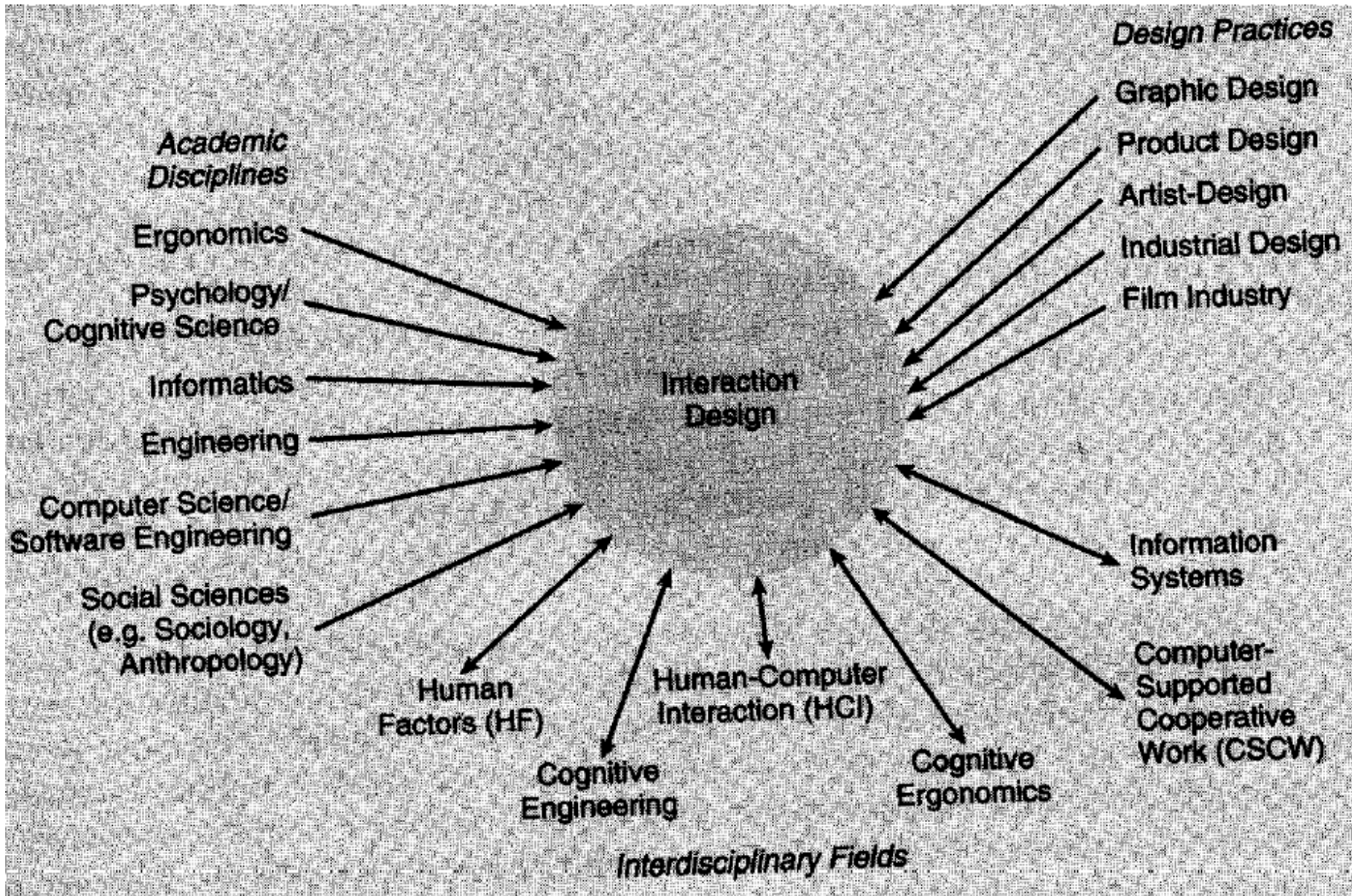


Interaction Design is Interdisciplinary



Process of interaction design

1. Identify needs and establish requirements.
2. Develop alternative designs that meet those requirements.
3. Build interactive versions of the designs so that they can be communicated and assessed.
4. Evaluate what is being built throughout the process.

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

References

- Norman, D. (1988) The Psychology of Everyday Things. Basic Books.
- Nielsen, J. (2001) Ten Usability Heuristics.
www.useit.com/papers/heuristic
- Shneiderman, B (1998) Designing the User Interface (3rd edition). Addison-Wesley.

