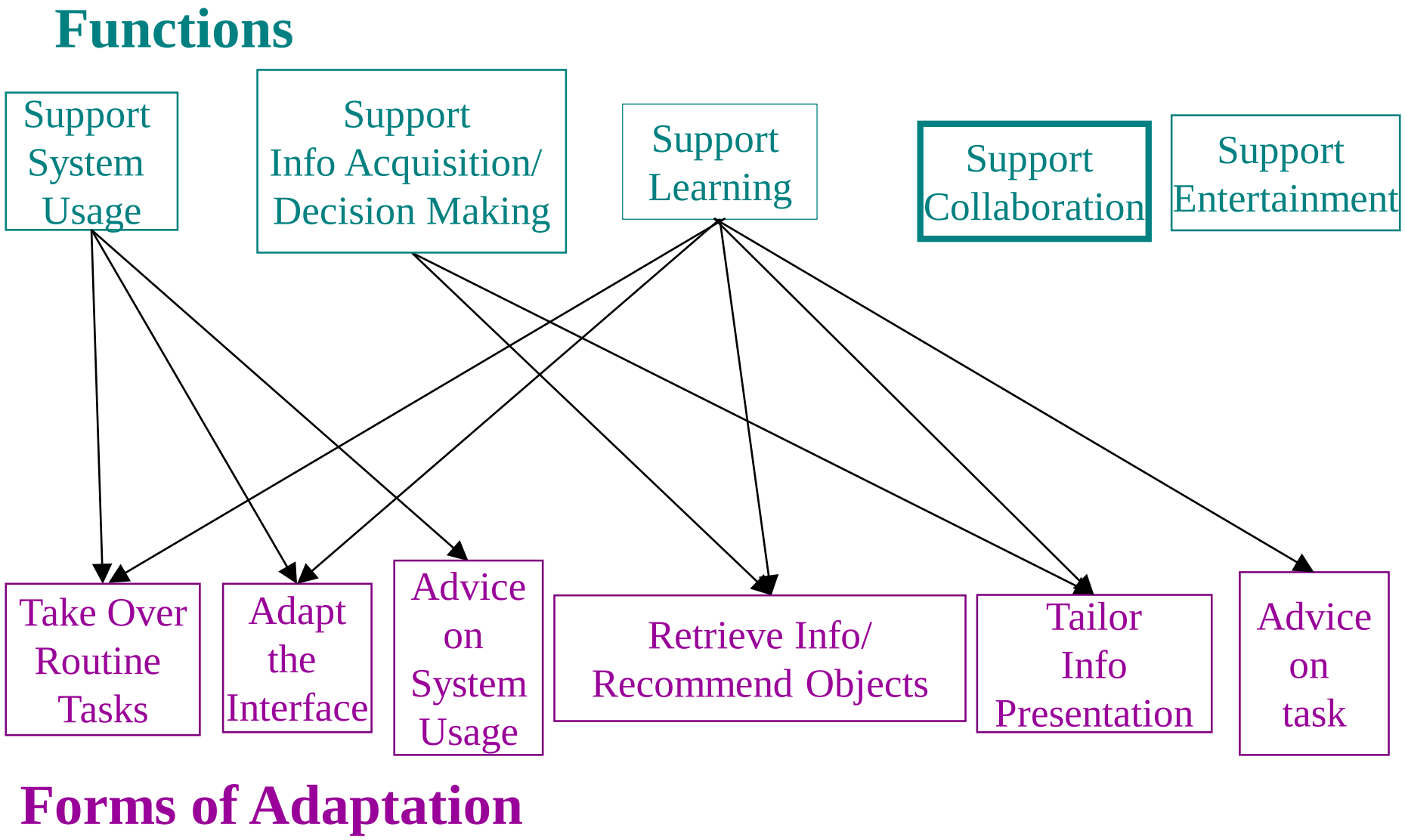
UAI: Functions and Forms (some)



