Conference or Workshop Item:
Hawley, Mark, Judge, Simon, Cardinaux, Fabian et al. (Completed: 2007) Voice-In, Voice-Out Communication Aids. In: Communication Matters 2007, 23-25 Sep 2007, Leicester, UK.

The University Of Sheffield.

CAST Clinical Applications of Speech Technology

Barnsley Hospital NHS NHS Foundation Trust

Voice-input voice-output communication aid (VIVOCA)

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Rebecca Palmer

Barnsley AT Team

- Assistive Technology (AT) team, covering 3 areas of S Yorkshire
- Assess for and provide a wide variety of AT
- Run training and provide support on AT
- Contribute to & run research and development projects…

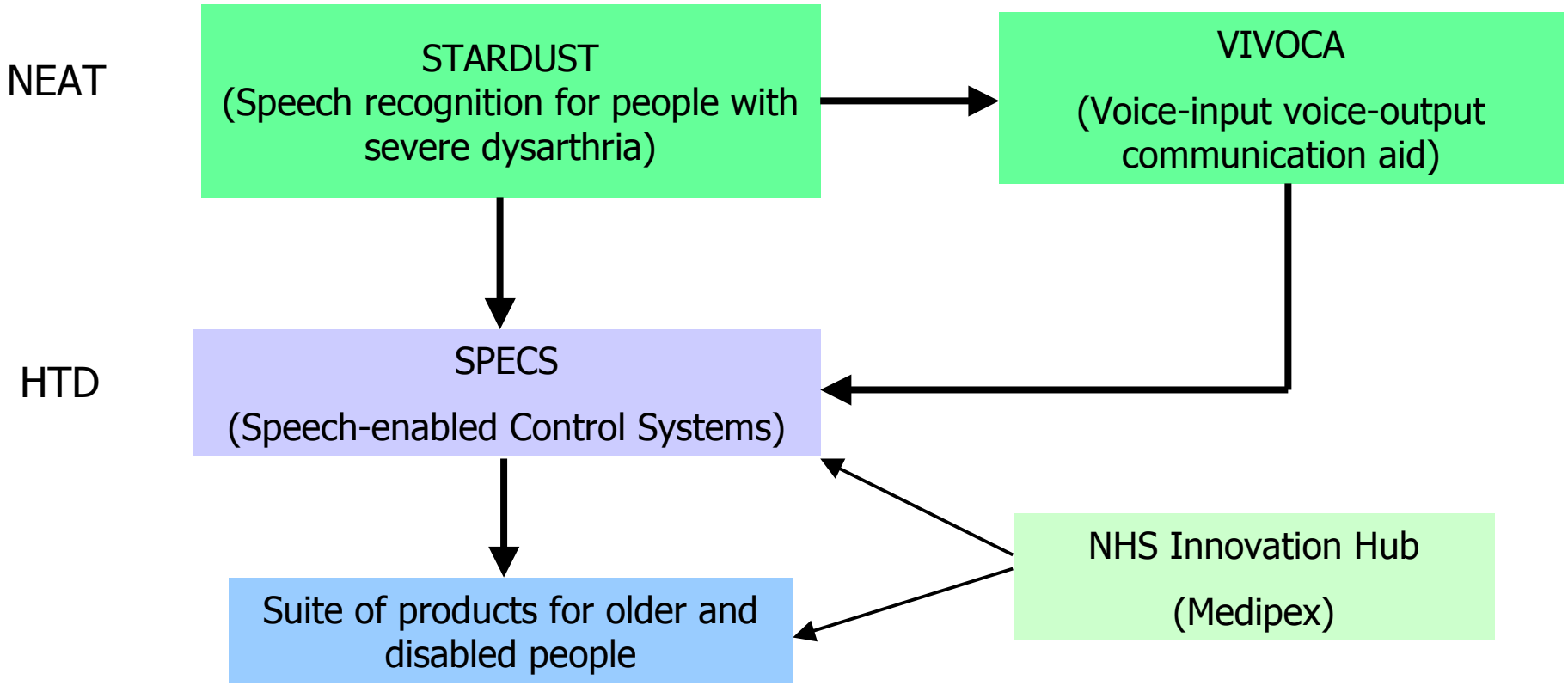
Research Groups

- Barnsley District General Hospital Foundation Trust – R&D Department, AT Team
- Sheffield University – Computer Science Dept, Health and Related Sciences School
- Collaboration & Track record on AT projects.
- New group forming involving AT
- CAST group: Clinical Applications of Speech Technology