Conceptual Model

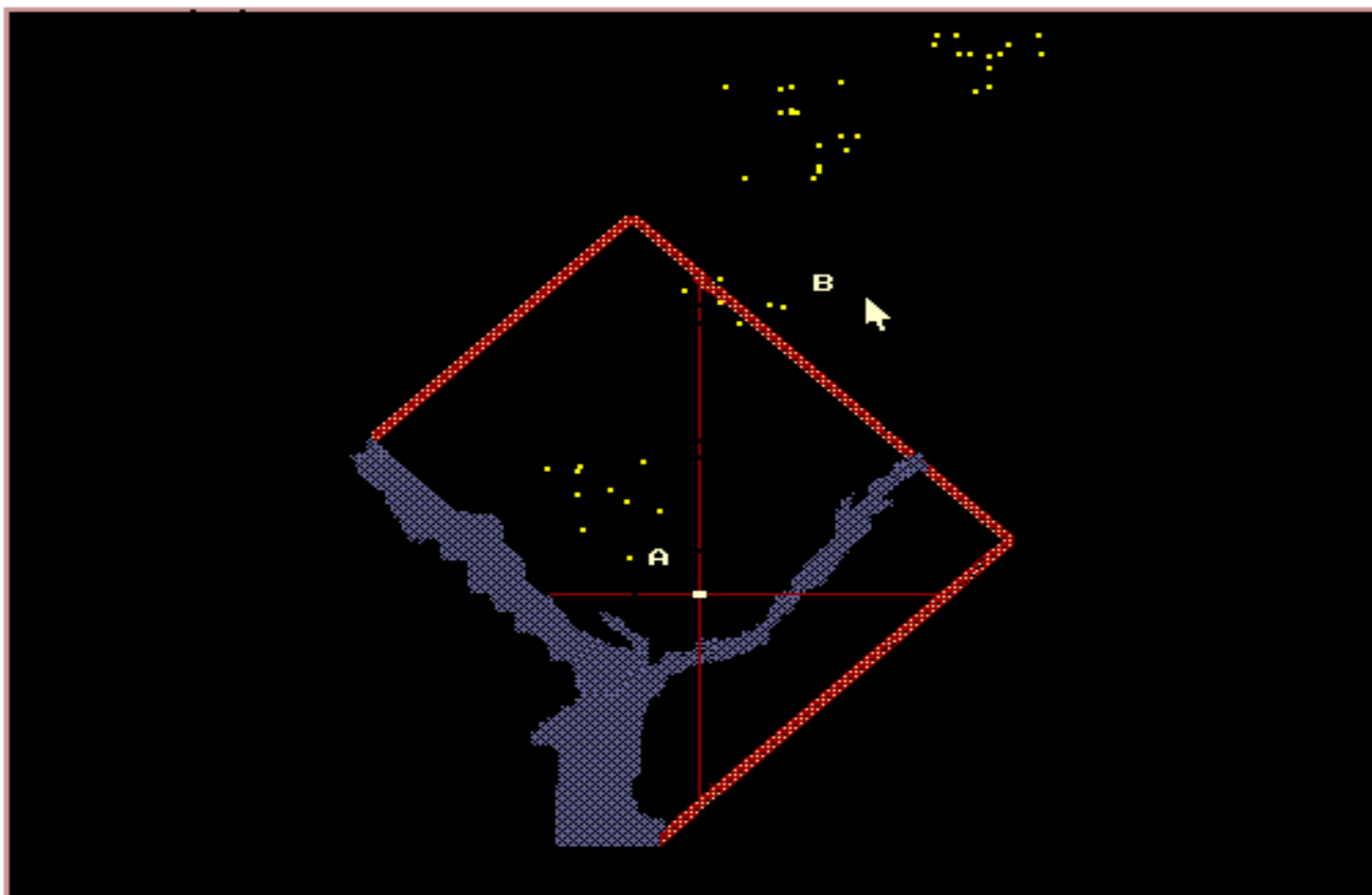
- “a description of the proposed system in terms of a set of integrated ideas and concepts about what it should do, behave and look like, that will be understandable by users in the manner intended”
- This model represents what the user is likely to think , and how the user is likely to respond.
- “The 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



The yellow dots above are homes in the DC area for sale. You may get more information on a home by selecting it. You may drag the 'A' and 'B' distance markers to your office or any other location you want to live near. Select distances, bedrooms, and cost ranges by dragging the corresponding slider boxes on the right. Select specific home types and services by pressing the labeled buttons on the right.