Support Collaboration

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

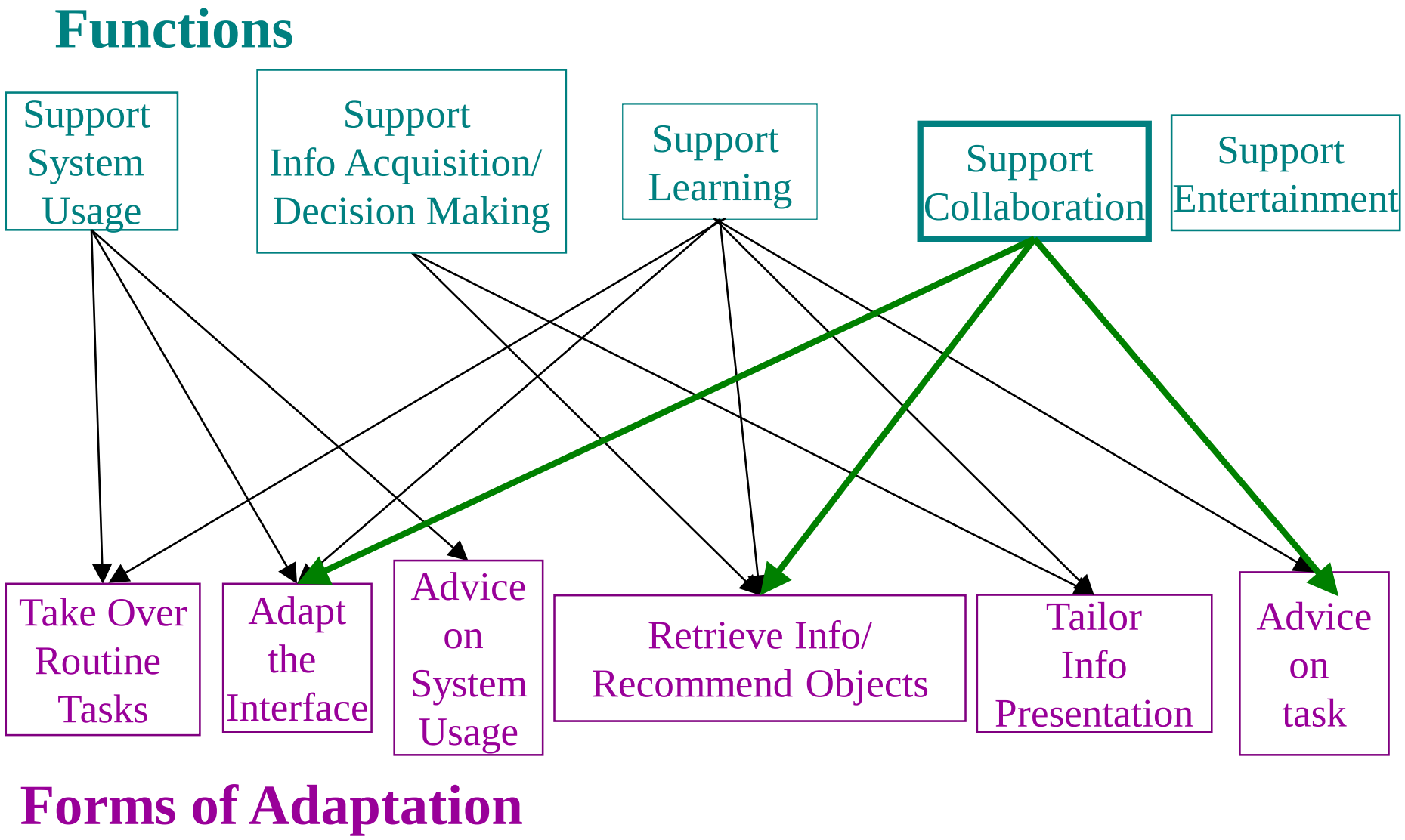
UAI


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

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)

