Barnsley Assistive Technology Team

Speech Driven Environmental Control System
From Specification to Prototype

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- About the SPECS Project
- User requirements for speech driven environmental controls
- User trials and evaluation of a new speech driven environmental control

Barnsley Assistive Technology Team

- Specialist service covering three areas of South Yorkshire
- Expertise in electronic assistive technology
- Work with speech therapists, occupational therapists, physiotherapists, teachers etc.
- Assess, evaluate, customise and deliver EAT
- Involved in research which is related to clinical work

Environmental Controls

- Used by people with disabilities to control their immediate environment e.g. television, telephone, opening door
- A number of common access methods
  - Switch
  - Direct access
- Some speech-driven systems available but speech not widely adopted for EC access

SPECS :: Background

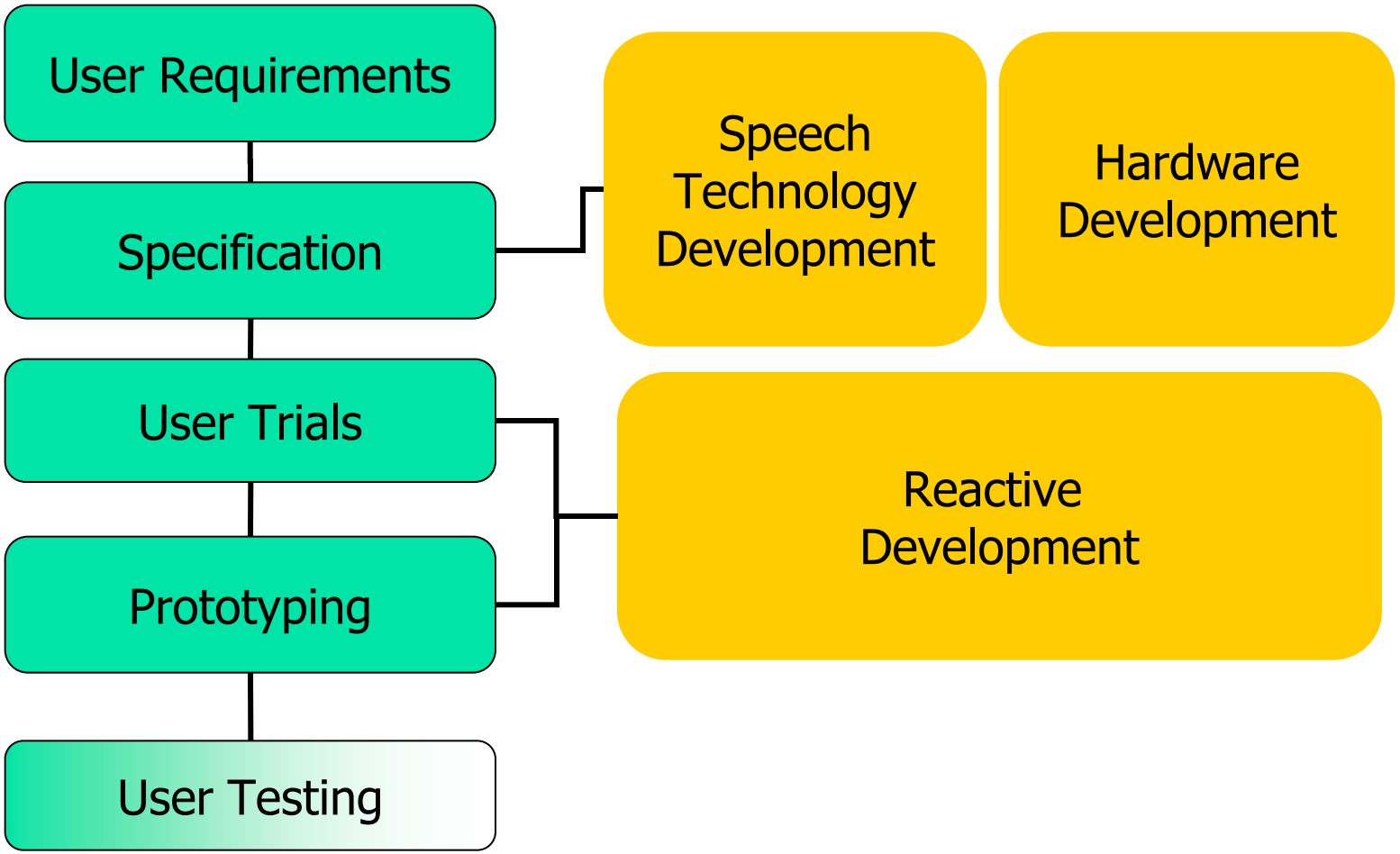
- **Sp**eech Driven **E**nvironmental **C**ontrol **S**ystem
- [SPECS]

