

Interaction Techniques for Ambiguity Resolution in Recognition-based Interfaces

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Recognition

- Recognition is becoming ubiquitous
- Recognition is difficult to use
- A range of interface problems result
- OOPS toolkit helps solve them

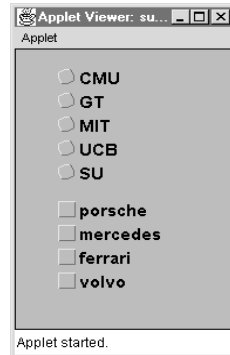
Definitions

- Mediation
 - dialogue between user and computer
 - used for resolving ambiguity
- Recognizer
 - interprets user input
 - creates ambiguity
- Error
 - mistake from user's perspective
 - represented with ambiguity

Outline

- Definitions
- Illustration
- Broad Solution: OOPS
- Context Applications
- Discussion

Clicking



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OOPS Toolkit (CHI'00)

- Toolkit-level support for handling ambiguity in recognition
 - Library of mediators
 - Architectural support
- 1st version: GUI
- 2nd version: Based on Context Toolkit

Library of mediators

- Based on literature survey
- Generic and re-usable
- Three major classes
 - Repetition
 - Choice
 - Automatic

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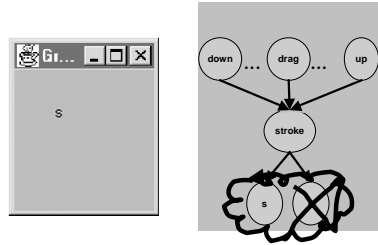
Library of mediators

- Based on literature survey
- *Generic and re-usable*
- Three major classes
 - Repetition
 - Choice
 - **Automatic**

Architectural Support

- **INDEPENDENT** of any specific toolkit
- Separation of mediators, recognizers, context widgets, and application
- Communication by a common internal model (ambiguous hierarchical events)
- Maintains ambiguity indefinitely

Ambiguous Hierarchical Events



Outline

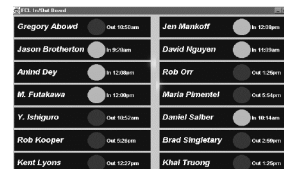
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Context Applications

- In/Out Board
- Messaging

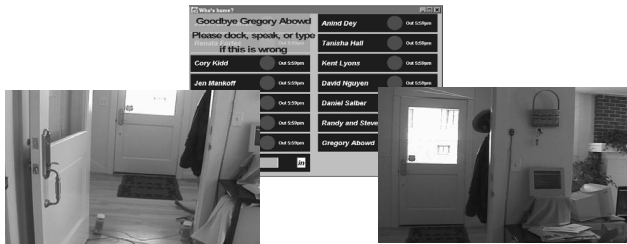
In/Out Board

- What's ambiguous?
 - Direction
 - People Forget



In/Out Board: Mediation

- Visual, Audio feedback of guess
- Many choices for how to mediate



In/Out Board: Mediation

- Distributed over space and time
- Implicit -> Explicit input



Messaging/Communication

- How do you reach someone?
 - Many possible devices (Cell phone, email, find them, etc)
 - Many possible situations (meeting, meal, sleep, etc)
 - Many possible locations

Messaging/Communication

- What's ambiguous?
 - Is it OK to call someone (interrupt)?
 - Where is the person being called?
 - With what device should we try to reach them?
 - Is it OK to give extra info to the caller? What information?

Messaging: Mediation

- Give callee choice to answer call
 - Non-speech audio (e.g. ringing phone)
 - Other, less intrusive alternatives?
 - Inform them about caller
- Give caller choice to send call
 - n -best list of ways to reach someone
 - Information about what they're doing
 - Information about where they are

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Conclusions

- Resolution of ambiguity through mediation
- General toolkit architecture
- Lots of difficult design work left

Future Work

- Testing
- Implicit input
- Arbitrary input devices
- Ambiguity

Acknowledgements

Gregory Abowd
FCE Group

Further Information

<http://www.cc.gatech.edu/fce/errata/>

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Is subArctic doing the work here?

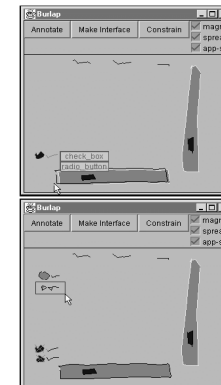
- No, our minimal requirements are common in today's toolkits:
 - An event-based toolkit
 - An input-handling module that delivers events to the appropriate places
 - A library of interactors/widgets
 - Access to source code (OOPS is *not* just a library!)