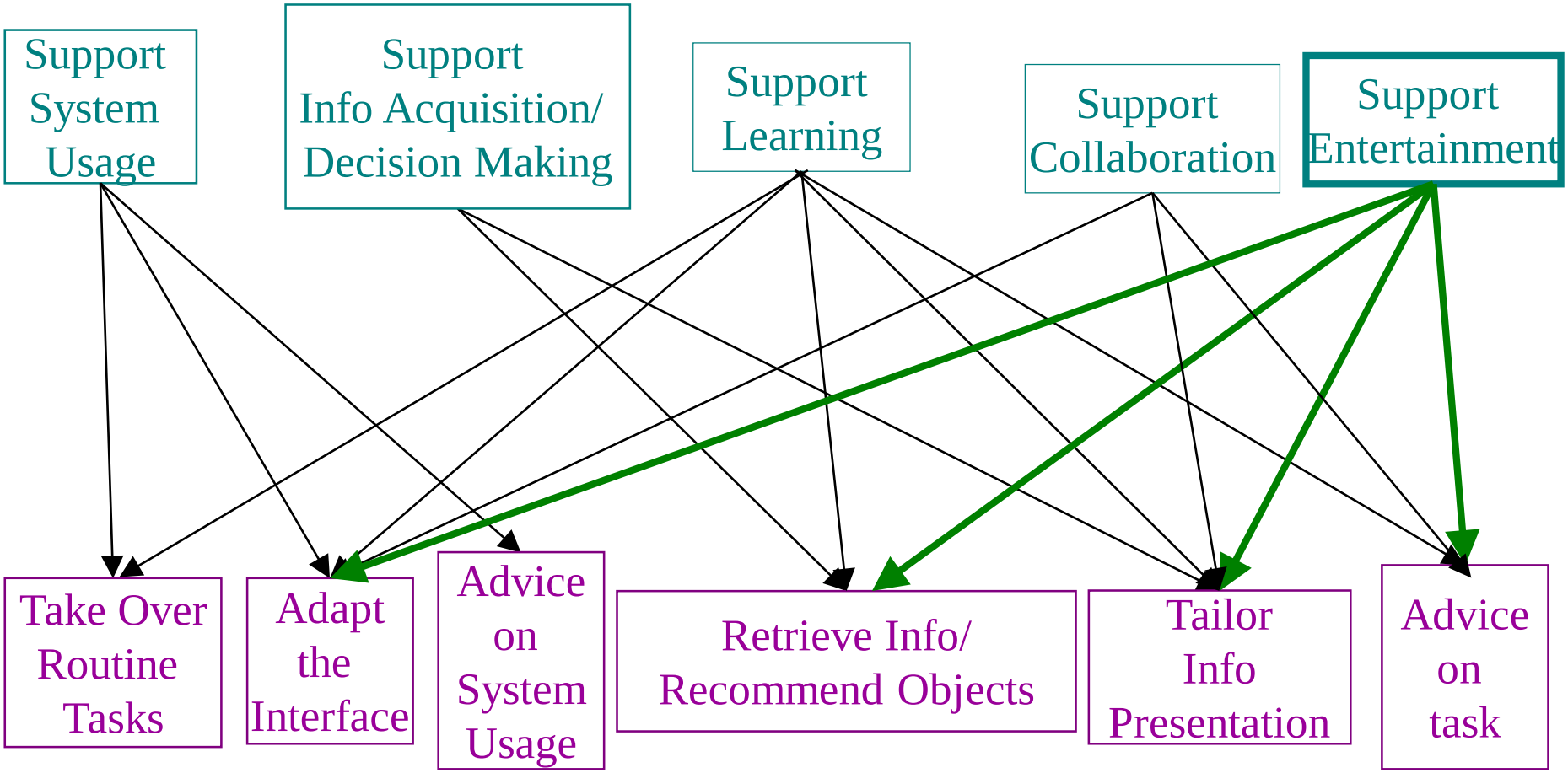


Support Entertainment/Social media

- 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



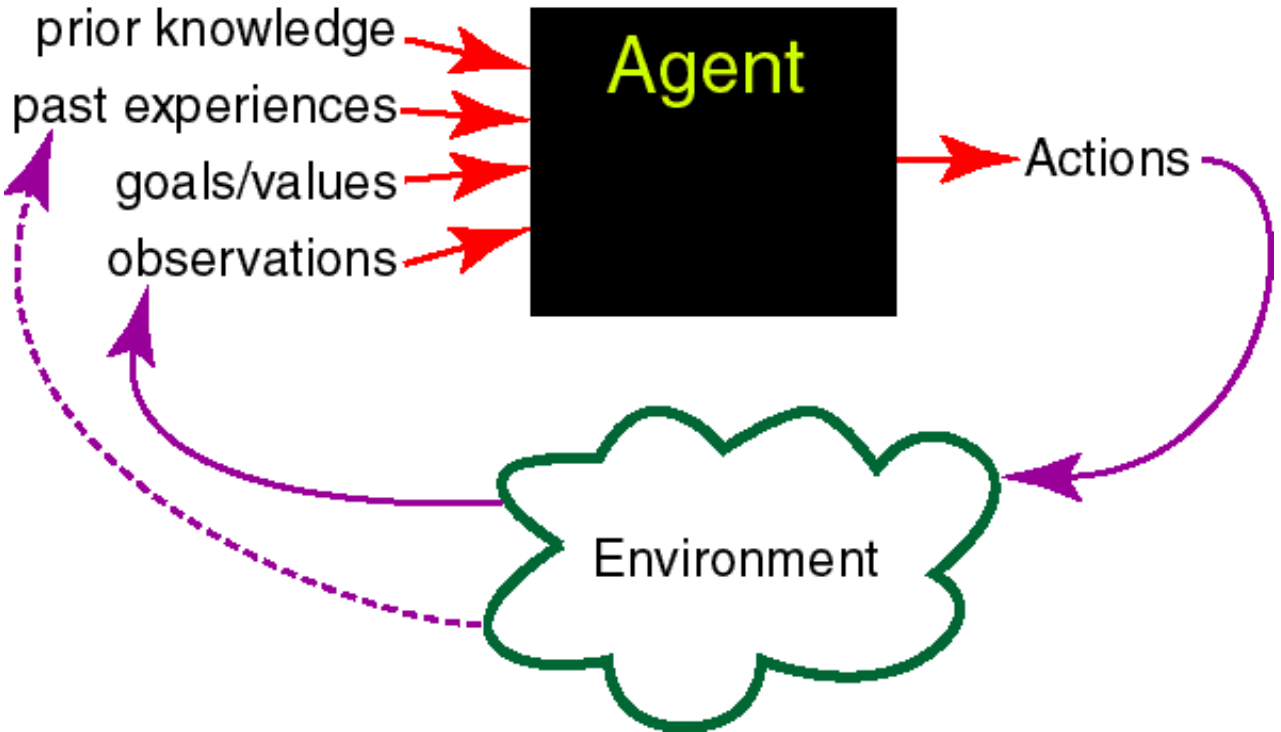
Forms of Adaptation

