

Non-Speech Audio

Area overview
Four Areas
Evaluation
Challenges/issues

Area overview

1. Will it be heard?
2. Will it be identified?
3. Will it be understood?

Four Areas

Uses of Non-Speech Audio

- Beeps 'n' Bops
- Peripheral Awareness
- Sonification
- Navigation

Four Areas

Beeps 'n' Bops

- Warnings, alerts, status messages
 - Status indicators
 - Error messages
 - Alarms
- Will they be heard, identified, and understood?

Peripheral Awareness

- Using sound to communicate information about the environment
- Compare to information visualization
 - Web server traffic
 - Weather outside
 - Traffic
 - Activity level of colleagues
 - Status of resources (printers, etc.)

Four Areas

Sonification

- “Auditory display of quantitative information”
- Compare to visualization
 - Weather data Demo: Nebraska
 - Stock market data Demo: DJIA
 - Election results Demo: Florida 2000
 - Factory process monitoring and control
 - Surgical assistance Demo: Tactical Surgery
 - Brainwave sonification Demo: Paul's brainwaves



Sonification

Sonification in Education

- Math & science are largely visual
- Blind students are shut out
- Develop a system to turn data into sound
- Virtual Physics Lab
- "Auditory Graphs"
 - ❖ Demo: Sonification Sandbox

Sonification Design Issues

- Mapping
 - ❖ Data dimension --> Display
 - > Dollars --> pitch (or distance from x-axis)
- Polarity
 - ❖ Increasing pitch = increasing or decreasing \$?
- Scaling
 - ❖ Double the pitch = double the \$?
- Context
 - ❖ Equivalent to tick marks, axes, trend lines
- Interaction techniques

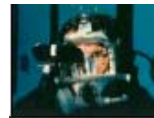
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Four Areas

Navigation

- Getting around, for those who cannot look or cannot see
 - ❖ Persons with visual impairments
 - ❖ Military applications



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Evaluation

- How do we evaluate these technologies?
 - ❖ Navigation effectiveness
 - ❖ Situational awareness
 - ❖ Movement speed, efficiency
 - ❖ Comfort, satisfaction
 - ❖ Safety
- Key: Do they help the user to safely accomplish specific tasks?

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Other Issues

- Interaction with the system?
 - ❖ Input (speech, text, other)?
 - ❖ Output (auditory display design)?
- Output devices
 - ❖ Headphones block ambient sound
 - ❖ Other systems are either bulky (speakers, audio spotlight), or poor quality (bone phones)
- Standards, programming tools, awareness
- Training and practice
 - ❖ Smith & Walker, 2002

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More Practical Issues

- Human auditory perception
 - ❖ Abilities, limitations
- Audio-visual integration
 - ❖ e.g., McGurk effect
- Technical issues
 - ❖ File formats (wav, aiff, mp3, acc/mp4)
 - ❖ Sampling rates, frequency responses
 - ❖ Output variability (speakers, phones, etc.)
 - ❖ Programming hooks

Interested in More...

- Sonification Lab
 - ❖ <http://sonify.psych.gatech.edu>
- Bruce Walker
- Projects in all these areas, plus other “non-traditional interfaces”

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AGENT

UI Agent

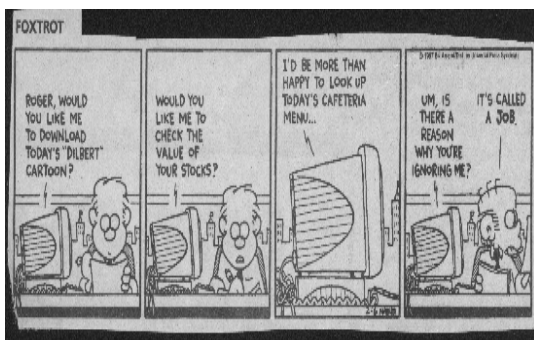
Agency

Autonomous Agent

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Yet To Come...?



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AGENCY

- Direct Manipulation
 - User initiates actions and carries them out directly
- Indirect Management
 - Cooperative process where human and computer both initiate actions

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AUTONOMOUS AGENT

- Personal assistant who collaborates with user to accomplish tasks
 - Level of autonomy can vary
 - Takes directions
 - Takes initiative
 - May learn user's preferences
 - Human appearance?

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Ack! It's the Paper Clip

- Two challenges exist
 - Competence - Does the agent have the requisite knowledge to truly assist the user?
 - Trust - Does the user feel comfortable delegating task to agent?



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More help...



- What could agents do for us?

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Agency Approaches

- 1. Application is semi-autonomous agent
 - User programs rules a priori for how agent should perform
- 2. Knowledge-based
 - Give the agent interface domain knowledge and user knowledge
- 3. Learning approach
 - Give agent minimal domain knowledge, then have it watch user and learn behaviors

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Learning Approach

- Like a personal assistant who gets better and better
- Learns by
 - 1. Looking over shoulder, watching actions
 - 2. Direct and indirect feedback
 - 3. Hypothetical examples
 - 4. Asking other agents for advice

Examples

- Email agent
 - Prioritize, delete, sort, ...
 - Looks at fields to make decisions (How weighted?)
 - Has “tell-me” and “do-it” thresholds for individual actions
 - Has facial expressions to communicate state
- Meeting scheduler
 - Very personalized behaviors
- News filtering
 - Watches what you read, then does filtering
 - Uses keywords
 - Needs deeper natural language help

Examples

- Entertainment agent
 - Agent memorizes user's preferences
 - Goes out and talks to other agents and looks for correlations
 - Makes recommendations

Issues

- Should agents be made human-like?
- If so, should they have personalities?
- How can we guarantee privacy if agent collaboration occurs?
- Should someone be held responsible for what their agent does?