Dynamic HomeFinder

Reset

Quit

Save

Print

Dist to A:



Dist to B:



Bedrooms:



Cost:



Look at:

Hse

TH

Cnd

Features:

Grg

Fp1

CAC

New

Dynamic Browser : DC Home Finder

IdNumber	Dwelling	Address	City
2	House	5256 S. Capitol St.	Beltsville, MD
4	House	5536 S. Lincoln St.	Beltsville, MD
5	House	5165 Jones Street	Beltsville, MD
8	House	5007 Jones Street	Beltsville, MD
9	House	4872 Jones Street	Beltsville, MD
17	House	5408 S. Capitol St.	Beltsville, MD
20	House	5496 S. Capitol St.	Beltsville, MD
85	Condo	5459 S. Lincoln St.	Laurel, MD
86	Condo	5051 S. Lincoln St.	Laurel, MD
88	Condo	5159 Hamilton Street	Laurel, MD
92	Condo	5132 Hamilton Street	Laurel, MD
93	Condo	5221 S. Lincoln St.	Laurel, MD
94	Condo	5043 S. Lincoln St.	Laurel, MD
95	Condo	4970 Jones Street	Laurel, MD
97	Condo	4677 Jones Street	Laurel, MD
98	Condo	4896 S. Capitol St.	Laurel, MD
99	Condo	5048 S. Capitol St.	Laurel, MD
100	Condo	4597 31st Street	Laurel, MD
101	Condo	5306 S. Lincoln St.	Laurel, MD
103	Condo	5562 Glass Road	Laurel, MD
105	Condo	5546 Hamilton Street	Laurel, MD
152	House	7670 31st Street	Upper Marlboro, MD

Reset Quit
 ASCEND DSCEND
 HELP

IdNumber:
 1 911
 0 10

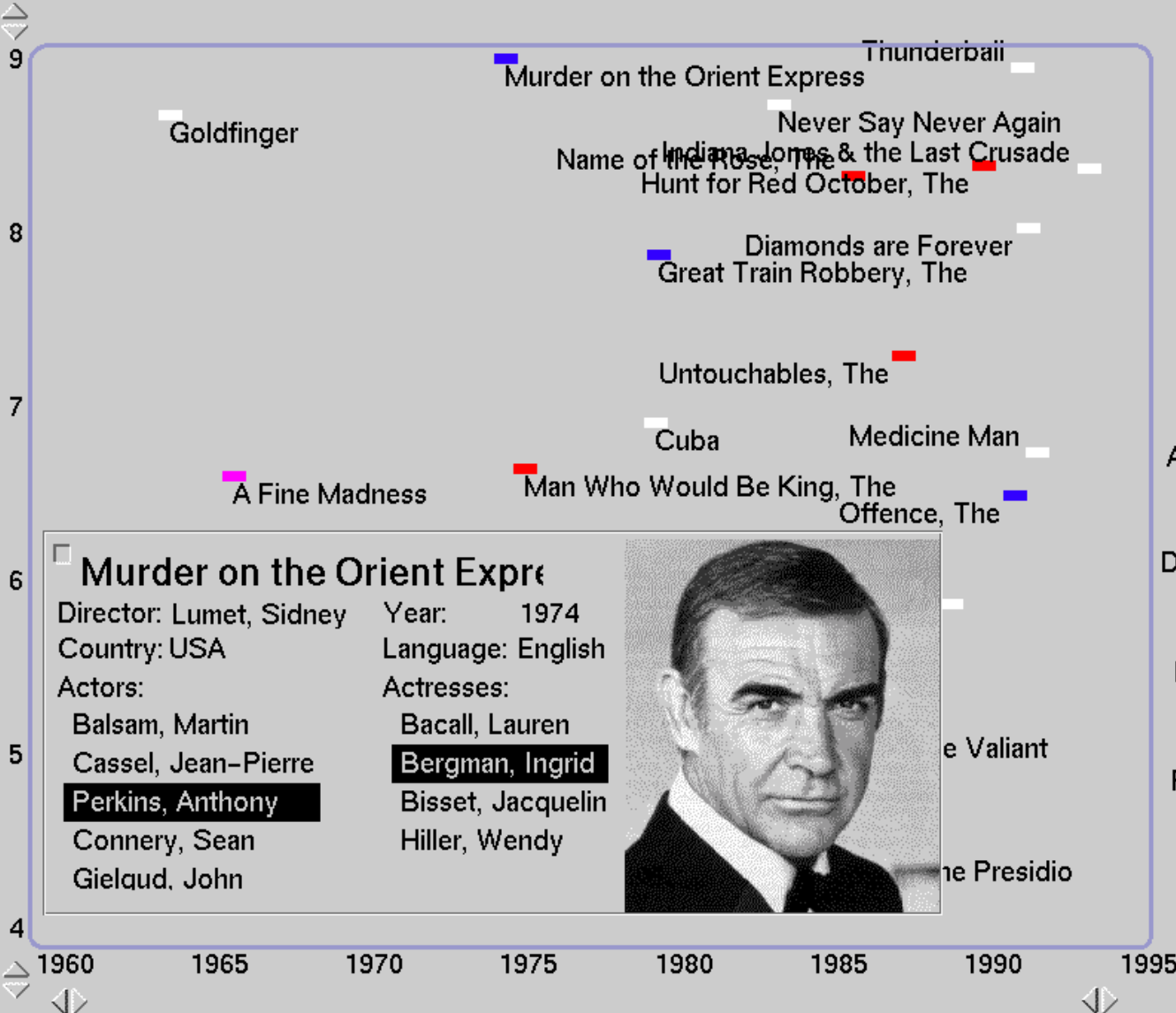
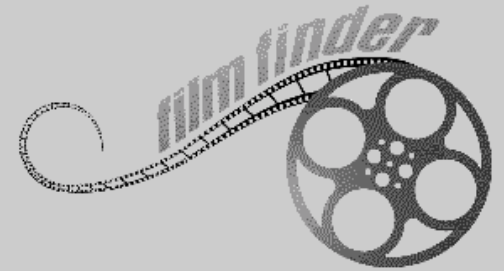
Cost:
 50k 471k
 13 21