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***

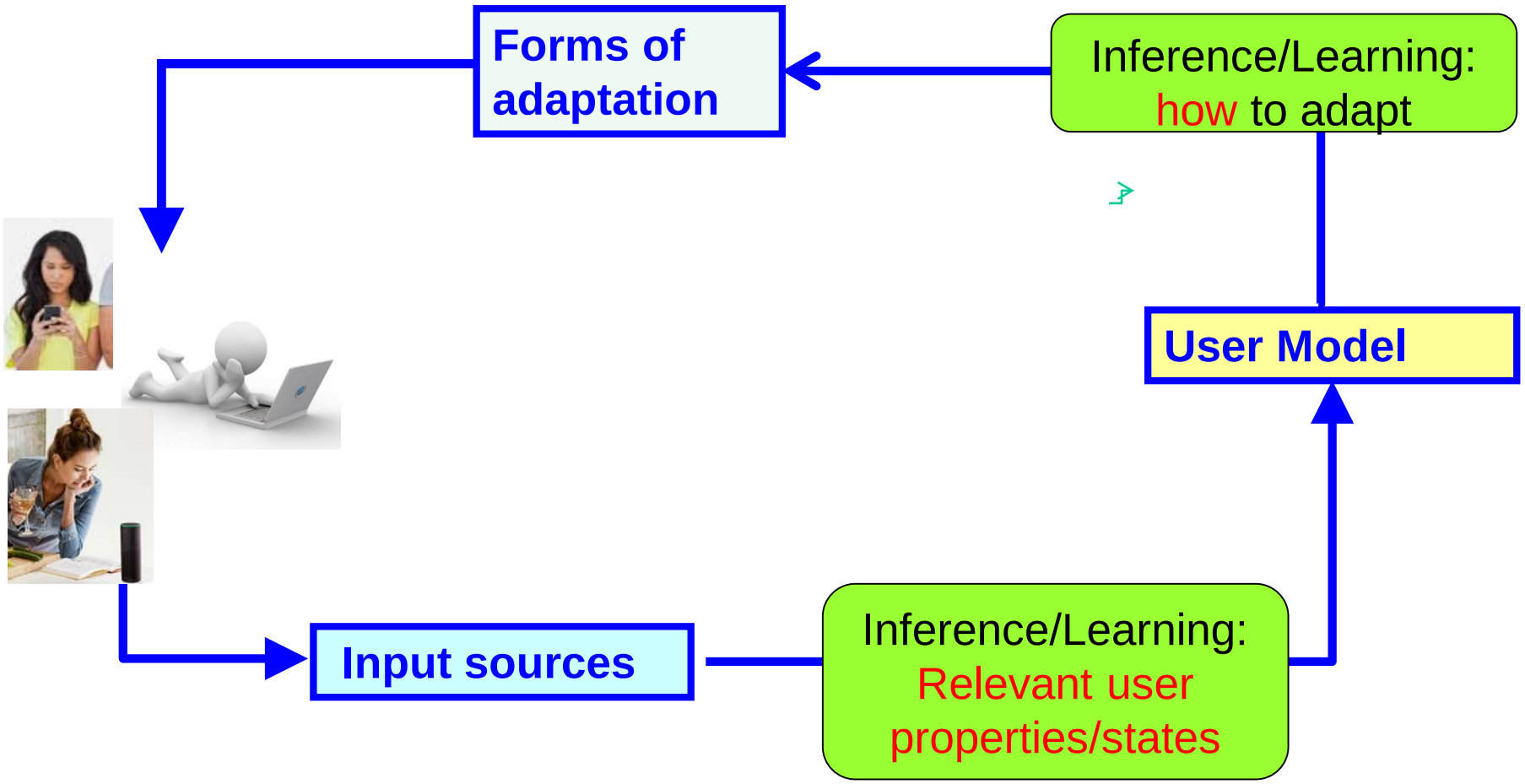
- One of AI goals: specify techniques to
  - Acquire and represent knowledge about a domain
  - Use the knowledge to solve problems in that domain