Background

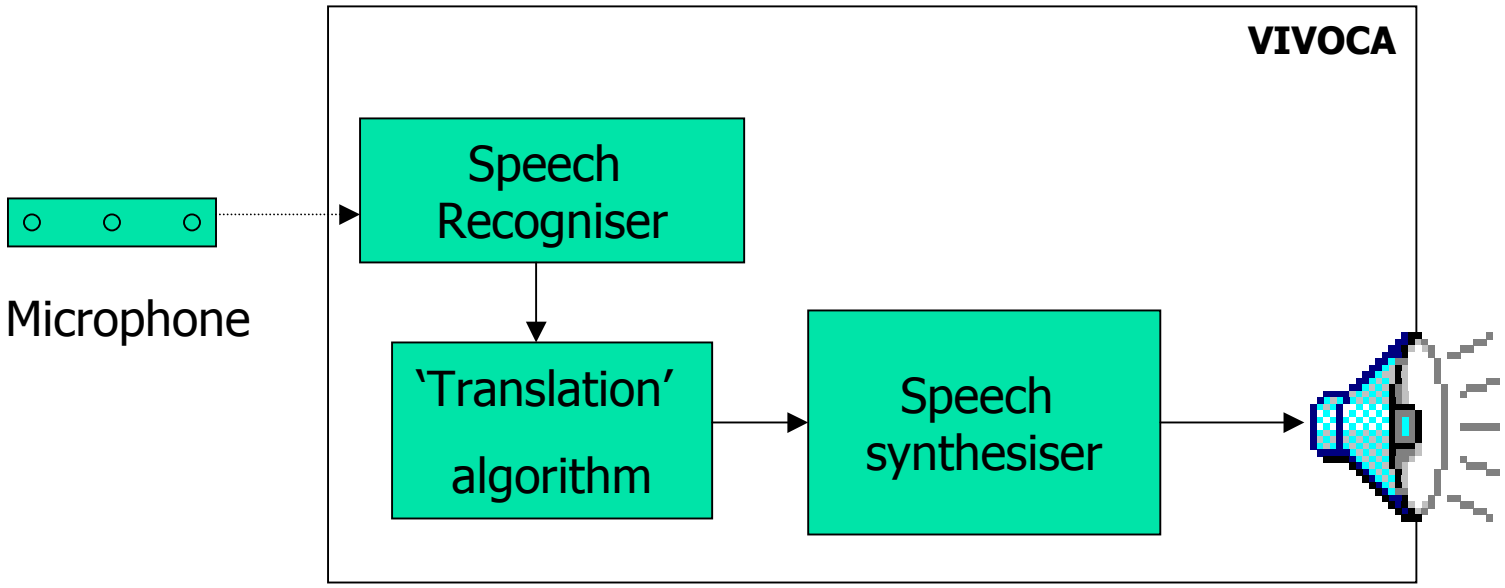
- Dysarthria is the most common acquired speech disorder (170 per 100,000)
- Many current communication aids (VOCAs) are slow and effortful to use
- Dysarthric speech can be an effective control input to assistive technology