- Design a new speech-driven environmental control system for use by people who are elderly or have a disability
- Sensitive to disordered speech

SPECS :: Background

- Funding:
  - Health Technology Device Programme of the Department for Health
- Previous successful projects:
  - STARTDUST and VIVOCA: looking at other aspects of speech recognition for disordered speech

SPECS :: Project Plan



SPECS :: User Requirements Stage

- Develop specification based on user feedback about existing speech driven environmental control systems
  - 12 in-depth qualitative interviews with users performed
  - 2 in-depth qualitative interviews with professionals performed
  - 1 professionals focus group carried out

SPECS :: User Requirements :: Data Analysis

- Data analysed using a framework analysis approach [1]
- Themes identified and data coded according to requirements of overall SPECS project [2]
- Data also analysed to look at perceptions of environmental controls in general

[1] Ritchie J, Lewis J. Qualitative Research Practice: A guide for Social Science Students and Researchers. SAGE Publications Ltd. 2006

[2] Judge S, Robertson Z, Hawley M, Enderby P. Speech driven environmental control systems – a qualitative analysis of users' perceptions. Disability and Rehabilitation: Assistive Technology. 2009;4(3):151-157

SPECS :: User Requirements :: Results

- Themes identified can be correlated with a typical patient journey
  - Background
  - Assessment (success | failure)
  - Risk Assessment
  - EC Use
  - Provision of EC
  - Perception of current EC systems

SPECS :: User Requirements :: Background

- Bias!
  - Experienced and successful users
  - All users had speech driven systems however all had at least seen alternative systems
  - Over half of users used another system in addition to speech control
  - In general, users viewed themselves as IT literate
  - Professional participants had experience of prescribing a range of EC systems

SPECS :: User Requirements :: Assessment

- Patients as expert-prescribers

> "A [Professional] kind of assesses me to see what I needed. He had his little briefcase and he thought this was best for me"

- Not all EC needs met

> "No, he came with [a Professional] who gave me the system and the brought this system along and we spent a long time – it seemed like half a day I should think setting it up and putting it up but no, I didn't have a choice, this is what they brought"

SPECS :: User Requirements :: Assessment

- Benefits perceived by professionals of initially providing a basic system to build on as user gains experience
- Benefits of trial and demonstration

"Sometimes the proof of the pudding is in the trying and the only way to prove a point is to show what you feel the most appropriate option in an assessment, in a trial or whatever"

SPECS :: User Requirements :: Assessment

- Provision 'bias' of speech driven EC
- Low level of provision in UK

"I looked at the patients who I remembered had got them and they were all spinal chord injuries"

"You've got to match the client's cognitive profile haven't you and obviously it's not always appropriate."

SPECS :: User Requirements :: Risk Assessment

- Professionals highlighted importance of risk assessment

"You've got to assess them, 'are they competent to take that decision on the risk?' and then they've got to insist, event if you just list the possible side effects of what could go wrong. I mean most people are well aware of those and if they insist you say 'sign here please'."