Knowledge in UAI

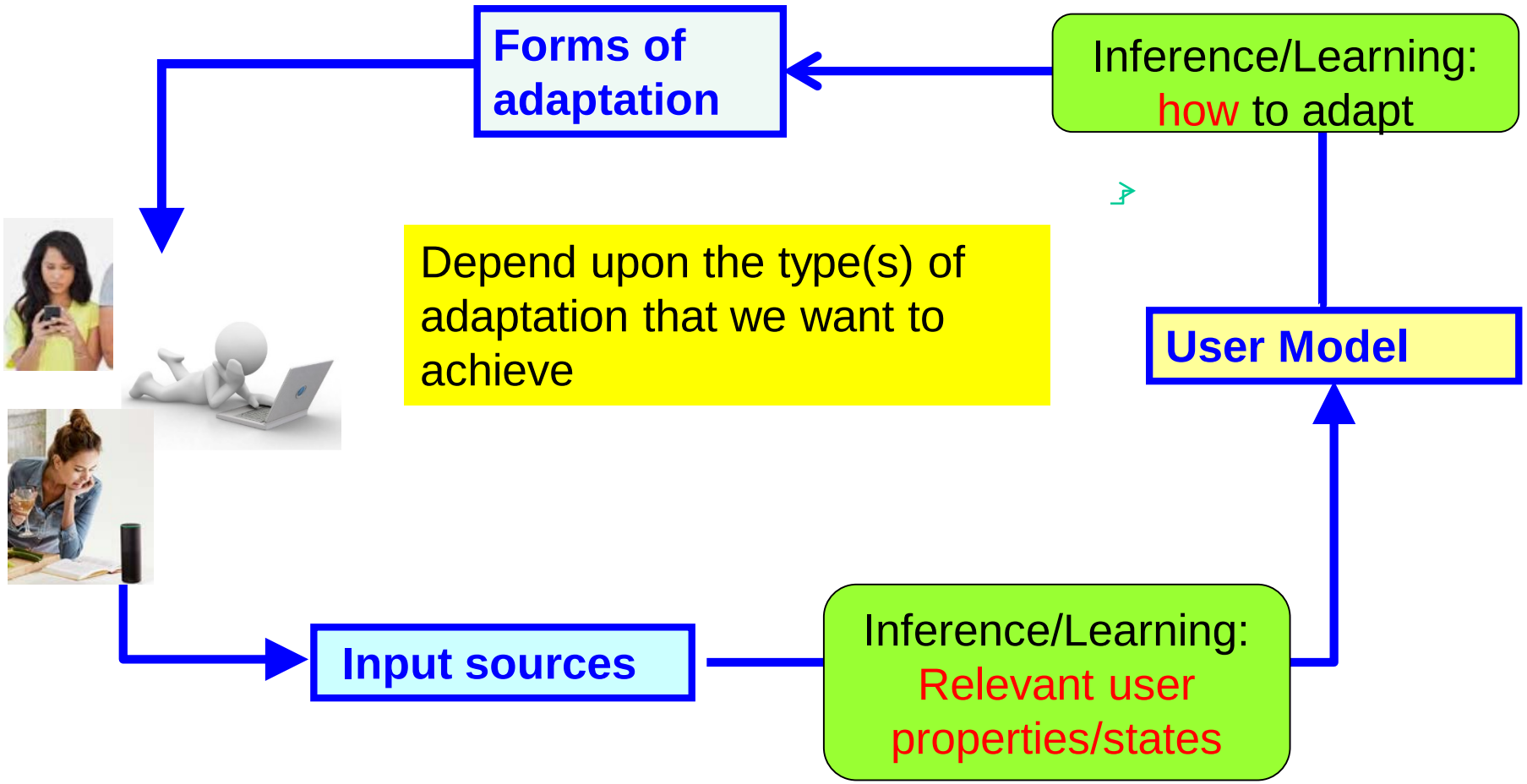
Knowledge in UAI

- 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)
- **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)

Figure 14. Detail of a presentation page describing the "Fac
tailored to an expert user.

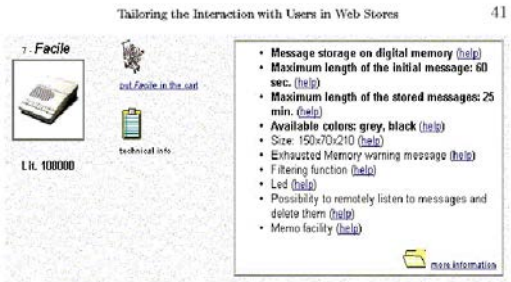


Figure 14. Detail of a presentation page describing the "Facile" answering machine, tailored to an expert user.

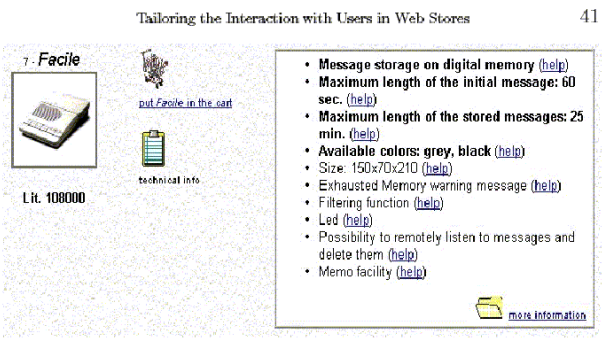
SETA: Which User Properties are Represented?