CAST Projects

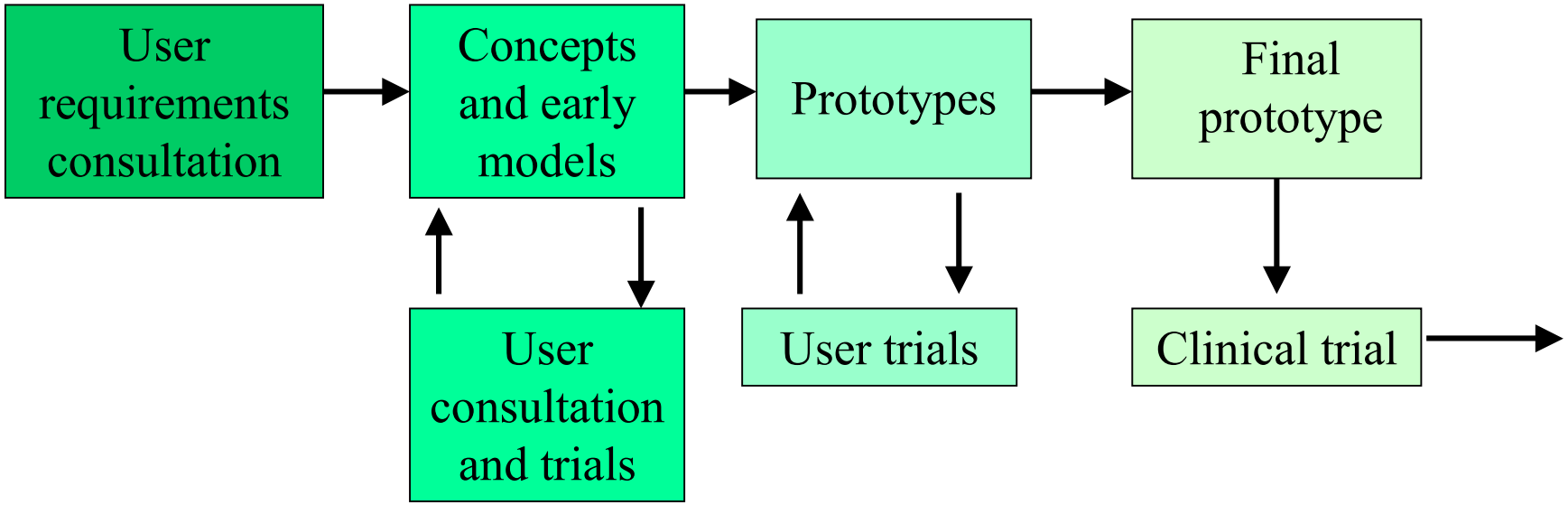


VIVOCA

Voice-input voice-output communication aid



User-centred design & development



User and professional consultation

Method

VOCA users and speech therapists

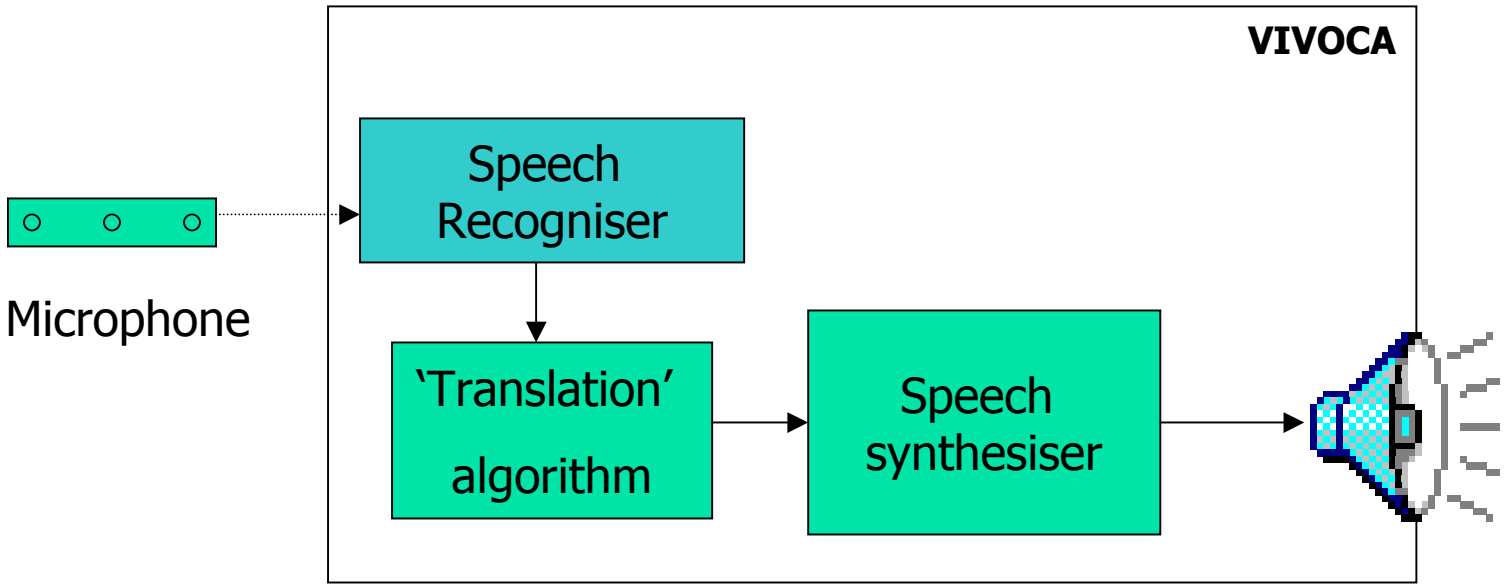
Semi-structured interviews and focus groups

