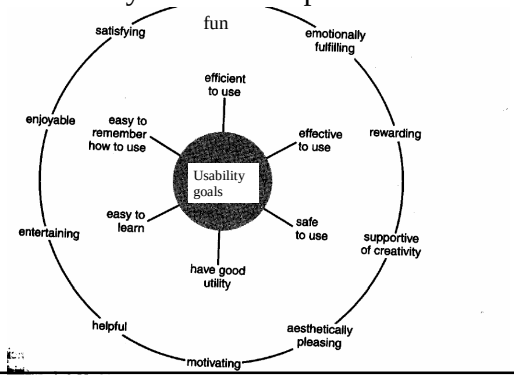
Review slides

Usability and User Experience Goals



Usability Principles (Norman, 1988)

- Visibility
- Feedback
- Constraints
- Mapping
- Consistency
- Affordance

Usability Principles (Nielsen, 2001)

1. Visibility of system status
2. Match between system and the real world
3. User control and freedom
4. Consistency and Standards
5. Help users recognize, diagnose, and recover from errors
6. Error Prevention
7. Recognize rather than recall
8. Flexibility and efficiency of use
9. Aesthetic and minimalist design
10. Help and documentation

8 Golden Rules (Shneiderman)

- Strive for consistency
  - Identical Terminology (unifying metaphor) in prompts, menus, and help screens
  - Consistency in color, layout, capitalization, fonts
- Enable frequent users to use shortcuts
  - Abbreviations; Special keys; Hidden commands; Macro facilities
- Offer informative feedback
- Design dialogs to yield closure
  - Sequences of actions should be organized into groups
  - Beginning, middle, and an end
- Offer error prevention and simple error handling
- Permit easy reversal of actions
- Support internal locus of control
- Reduce short-term memory load

Conceptual Model

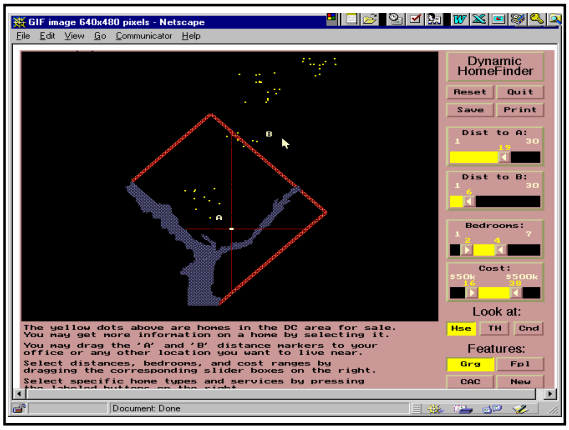
- "a description of the proposed system in terms of a set of integrated ideas and concepts about what it should do, behave and look like, that will be understandable by users in the manner intended"
- This model represents what the user is likely to think , and how the user is likely to respond.
- "The most important thing to design is the user's conceptual model. Everything else should be subordinated to making the model clear, obvious, and substantial. That is almost exactly the opposite of how most software is designed"
  Little, 1996, p. 17