Forms of adaptation

Inference/Learning: how to adapt

User Model

Expertise on items


Tailoring the Interaction with Users in Web Stores 41

7. Facile

Lit. 108000

put Facile in the cart

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more information

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

Input sources

Inference/Learning: Relevant user properties/states

Example: DiamondHelp

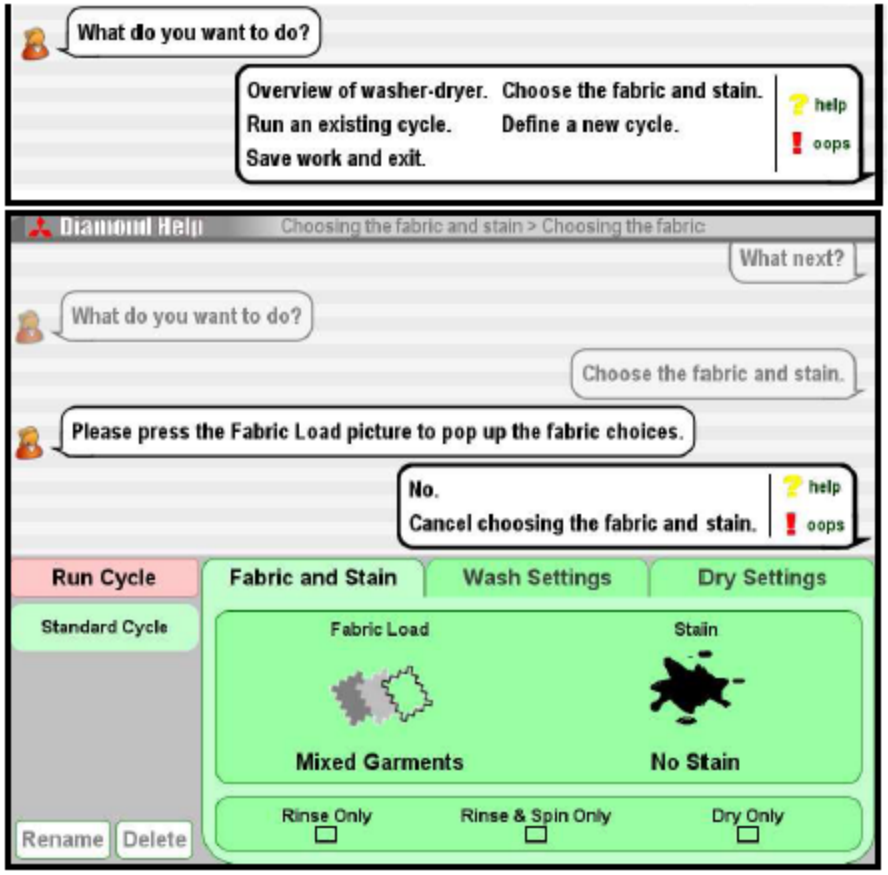


Figure 15.8. Example of collaborative assistance offered by DIAMONDHELP.

DH: Which User Properties are Represented?

Forms of adaptation

Inference/Learning: how to adapt

User Model

Goals and subgoals in during machine operation

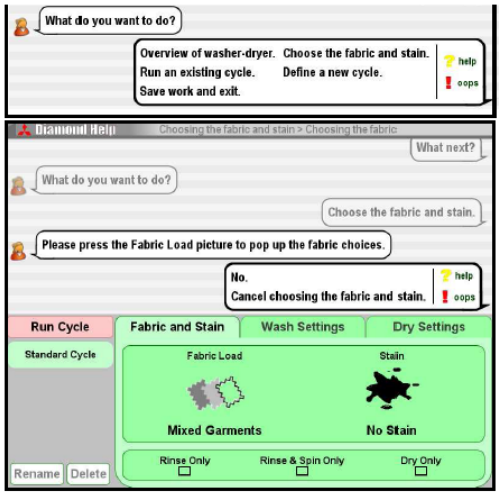


Figure 15.8. Example of collaborative assistance offered by DIAMONDHELP.

Input sources

Inference/Learning: Relevant user properties/states

Which User Properties are Represented?