Thematic analysis

Results

- Acceptable as a means of communication
- Potential advantages over conventional VOCA
  - *Quicker*
  - *Easier to use*
  - *Increased communication and independence*
- Useful where speed and intelligibility crucial
  - *Meeting new people*
  - *Telephone*
  - *Shopping*
- Range of requirements for hardware and software

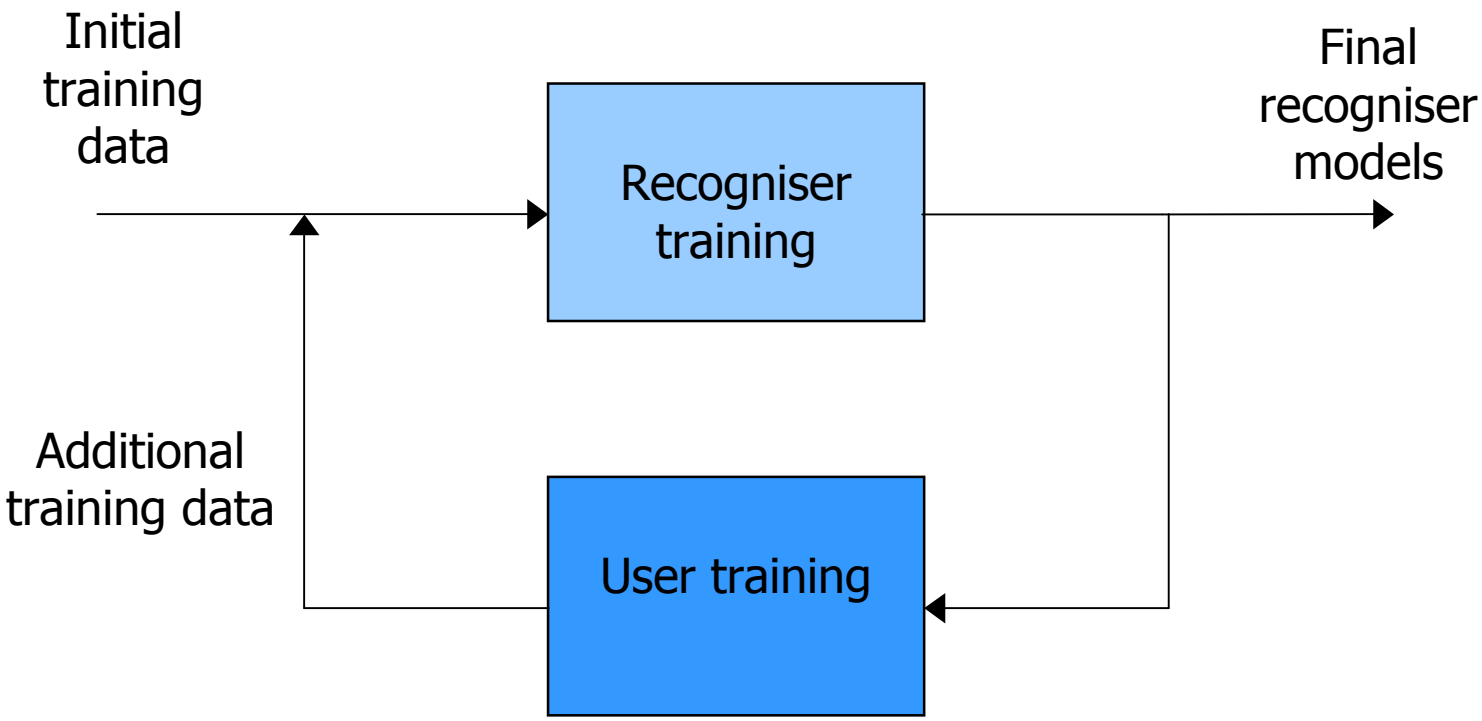
Speech Recogniser



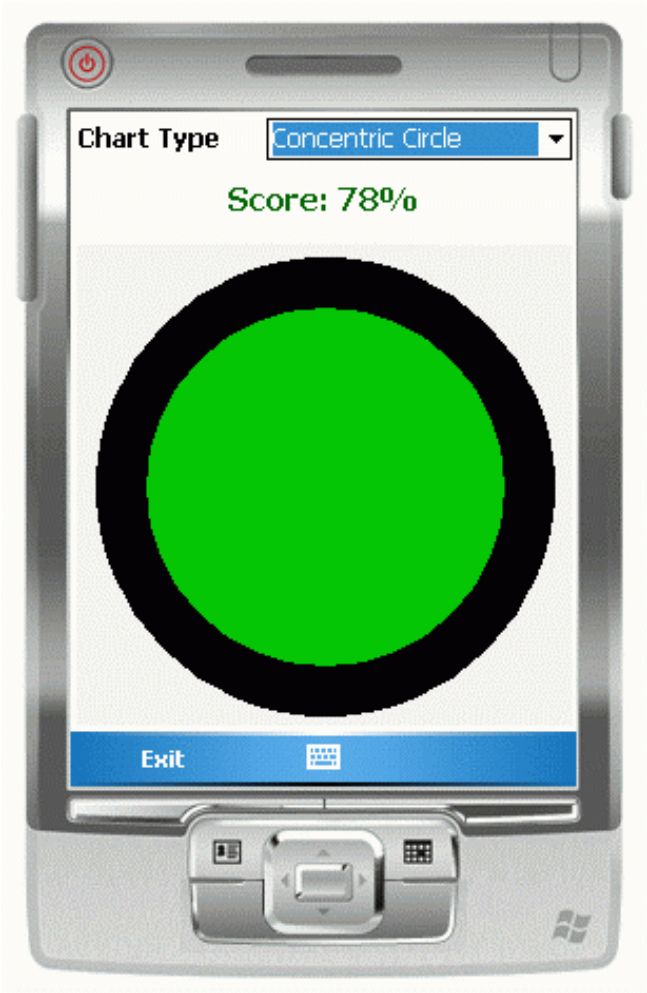
Speech recogniser for dysarthric speech

- Commercial speech recognisers do not work well for dysarthric speech
- User-centred approach – aim to make it work
- Speaker dependent recognition
- Vocabulary of discrete words tailored to speech capabilities of individual
- Closed loop between recogniser training and user training