Bedrooms:
 1 6
 2 3

HSE APT CND
 FireP1 CntrAC
 yes no yes no
 Garage New
 yes no yes no

911

85



Title : ALL

A B C D E F G H I J L M N O P R S T W Z

Actor : Perkins, Anthony

A B C D E F G H I J K L M N O P R S T W Z

Actress : Bergman, Ingrid

A B C D E F G H I J K L M N P R S T W Z

Director : ALL

A B C D E F G H I J K L M N P R S T W Z

Length : 59 276

0 450

Ratings :

- G
- PG
- PG-13
- R



- Drama
- Mystery
- Comedy
- Music
- Action
- War
- SF
- Western
- Horror

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 actions 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. and 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

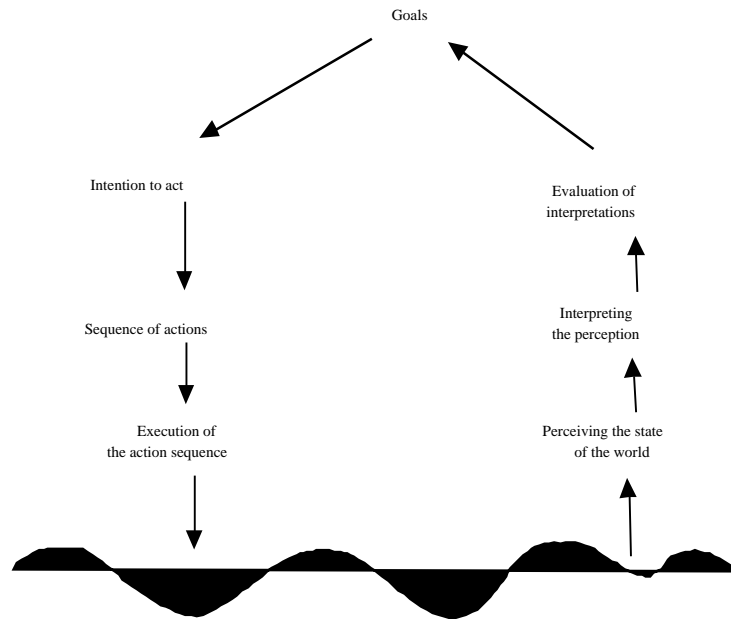
Stages of action (Norman)

- 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?



THE WORLD

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 think 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.