SPECS :: User Requirements :: Risk Assessment

- Users also considered risk carefully

"whereas with the TV the worst thing that could happen is you end up watching the wrong channel or it gets too loud and when somebody then does come to assist you, you haven't threatened your existence."

"So I've got back-up for both because I do need it, because obviously my voice alters so much, especially in the mornings."

SPECS :: User Requirements :: EC Use

- Increase in independence
- Reducing load on carers

"it's made my life a lot easier and simpler, you know, because they'd be nothing worse than every time you wanted to do a channel change or something having to call a carer."

"I can open and shut a curtain, if I want to look at the moon I can do, if I want some fresh air in the room I can open the window, I can put my heater on if I get a bit cold, so it has made a big difference to my role in the house on my own."

SPECS :: User Requirements :: EC Use

- Reliability, Reliability, Reliability
- Key to success!

"normally it doesn't let me down but it did on that occasion when I really needed it, that's the trouble, when I really needed it."

"So if I haven't had a drink then my voice is that dry that the voice activator doesn't recognise it and you can sometimes scream at it and it will get you nowhere."

SPECS :: User Requirements :: EC Use

- Switch scanning is challenging!

- Potential for speech access is clear

"I think for about 3 or 4 months but I got very frustrated with it and I felt like a budgie banging my head on a bell. Didn't suit me at all like."

"if anybody is like me I would recommend a combination of the two. It is like stopping and rewinding video and stuff like that, it is quicker to do it by voice"

SPECS :: User Requirements :: EC Use

- Currently speech EC used for:
  - Last resort
  - Backup use

we've got eleven now and it's literally just down to that issue of when there is no other available controllable function

he was turned every two hours as well because of pressure sores, so he didn't want to go from the switch. We initially set him up with two switches but the nursing staff didn't have the patience to actually reconnect the system, so he went for a voice

SPECS :: User Requirements :: Provision of EC

- Positive and negative comments
  - Assessors
  - EC suppliers
- User awareness of cost
- Professionals demonstrated empathy

"It would be nice to be able to control the curtains, but I guess it was decided that for this system that that's too expensive to do and that I don't really need it that badly."

"there's an image aspect that the market has created and people do latch onto that I'm sure, but I think vanity one is there as well. You do get a clean system in a lot of cases. No intruding switch."

SPECS :: User Requirements :: Perceptions of current EC systems

- Functionally sufficient
- Enhance independence and reduce carer load

BUT

- EC systems could be more advanced
- ……

> "obviously they're getting more advanced, but they still use the same dull equipment and some people have got to use that because obviously they are so severely disabled that they've got to use that sort of equipment."

SPECS :: User Trials

- Prototype device developed
  - Based on specification generated from user requirements work
- Initial 'rapid prototyping approach'
  - Objective: find and develop out usability problems

SPECS :: User Trials

- User Trials:
  - 6 participants
    - 2 people with dysathria
    - 2 people who use existing speech EC system
    - 2 people with disabilities who do not use EC

SPECS :: User Trials :: Initial Results

- Challenges
  - Integrating speech recognition software onto device (Improving recognition)
  - Microphone problems
  - Improving training procedure
  - Positive feedback about hardware/interface

SPECS :: User Evaluation

- *(Next Step)*
- 10 participants planned
- Device setup in participant's environment and trained to voice
- Extended evaluation period (2 months)

Key Outcomes :: Process

- Demonstration of benefits of using a qualitative approach in this context
- Further work – Study employing this methodology but focussed solely on EC in general
- Development of new device involving users is valuable
- Developing high-tech is challenging!

Key Outcomes :: Speech and Environmental Control

- Environmental Control increases independence and reduces carer load
- Currently
  - speech driven EC provision is low
  - professionals have a (fairly accurate) mental model of a successful SPECS user and filter
  - speech driven EC can be very enabling
- Reliability is the key to creating a better speech driven EC system
- Professionals demonstrated good empathy

Questions

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