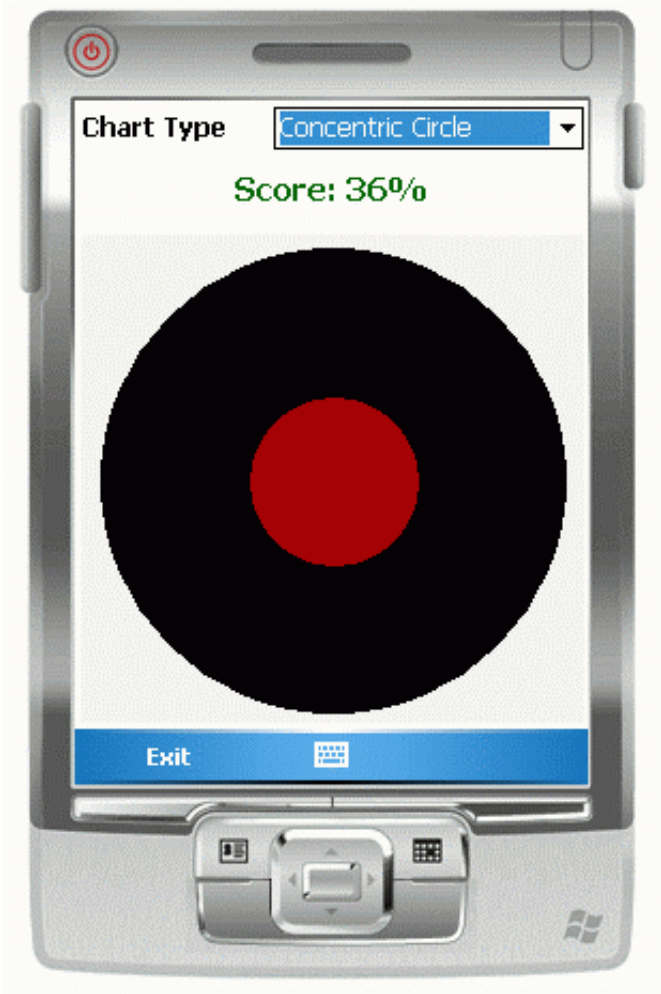
Speech recogniser for dysarthric speech



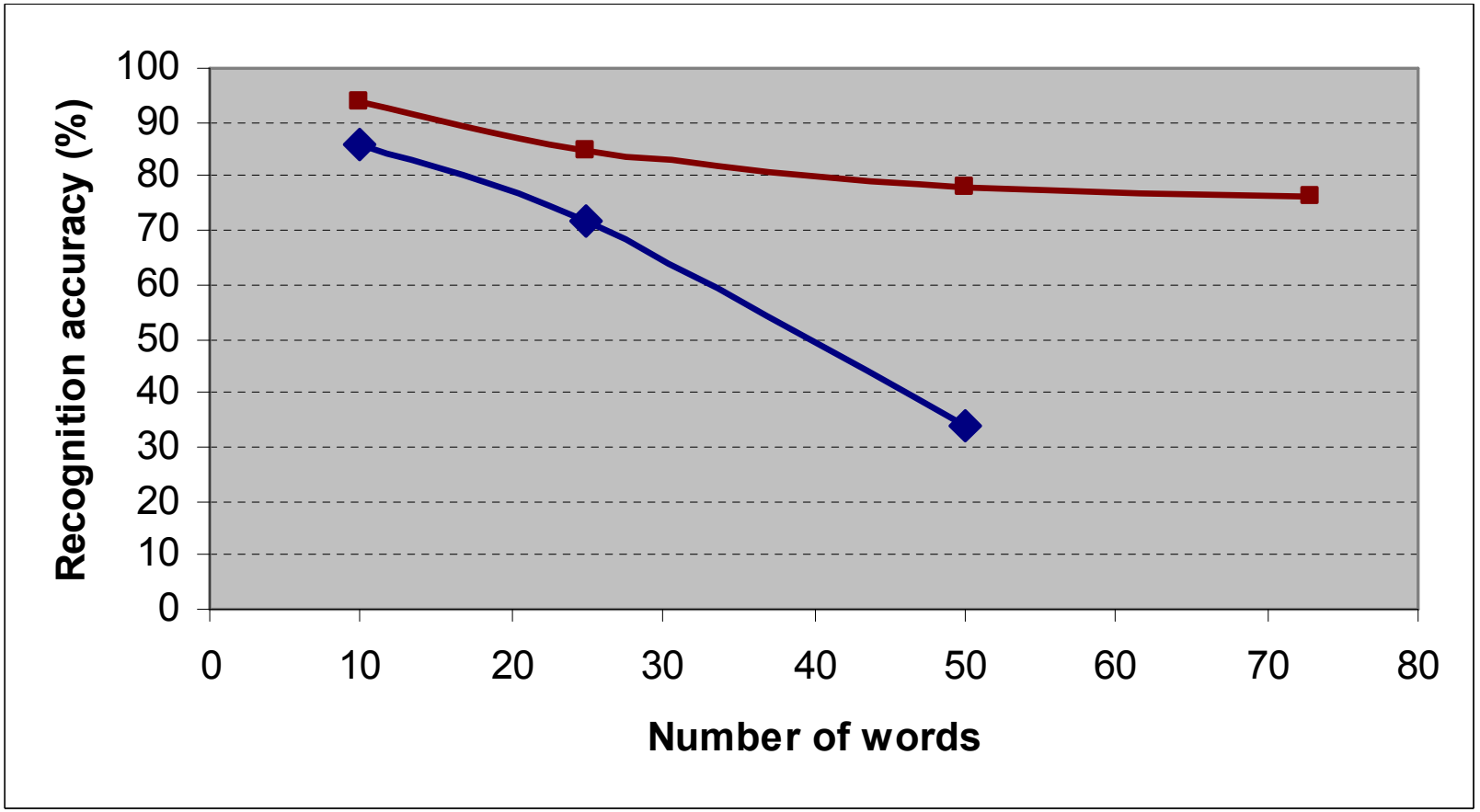
Training: User Feedback



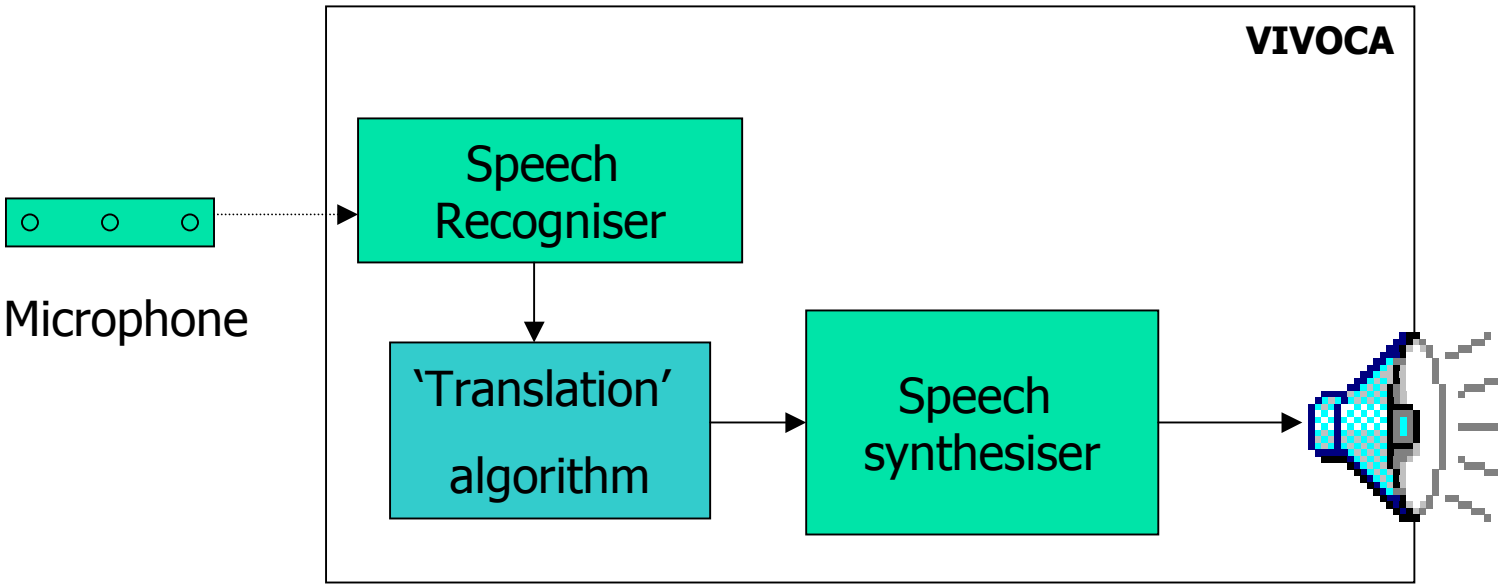
Training: User Feedback