Recognizer

- Definition:
 - something that interprets user input
 - generally has a domain (of input) and a range (of output)
- Examples:
 - DragonDictate (speech to text)
 - GDT (strokes to gestures)
- Problem areas:
 - Support for correction of errors

Error

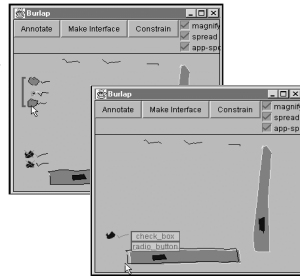
- Definition:
 - a mistaken interpretation (from the *user's* perspective)
- Examples:
 - substitution
 - rejection
 - insertion
- Problem areas:
 - rejection



Mediation

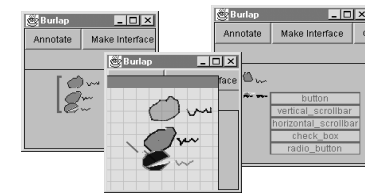
- Definition:
 - a dialogue between the user and application used to determine the correct interpretation
- Problem areas
 - Occlusion
 - Wrong choices

- Examples:

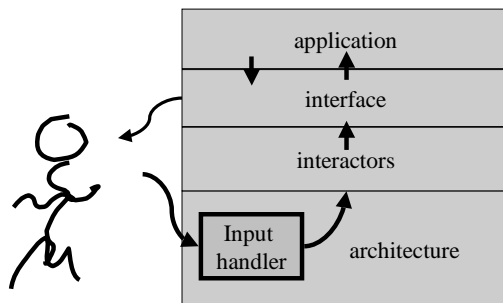


Ambiguity

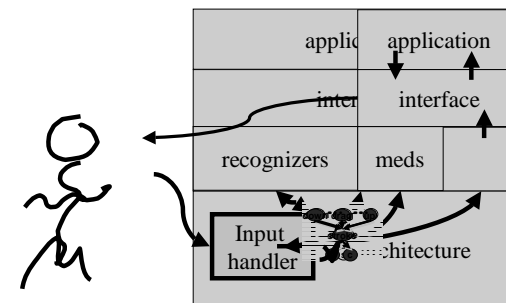
- Definition
 - A case where there is more than one potentially correct interpretation of the user's input
- Problem areas
 - target ambiguity
- Examples
 - target ambiguity
 - segmentation ambiguity
 - recognition ambiguity



Architectural support



OOPS Architecture

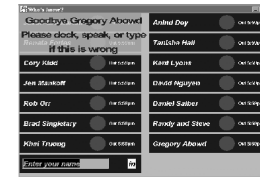


Further generalization: OOPS

- Testing

Further generalization: OOPS

- Testing
- Implicit input
(CT-OOPS; Current)



Further generalization: OOPS

- Testing
- Implicit input
- Arbitrary input devices

Further generalization

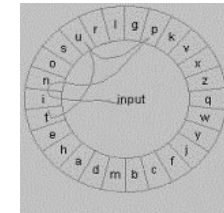
- Testing
- Implicit input
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- Ambiguity

Further generalization

- Testing
 - Implicit input
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- Input

Further generalization

- Testing
 - Implicit input
 - Arbitrary input devices
 - Ambiguity
- Input
 - Cirrin (UIST 98)



Further generalization

- Testing
 - Implicit input
 - Arbitrary input devices
 - Ambiguity
- Input
 - Cirrin (UIST 98)
 - Locked-In Syndrome (Brain-UI; Current)

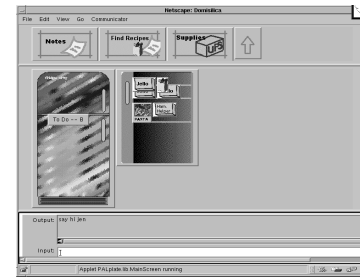
Further Generalization

- Testing
 - Implicit input
 - Arbitrary input devices
 - Ambiguity
- Input
 - Cirrin (UIST 98)
 - Locked-In Syndrome (Brain-UI; Current)
 - Cerebral Palsy (Cursor Activity Recognition; Current)

Further Generalization

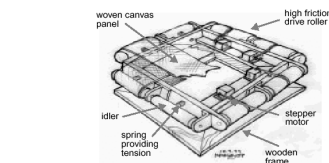
- Testing
- Implicit input
- Arbitrary input devices
- Ambiguity
- Input
- Output

Further Generalization



- Input
- Output
- Bringing People and Places together (Domisilica; CVE 98)

Further Generalization



- Input
- Output
- Bringing People and Places together (Domisilica; CVE 98)
- Ambient Displays (Ten Inch Pixels; 1999)

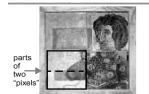


FIGURE 2: A mis-aligned image



FIGURE 3: A mis-matched image



FIGURE 4: More dissonance

Further Generalization

- Testing
- Implicit input
- Arbitrary input devices
- Ambiguity
- Input
- Output

Conclusions

- The problem areas are not intractable
- Toolkit-level support allows us to explore them
- OOPS allows us to build general, reusable solutions

Other thesis results

- Survey of mediation techniques found in existing interfaces to recognition systems
- Two implementations of our architecture