Forms of adaptation

Inference/Learning: how to adapt

User Model

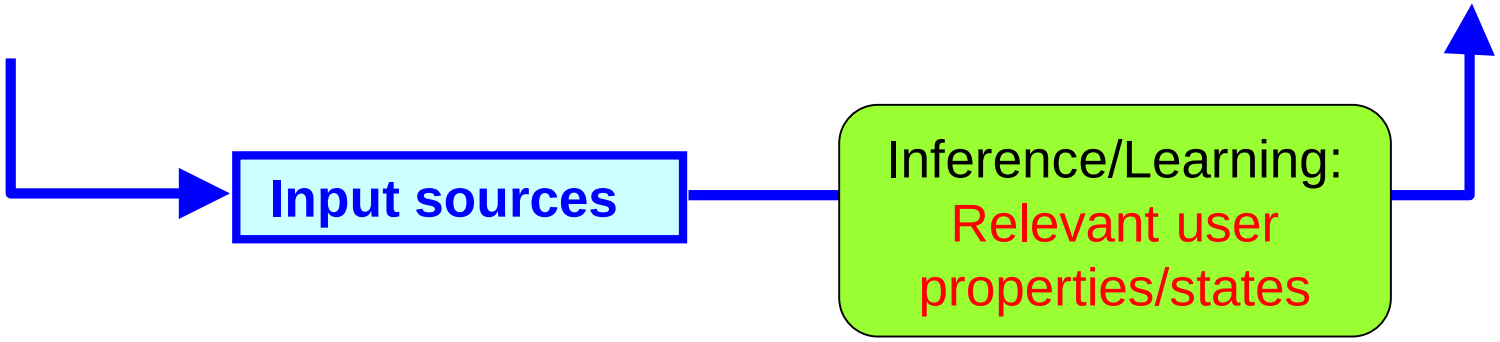
- Goals
- Beliefs/Domain knowledge
- Proficiencies
- Behavioral regularities
- Interests
- Preferences
- Personality
- Affective state
- Context of interaction
- ……..

Input sources

Inference/Learning: Relevant user properties/states

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

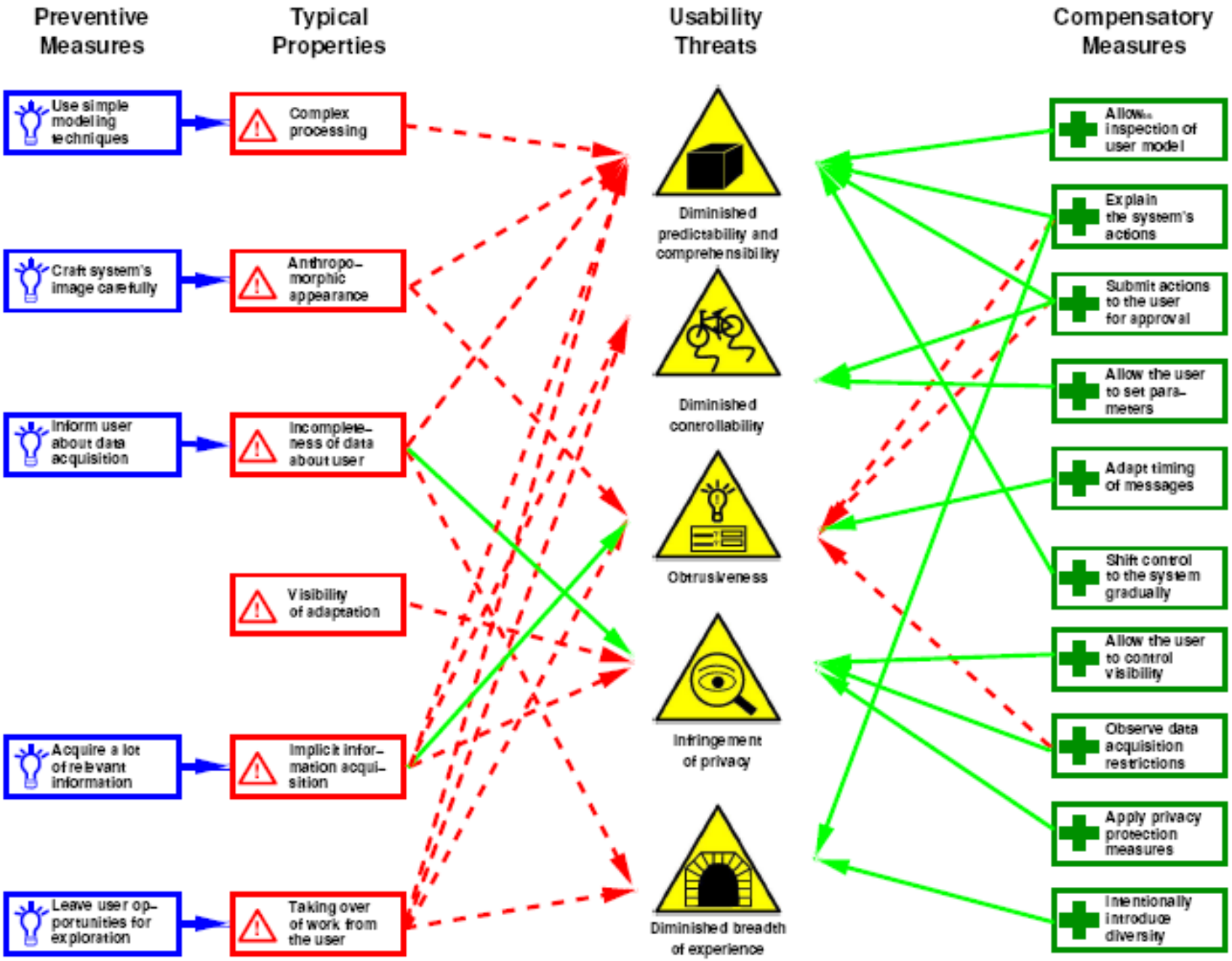
Learn how to classify new postings on property ***Action*** *(skip, read)* from attributes *Author, Thread, Length*, and *Where,* based on existing labeled examples

