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Robots for Pre-orientation and Interaction of Toddlers and Preschoolers who are Blind





## Robots to guide the blind

Can we effectively use multi-modal interfaces in autonomous mobile robots at least to facilitate humancomputer interaction?

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#### WEDNESDAY, JUNE 18, 2003 **Visionary plan for robots**

ROBOTS that can detect fires and intruders in the home and micro-chipped glasses that can alert the wearer to upcoming objects will seen become tools for the vision impaired if funding is gained for a Griffith University project.

Associate Professor Brendan Bartlett, of the Vision, language and special education school said the massive project involved the use of specially programmed robots designed to enhance the lives of standly impaired people at all stages of their lives.

With the aim of making robots a familiar and useful object from childhood, a team from Griffith University last week visited Narbethong Special School at Buranda where Johanna Medcalf, 3, was introduced to a modified Sanyo rebotic deg nicknamed Miranda. Johanna's initial caution was

quickly overcome as she reached out to investigate the talking. singing dancing toy.

While the robotic dog (which they plan to turn into a kangaroo called Eye Quede Kangaroo). was designed just to be a boy, the academics carofully observed Johanna's reaction to it.

The first thing is to see if a young child is capable of changing the battery and turning it on and off to get various outcomes." Dr Bartlett said:

He said while a blind person compensated for the lack of right by using other senses, it

was their tactile sense that was of literacy. of paramount importance.

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They learn to learn about learning.

"The day they reach out to feel the world is like a breakthrough The university team, including

What we're looking for here computing and information tech is how long it takes to move from unlogy school deputy head, An toy to tool - when it becomes sociate Professor Vladmir something to help build a house of blocks) with or do sums. "It takes time and patience."

Estrivill-Castro, and six PhD students, studied the reactions of four students from the school as part of their project.

- Margaret Slocomb



 Associate Professor Viedmir Estrivili-Castro introduces Johanna Medcall to Minanda the robot 'Early days are so important with children." Dr Bartlett said.

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## Hypothesis (1)

In the not so distant future humans will be surrounded by all sorts of `intelligent machines'



- Intelligent buildings and Sensitive computing
  - Computing environment intended to assist the user for retrieving, organizing and interpreting available information resources by augmenting and extending the sensory as well as the cognitive capabilities of the user



## Hypothesis (2)

- The sector of the human population that is to benefit the most from `robots around us' are people with disabilities, the elderly and pupils
  - If technology is to reflect an advance society it should make an impact on improving
    - the life of its weak/disadvantaged/untrained members





## Hypothesis (3)

- A convergence is looming on Information and Communication Technologies
  - Mobile phones, PDAs, Wireless/Internet and Intranets through computer watches
  - Wearable computers

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## Hypothesis (4)

- There is a shift from "accessible computing" to "user centered design" in the Human-Computer Interaction community
  - Accessibility
    - Providing accessibility means removing barriers that prevent people with disabilities from participating in substantial life activities
  - UCD

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• Focusing on the product's potential users from the very beginning, and checking at each step of the way with these users to be sure they will like and be comfortable with the final design.



## What does robotics provide?

#### Mobility/autonomy

- It seems intuitively clear that the problems of mobility, orientation and navigation in robotics are similar to those experienced by people who are blind
  - A walking PDA?

### Embodiment

- Does this really matter to the blind?
  - Does it matter that it looks like a dog?





## Robotics has penetrated the home market

Toys

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Lego Mindstorms<sup>TM</sup>



Cindy Smart TM







## Robotics has penetrated human environments

Home artifacts

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- The EUREKA Robo Vac<sup>TM</sup>
- Electrolux Trilobite TM
- Guides for visitors in museums and the elderly







## What is there for people who are blind

- The GuideCane (U of Michigan)
  - weighs about 4 kilograms
- The vOICe (prototype)





• The MINIGUIDE<sup>TM</sup>

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We tested if "off the shelf" technology is usable by people who are blind

#### SONY Aibo

- Relative inexpensive to other ICTtools for people with disabilities
  - JAWS 3.5 for Windows
     Henter Joyce,
     a division of Freedom Scientific
     (800) 444-4443
     www.freedomscientific.com
  - Full version for Windows 95/98: \$795 USD Full version for Windows NT 4.0 or Windows 2000 Professional: \$1,195 USD







## Our revisions:

Back felt

Fuzzy head





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## Aspects investigated empirically

- Can the person who is totally blind turn Miranda on and off?
- Can this individual tell if Miranda is on or off?
- Can the blind person easily find the on/off button?
- Can the person recharge Miranda?
- Can the individual replace the battery?
- Can the blind person remove the battery?
- Can people who are blind find the touch sensors and operate them as buttons? Can they find the tail?

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## Aspects investigated empirically

- Can they keep track of Miranda's sensors?
- Can the blind person recognize Miranda's posture?
- Can the person who is blind recognize Miranda's movements?
- Can the blind toddler be stimulated to explore different options of behavior?
- Do children who are blind develop a bond for a machine that offers multi-modal interaction (sound and movement) under autonomous control in the same way seeing children develop a bond for Miranda because it looks like a dog?

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## Validated the revisions:

- Physical operation by children
  - who are blind (from birth)

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- Blind-folded (seeing subjects)
- Up to 3 sessions with toddlers who are blind
- Two schools

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17 UNIVERSITY

# We developed software that allowed interaction

- A series of configurable tools
  - Simple dance/play soccer/ walk about/sounds
  - Tape recorder/Music player
  - Mail reader/composer
  - Web navigation

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• Emergency assistant



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## Provide multi-modal interaction

- **SOUND** and MOTION
- SOUND => music / speech

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MOTION => pressure, texture, sound, shape, distinctive gestures

Like a mobile phone today with voice, images and vibration when ringing

A series of experimental interactions with toddlers who are blind

Meaningful play is learning



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## **Observations**

- It does matter that it is embodied as a dog
  - What the child learns are **SPATIAL** concepts
    - Fine motor skills for locating buttons
    - A sense of all spatial predicates (preorientation is usually acquired through vision)
      - Back, behind, standing up, sideways





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## **Observations**

Impact of the experience

- Surveyed parents with questionnaire
- Children developed an interest for other technological instruments
  - Play recorders

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• Remote controls for the TV



### Video



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## Summary

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Focus on the robot FOR THE HUMAN who will use it

- Robotics is to enter and overlap with the `sensitive computing /wearable computer/ intelligent PDA'
- We should focus on people with disabilities
  - In educational settings

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• Future work – how can the programmable capability allows development?







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