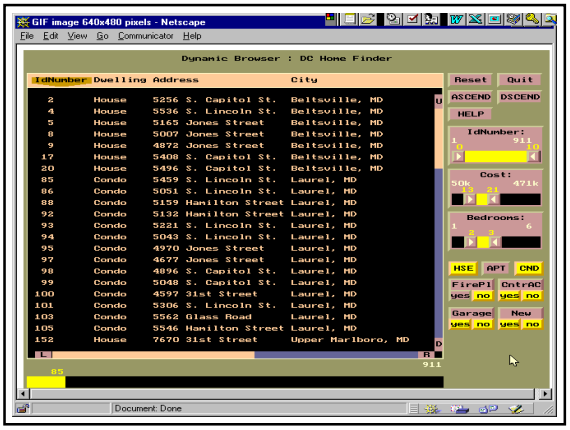
Conceptual Models

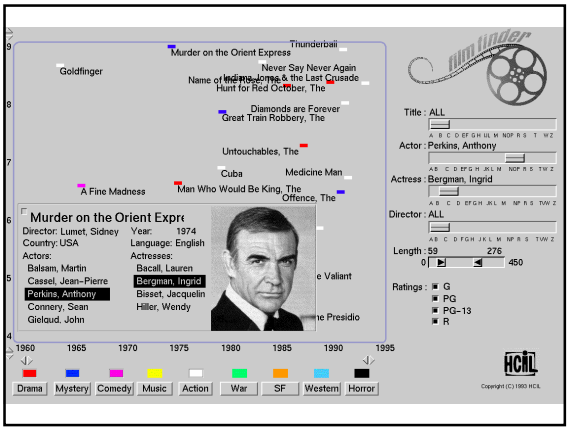
- Based on activities
  1. Instructing
  2. Conversing
  3. Manipulating objects & Navigating
  4. Exploring & Browsing
- Based on objects
- Unix versus desktop
- Word versus Latex
- Paper clip versus help

Direct Manipulation Interfaces

- Visual representation (metaphor) of the "world of action"
  - Objects and actions are shown
  - Analogical reasoning is tapped
- Rapid, incremental, and reversible actions
- Replacement of typing with pointing and selecting
- Immediate visibility of results of actions







Claims about virtues

- Novices can learn basic functionality quickly, usually through a demonstration by a more experienced user
- Experts can work extremely rapid to carry out a wide range of tasks, even defining new functions and features
- Knowledgeable intermittent users can retain operation concepts
- Error messages are rarely needed
- Users can see immediately if their act5ions are furthering their goals, and if not, then can simply change the direction of their activity
- Users have reduced anxiety because the system is comoprehensible and because actions are easily reversible

Direct Manipulation Interfaces

- Hutchins, E., Hollan, J., and Norman, D. (1986). Direct Manipulation Interfaces. In Norman, D. an Draper, S. (Eds.), *User Centered System Design*, LEA, 87-124.
- Directness
  - Distance
    - Semantic
    - Articulatory
  - Engagement

Distance & Engagement

- Distance
  - Distance between one's thoughts and the physical requirements of the system under use
  - Short distance means that the translation is simple and straightforward, that thoughts are readily translated into the physical actions required by the system and that the system output is in a form readily interpreted in terms of the goals of interest to the user.
  - It is called "distance" to emphasize the fact that directness is never a property of the interface alone, but involves a relationship between the task the user has in mind and the way the task can be accomplished via the interfaces.
  - The critical issues involves minimizing the effort required to bridge the gulf between the user's goals and the way they must be specified to the system.
- Engagement -- The feeling that one is directly manipulating the objects of interest

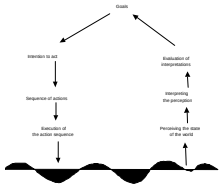
Stages of action (Norman)

- Forming the goal
- Forming the intention
- Specifying the action
- Executing the action
- Perceiving the system state
- Interpreting the system state
- Evaluating the outcome

Two Gulfs:

Execution: Does the system provide actions that correspond to the intentions of the person?

Evaluation: Does the system provide a physical representation that can be directly perceived and this directly interpretable in terms of the intentions and expectations of the person?



More on Distance

- The feeling of directness is inversely proportional to the amount of cognitive effort it takes to manipulate and evaluate a system
- Cognitive effort is a direct result of gulfs of execution and evaluation
- The more of the gulf spanned by the interface, the less distance need be bridged by the efforts of the user

More on direct engagement

- The systems that best exemplify Direct Manipulation all give us the qualitative feeling that we are directly engaged with control of the objects – not with the programs, not with the computer, but with the semantic objects of our goals and intentions.
- Making the central metaphor of the interface that of the model world supports the sensation of directness: instead of describing the actions of interest, the user performs those actions.
  - In the conversational interface, the system describes the results of the action.
  - In the model world the system would present directly the actions taken upon the objects.
- When an interface presents a world of action rather than a language of description, manipulating a representation can have the same effects and the same feel as manipulating the thing being represented.

Semantic Directness

- Is it possible to say what one wants to say in this language?
- Can things of interest be said concisely
- Semantic directness requires matching the level of description required by the interface language to the level at which the person thinks about the task.
- Semantic distance in the gulf of execution reflects how much of the required structure is provided by the system and how much by the user.
  - The more that the user must provide, the greater the distance to be bridged.
- On the evaluation side, semantic distance refers to the amount of processing structure that is required for the user to determine whether the goal has been achieved.
  - If the terms of the output are not those of the user's intention, the user will be required to translate the output into terms that are compatible with the intention in order to make the evaluation.