Effect on Recognition Accuracy



Translation Algorithm



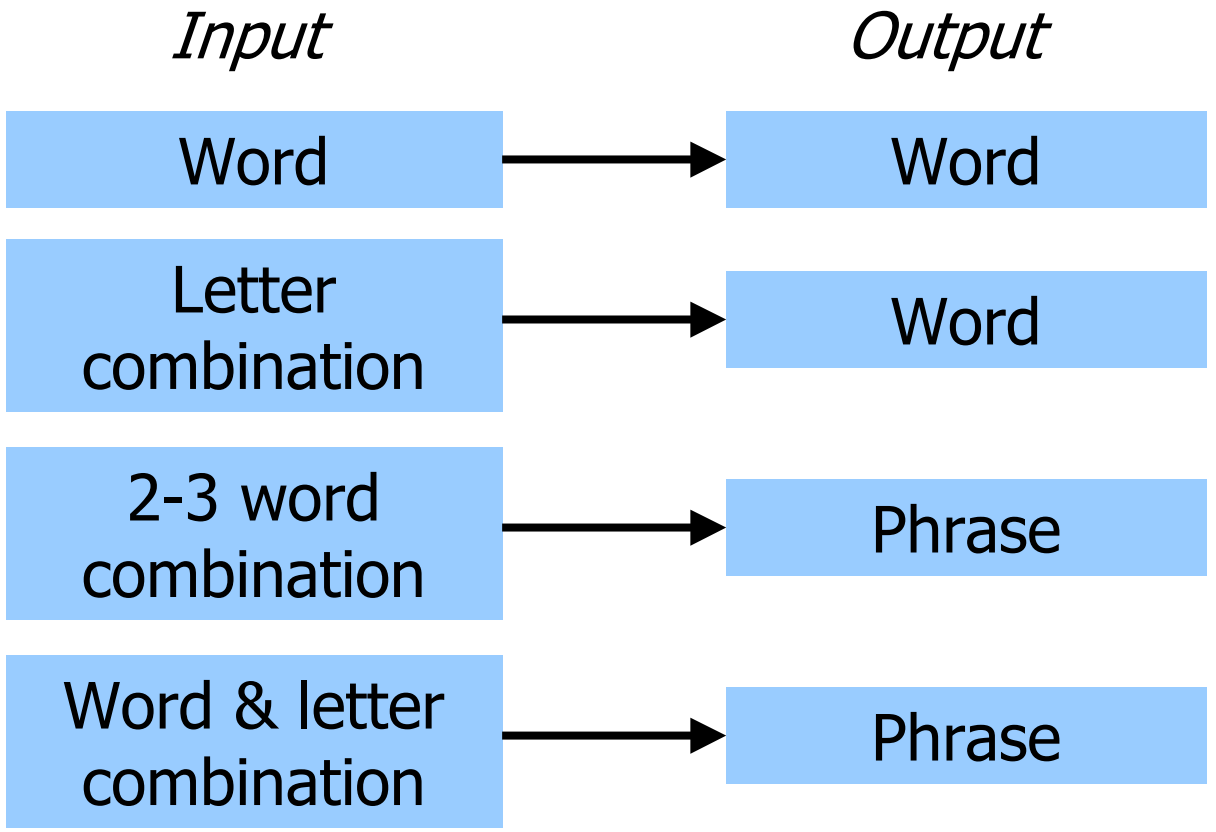
'Translation' methods

Small Number of inputs → *Large vocabularies*

1-5	~10	~30	~100	~1000
Switch scanning Morse code	Mobile phone/T9	Spelling Word