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

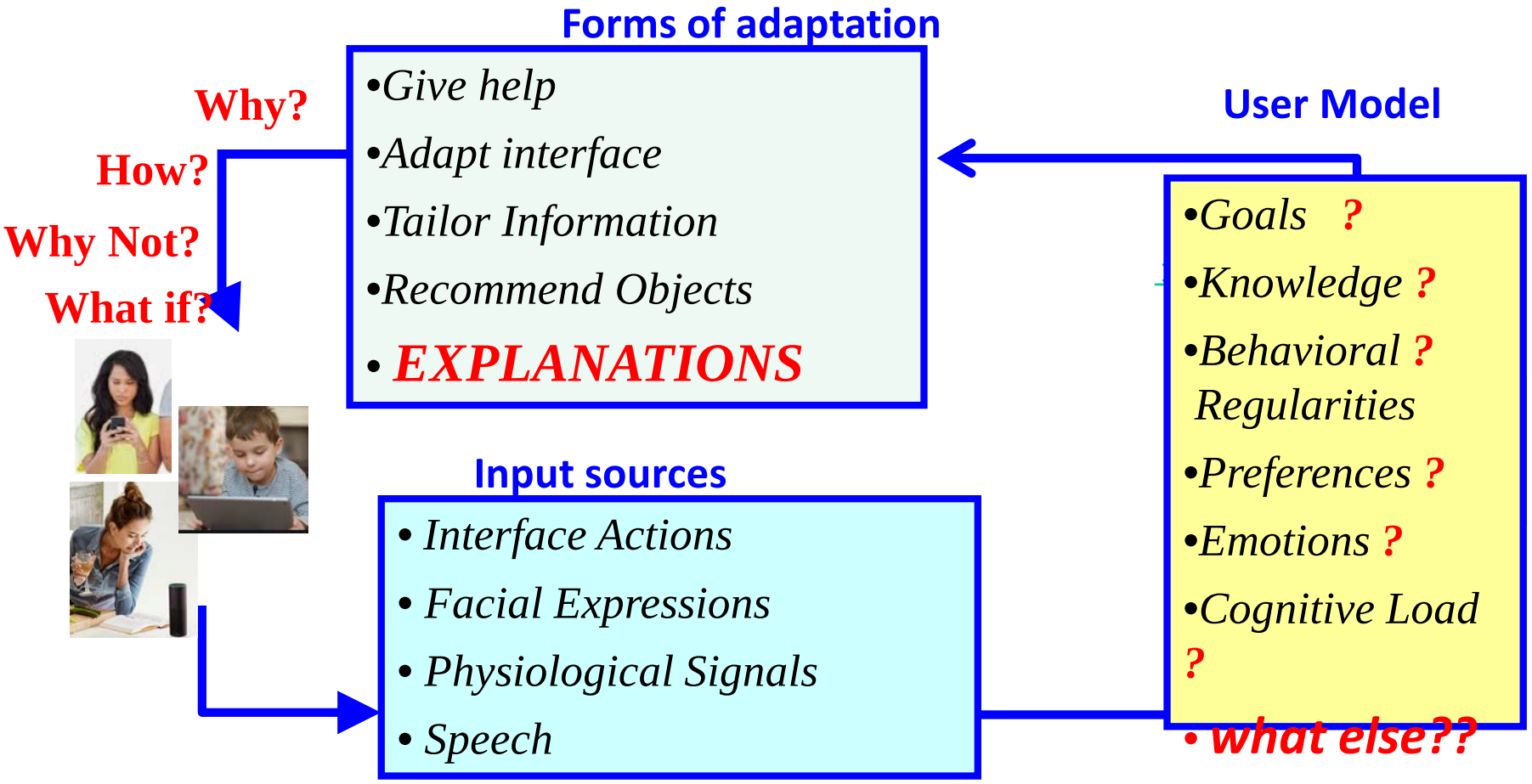
Communication Model

- 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


Preventive Measures
Typical Properties
Usability Threats
Compensatory Measures
Use simple modeling techniques
Craft system's image carefully
Inform user about data acquisition
Acquire a lot of relevant information
Leave user opportunities for exploration
Complex processing
Anthropomorphic appearance
Incompleteness of data about user
Visibility of adaptation
Implicit information acquisition
Taking over of work from the user
Diminished predictability and comprehensibility
Diminished controllability
Obtrusiveness
Infringement of privacy
Diminished breadth of experience
Allow inspection of user model
Explain the system's actions
Submit actions to the user for approval
Allow the user to set parameters
Adapt timing of messages
Shift control to the system gradually
Allow the user to control visibility
Observe data acquisition restrictions
Apply privacy protection measures
Intentionally introduce diversity

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



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

Evaluation of Adaptive IUI

- 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

Survey for students

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