Reducing the semantic distance that must be spanned

- The designer can construct higher-order and specialized languages that move toward the user, making the semantics of the input and output languages match that of the user.
  - Because of the incredible variety of human intentions, the lexicon of a language that aspires to both generality of coverage and domain specific functions can grow very large (e.g., lisp).
- The user can develop competence by building new mental structures to bridge the gulfs. In particular, this requires the user to automate the response sequence and to learn to thing in the same language as that required by the system.
  - Automated behavior does not reduce semantic distance
    - Reduces effort to cross gulfs, but not size of gulfs.
  - The user can adapt to the system representation

Articulatory directness

- Where semantic directness has to do with the relationships between user's intentions and meanings of expressions, articulatory directness has to do with the relationships between the meanings of expressions and their physical form
  - On the input side, the form may be a sequence of character-selecting key presses for a command language interface, the movement of a mouse and the associated "mouse clicks" in a pints device interface, or a phonetic string in a speech interface.
  - On the output side, the form might be a string of characters, a change in an iconic shape, an auditory signal, or a graph, diagram, or animation.

Articulatory distance in the gulfs of execution and evaluation

- input side
  - an interface that permits specification of an action by mimicking it, thus supporting a articulatory similarity between the vocabulary item and its meaning.
  - It may be possible to exploit previous user knowledge in creating this relationship. Much of the work on command names in command language interfaces is an instance of trying to develop memorable and discriminable arbitrary relationships between the forms and the meanings of command names.
- output side
  - if the user is following the changes in some variable, a moving graphical display can provide articulatory directness.
- In general, highly dependent upon i/o technology
- Iconographic languages are examples of articulatory representation in which the form of the expression is related to its meaning.

Direct Engagement

- Occurs when a user experiences direct interaction with the objects in a domain.
- There is a feeling of involvement directly with a world of objects rather than of communication with an intermediary.
- The interactions are much like interacting with objects in the physical world.
- Actions apply to the objects, observations are made directly upon those objects, and the interface and the computer become invisible.
- Form and speed of feedback is especially relevant in maintaining this illusion.

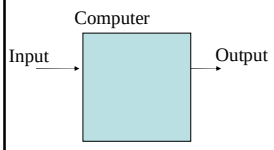
Understanding Users

Chapter 3

Representational Theory of Mind

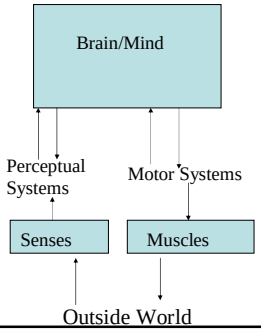
- Internal representations are the data the mind reasons about
- Perceptual processes produce internal representations
  - Vision is a peripheral process that delivers internal representations that the central processes reason with
  - Vision system developed as result of evolutionary processes
- Cognitive Processes reason given an internal representation (for example, in a logical form) as produced by peripheral processes

Computer Architecture



- Software
- Hardware
- Data Structures
- Central versus Peripheral Processes

Cognitive Architecture



- Software
  - Mind
- Hardware
  - Brain
- Data Structures
  - Internal reps, Symbols
- Central versus Peripheral Processes
  - Cognition versus perception and motor systems

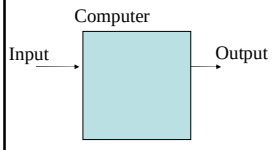
Part 2: Three conceptual frameworks

1. Mental Models
2. Information Processing (GOMS)
3. External Cognition

Mental Models

- Thermostat as a tap
  Thermostat as a switch
- Intelligence (Robert Wood)
  - *Fluid* - inherent capacity to process, interpret, encode and manipulate
    Crystallized - acquired knowledge, language, and culture and ability to recall info when needed
- Ability
  - *Entity theorists* believe that personal abilities are relatively fixed and difficult to change
  - *Incremental theorists* change and can be developed

Computer Architecture



- Software
- Hardware
- Data Structures
- Central versus Peripheral Processes

Social Mechanisms in Communication and Collaboration

Chapter 4

Computer-Mediated Cooperation

- Groupware system supports groups of people engaged in a common task (or goal)
  - Provide an interface to shared environments
  - Facilitate communication, coordination, and collaboration of group effort
- Groupware provides representational system
- Development requires analysis of work environment and design of both interface and mediated interaction among users

Groupware Systems

	Same Place	**Different Place**
Same Time	Live Board	Chat Room
Different Time	Shift Change	Email

Communication

Turn Taking Rules

At the point of turn transition:

1. Current Speaker selects next
   - The current speaker chooses the next speaker by asking an opinion, question, or request
2. Self-Selection
   - Another person decides to start speaking
3. The current speaker continues talking

Third Position Repair (Schegloff, 1993)

First Position:

Speaker presents a contribution

Second Position:

Other participants have an opportunity to display a response

Third Position:

First speaker can amend her presentation if it did not invoke a preferred response

Clark's features of communication

- Copresence
  - Users are near each other, and can point at objects in common ground
- Visibility
  - Users can see each other; allows gestures, facial expressions
- Audibility
  - Users can hear each other, and use natural language
- Co-temporality
  - Users can expect to receive a timely reply; interruptions or delays are significant

Clark's features of communication

- Simultaneity
  - Users can send and receive at the same time; allows interruption, backchannel feedback
- Sequentiality
  - User contributions are strictly ordered, and cannot get out of order
- Reviewability
  - Users can look at the past history of the conversation
- Revisability
  - Users have the option of editing their contributions before they commit to them

Some examples

- Face-to-face
  - Copresence, visibility, audibility, Cotemporality, simultaneity, sequentiality
- Telephone / Voice over IP
  - Audibility, cotemporality, simultaneity, sequentiality
- Family radio / DirectConnect / walkie-talkies
  - Audibility, cotemporality, sequentiality
- Email/SMS/Text messaging
  - Reviewability, revisability
- Chat/IM/IRC/ICQ
  - Cotemporality, reviewability, revisability

Coordination

Problems of Coordination

- greeting someone, planning a potluck dinner party, moving through a doorway, forming a queue at the coffee shop
- assignment of roles; location; path; manner; selection and ordering of actions; timing; establishment of co-references
  - example: two people moving a couch

Staying Coordinated

- Coordination Mechanisms
  - Verbal and non-verbal communication
  - Schedules, rules, and conventions
  - Shared external representations
    - Designed
    - Improvised
- Online Medium
  - Shared External Representations (WYSIWIS)
    - Whiteboards; Documents
  - Email

Shared Representations

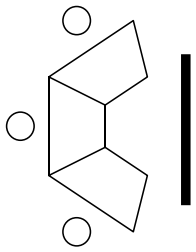
Shared Representations: Problems in Communication

Design for conversation: lessons from Cognoter

Tatar, Foster, and Bobrow (1990)

Colab Room and Cognoter - Colab

- Same-time/Same-place brainstorming
- Three users each with a private computer
- Liveboard visible to all
- Can mirror other computer's display on own display
- Can mirror one private display on Liveboard
- Colab designed for different collaboration project



Colab and Cognoter - Cognoter

- Cognoter designed to implement shared workspaces
- Parcel-Post model of communication
  - Basic unit is the "item" - icon + short text
    - Annotations can be added to items
  - Create items in private windows
  - Present and organize items in public (WYSIWIS) item-organization windows

User Experiences

- They hated it!
- First group gave up
  - First, each made private edits, ignoring the others
  - Evidently when the time came to merge them they gave up on the system and switched to pen and paper
- Second group switched to arrangement where one person typed and the rest contributed
  - Effectively, two roles: one author (typing in the information) and two reviewers (heckling)
- Users were extremely frustrated - didn't understand the conceptual model behind displaying others' screens

Shared Representations & Communication Problems

- Users must choose between verbal, textual, or combined communication
- Users must attend to both verbal, and three potential sources of textual, communication
- Users need to:
  - Produce contributions
  - Recognize contributions
  - Make responses to contributions

Producing contributions

- Verbal contributions are not permanent
- Textual contributions may not be noticed
- When combining the two, verbalization may precede incoming text; but waiting until the text appears will yield conversational floor.
- Speaker cannot make mid-utterance corrections, nor can the listener contribute by completing the utterance.

Recognizing contributions

- Anonymity of text ensures confusion
- Mixed timing of textual and verbal contributions means that listener has to make effort to connect the two
- Lack of obvious sequentiality makes it difficult to follow conversational thread
- Lack of try-markers and other cues implies that contribution is elementary, i.e., can be understood by itself, even when this is not the case

Making responses to contributions

- Responses, usually required in conversation, are optional in text
- Non-response to a textual contribution is therefore ambiguous
- Textual responses often missed, or not apparent as responses, because attention of listeners cannot be assessed.

Problems - Co-reference

- Users often used inappropriate references ("that one", "the one in the upper left corner")
- Since they were not usually comparing their screen to others', the uselessness of such references was not apparent
- Keeping track of changes increases difficulty of maintaining co-reference.

Findings from observational studies of collaborative work
John C. Tang

- Small groups of people were observed in a collaborative design task using a shared drawing space.
- Hand gestures used to uniquely communicate significant information
- Process of creating and using drawings conveys much information not contained in the resulting drawings
- Drawing space is an important resource for the group in mediating their collaboration
- Fluent mix of activity in the drawing space
- Spatial orientation among the collaborators and the drawing space has a role in structuring activity

Shared Workspaces: How do they work and when are they useful
(Whittaker, Geelhoed, Robinson)

- Compare (Audio) Vs. (Audio + Workspace)
  - Three kinds of tasks
- Undemanding text based
  - Joint production of brief textural summary
  - No benefits to shared external representation
- Demanding text based
  - text editing
  - With task practice, more efficient than audio alone
- Design Collaboration
  - Graphical design
  - Much easier to express spatial relations

Email

Semistructured Messages are Surprisingly Useful for Computer-Supported Coordination

Thomas W. Malone, Kenneth R. Grant, Kum-Yew Lai, Ramana Rao, David Rosenblitt

- Semi-structured Messages
  - "Messages of identifiable types, with each type containing a known set of fields, but with some of the fields containing unstructured text or other information."
- Examples
  - Seminar announcement, debug report, project management, computer conferencing
- Information Lens

Advantages of Semi-Structured Messages

- Reflects structure of the processing people already do in handling data
- Provides templates for creating messages, making sure that all the necessary information is provided in the message.
- Allows communication of non-standard info in the unstructured fields
  - This is the advantage over fully-structured communication.
- Genre Theory

Features Made Possible

- Automatic aids to constructing messages
  - Defaults for each field
  - Possible alternatives for limited fields like date or time
  - Explanation of filed
- Rules for automatically processing messages
- Allows default responses, including complex actions to incoming messages

The Coordinator (Winograd & Flores)

- Management Information System (MIS) based on Speech Act Theory
- A tool for interoffice communication (like email) about commitments, scheduling.
- Commitments are tracked. Conflict notification and reminders provided.
- Provides a method for filtering and visualizing status of current ongoing conversations.

Speech Acts

- Concerned with the functions of utterances in conversation
- Indirect Speech Act
  - Can you reach the salt?
  - What time does the train to Montreal leave?
- Use plan recognition to understand indirect speech act

5 Categories of Speech Acts

- Assertives
  - Commit the speaker to something being the case
- Commissives
  - Commit the speaker to some future action
- Declarations
  - Pronounce something has happened
- Directives
  - Get the listener to do something
- Expressives
  - Express a state of affairs, such as apologizing or praising someone

Conversation for Action (CfA)

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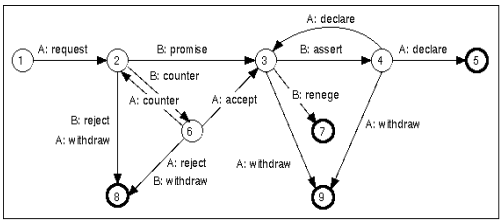


Implementation

- Each message belongs to a particular conversation.
- User specifies which linguistic action each message serves.
  - Request, Offer, Acknowledge, Commit-to-commit, Interim-report, Promise, Counter-offer, Decline, Report-completion
- User specifies a time frame where appropriate.
  - Respond-by date, Complete-by date, alert date

Converse Menu

```
                    C O N V E R S E

OPEN CONVERSATION FOR ACTION          REVIEW / HANDLE
   Request                              Read new mail
   Offer                                Missing my response
                                        Missing other's response
OPEN CONVERSATION FOR POSSIBILITIES
   Declare an opening                   My promises/offers
                                        My requests
ANSWER                                  Commitments due: 24-May-88

NOTES                                   Conversation records
```

Menu generated for responding to a request

```
SPEAKING IN A CONVERSATION FOR ACTION

 Acknowledge        Promise
 Free-Form          Counter-offer
 Commit-to-commit   Decline
 Interim-report     Report-completion
```

Awareness Mechanisms

Awareness

- Social awareness
  - Knowing who is around, what is happening, and who is talking with whom
- Peripheral awareness
  - Ability to keep track of what is going on in the physical or social context
- Versus interruption
- While multi-tasking

Social Translucence: Designing Systems that Support Social Processes

Thomas Erickson and Wendy A. Kellogg

ACM Transactions on Computer Human Interaction,
Vol.7, No. 1, March 2000

Renis Cama
Jie Chen

Foundations: Social Translucence

- What is a **"Socially Translucent System"**?
  Example: Door opens from stairwell into the hall

vs.

- Three properties:
  - Visibility
  - Awareness
  - Accountability

Making Activity Visible

- The Realist Approach
- The Mimetic Approach
- Abstract Approach

Realist Approach

Teleconferencing and Videospace Systems

Pros:

Minimizes the difficulty of producing and interpreting social cues

Cons:

a. Resolution limited
b. Very expensive
c. Scaling

Mimetic Approach

Graphical MUDS and Virtual Reality Systems – Avatars

Pros:

Reduces bandwidth requirement

Cons:

a. Scaling issues
b. Social cues must be consciously produced via users manipulating their avatars

Abstract Approach

- Social information independent of physical analogs
  - Text (e.g., emote)
  - abstract graphical representations (e.g., chat circles)
- Interested in Abstract Approach
  a. Creates and deploys working systems
  b. Lack of attention

Babble Prototype

- Two tactics used:

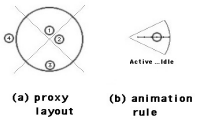
  a. Textual representation

  b. Synchronous representation

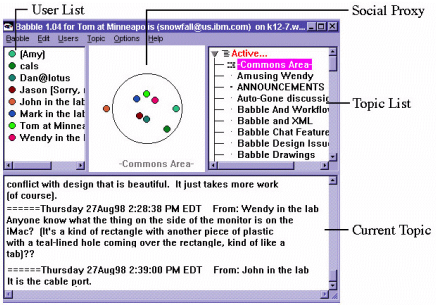
Social Proxy Schema

Minimalist graphical representation of users that depicts their presence and their activities

- Size of the audience
- Amount of conversational activity
  - More active participants are closer to the center
- Monitoring activity



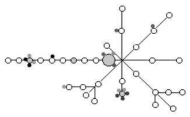
The Babble



Social Proxy

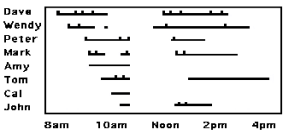
- Participants are shown in public conversations
- One-One private chats in the system not shown
- Making private chats visible increases Awareness
- Negative scenarios?
- Advice participants what actions are visible

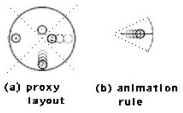
Community Proxy



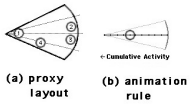
- Larger circles represent conversation topics
  - Filled circles new information
- Smaller dots represent participants

Diachronic Social Proxies





Lecture Social Proxy



- Dots move toward the apex of the wedge with cumulative activity
- Lecturer is all the way to the front

Visualizing Conversation

- Search for various topics in prior conversations
- Hits are color coded

Agents

Addendum to Chapter 5 notes for textbook

Agents that Reduce Work and Information Overload

- Pattie Maes, Communication of the ACM July 1994/Vol. 37, No. 7, 31-40.

Contra direct manipulation

- "The currently dominant interaction metaphor of *direct manipulation* requires the user to initiate all tasks explicitly and to monitor all events.
  - This metaphor will have to change if untrained users are to make effective use of the computer and networks of tomorrow."

Autonomous agents

- Implement a complementary style of interaction, which has been referred to as *indirect management.*
  - Instead of user-initiated interaction via commands and/or direct manipulation, the user is engaged in a cooperative process in which human and computer agents both initiate communication, monitor events and perform tasks.
  - The metaphor used is that of a *personal assistant* who is *collaborating with the user* in the same work environment. The assistant becomes gradually more effective as it learns the user's interests, habits and preferences (as well as those of his or her community.) …

Competence & Trust

- Competence:
  - How does an agent acquire the knowledge it needs to decide when to help the user, what to help the user with and how to help the user?
- Trust:
  - How can we guarantee the user feels comfortable delegating tasks to an agent?

Earlier Approaches

- End-user programming (e.g., user programmed rules for sorting mail)
  - Competence (depends on user)
  - Trust (do you trust your own programming skill)
- Knowledge-based approach (build large system with expertise about domain and user tasks, e.g., UCego --- help for user in solving problems in UNIX)
  - Competence (huge amount of work for knowledge engineer; also knowledge is fixed once and for all.
  - Trust (programmed by somebody else, user may not know limits, way it works, …)

Autonomous Agent Approach

- Under certain conditions, an interface agent can "program itself"
  - The agent is given a minimum of background knowledge, and it learns appropriate "behavior" from the user and from other agents.
  - the use of the application has to involve a substantial amount of repetitive behavior (with the actions of one user or among user
  - this repetitive behavior is potentially different for different users." (p812)
- Less work for user
- Agent can adapt to user over time

Agents acquire competence from four different sources

1. Observing and imitating the user
2. Receiving positive and negative feedback from the user
3. Receiving explicit instructions from the user
4. Asking other agents for advice

Claim

- The set of tasks or applications an agent can assist in is virtually unlimited: information filtering, information retrieval, mail management, meeting scheduling, selection of books, movies, music, and so forth.

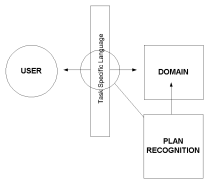
Four Example Agents

- Electronic mail agent
  - Learns to prioritize, delete, forward, sort, archive mail messages
- Meeting scheduling agent
  - Assists user with the scheduling of meetings (accept/reject,(re)schedule, negotiate meetings times)
- News filtering agent
  - Helps the user filter Usenet Netnews.
  - Train "news agents" on examples of (+-) articles
- Entertainment selection agent (music or books)
  - Does social filtering.
  - The agents rely on finding correlations between different users.
  - Every user has an agent that memorizes likes and dislikes
  - Agents find other agents that are correlated, accepting recommendations from other correlated agents.

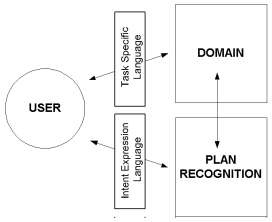
Adaptive Components & Conversational Agents

- Adaptive Component
  - Adjust system response to user's goals and preferences
  - Suggest hyper link, Macro operators, Adjust presentation of information, Sort mail, Improve retrieval of information, Assist in planning
- Conversational Agents
  - Conversational interaction with agent to do trip planning
- Both adaptive components & Conversation agents require agent can identify/recognize user intent

Plan Recognition with Task Specific Language



Plan Recognition with Intent Expression Language



User-created expressiveness

- Users have created *emoticons* - compensate for lack of expressiveness in text communication:
  - Happy :)
  - Sad :<
  - Sick :X
  - Mad >:
  - Very angry >:-(
- Also use of icons and shorthand in text and instant messaging has emotional connotations, e.g.
  - I 12 CU 2NITE

Key points

- Affective aspects are concerned with how interactive systems make people respond in emotional ways
- Well-designed interfaces can elicit good feelings in users
- Expressive interfaces can provide reassuring feedback
- Badly designed interfaces make people angry and frustrated
- Anthropomorphism is increasingly used at the interface, in the guise of agents and virtual screen characters