prediction AAC	AAC fixed overlay AAC dynamic screen	Word for word translation

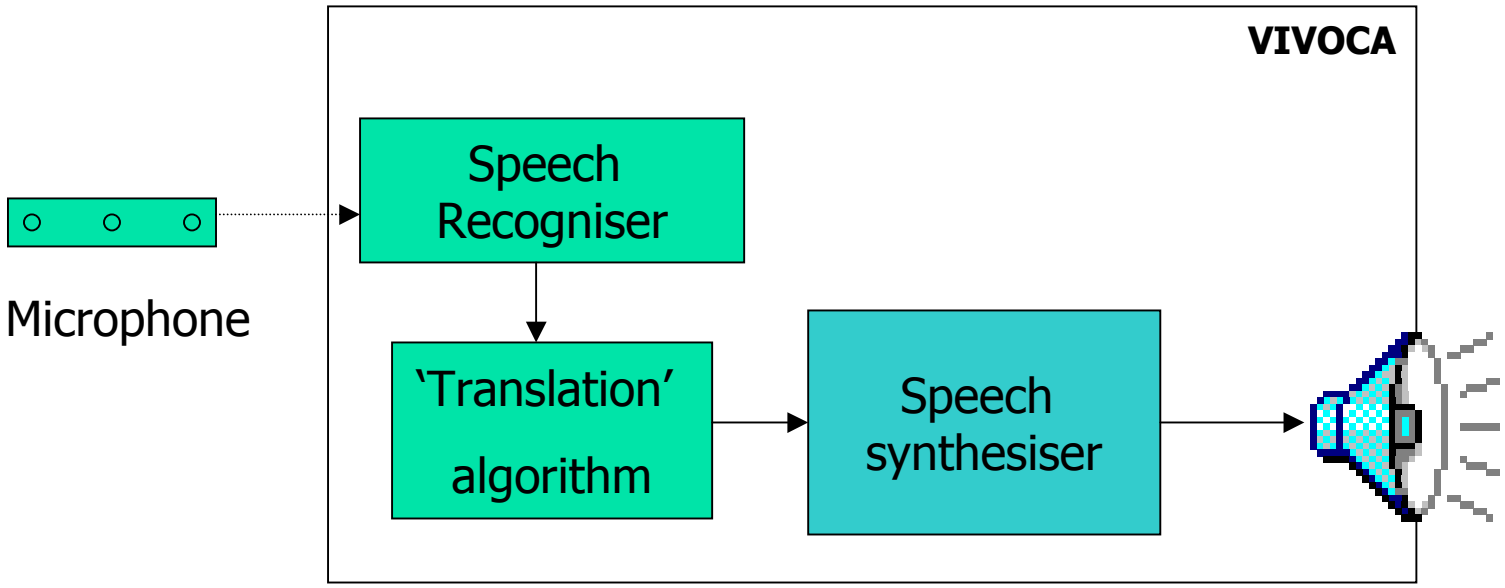
Coding → *Direct 'translation'*

Translation: input-output



"Want", "B", "R" *Can I have a beer please?*

Speech Synthesiser



Current speech synthesis: communication aids

- High quality voices available
- E.g.
  - DECtalk™ (Fonix) for American English 
  - Acapela for British English 
- Personalisation limited: age, gender, language

Personalisation

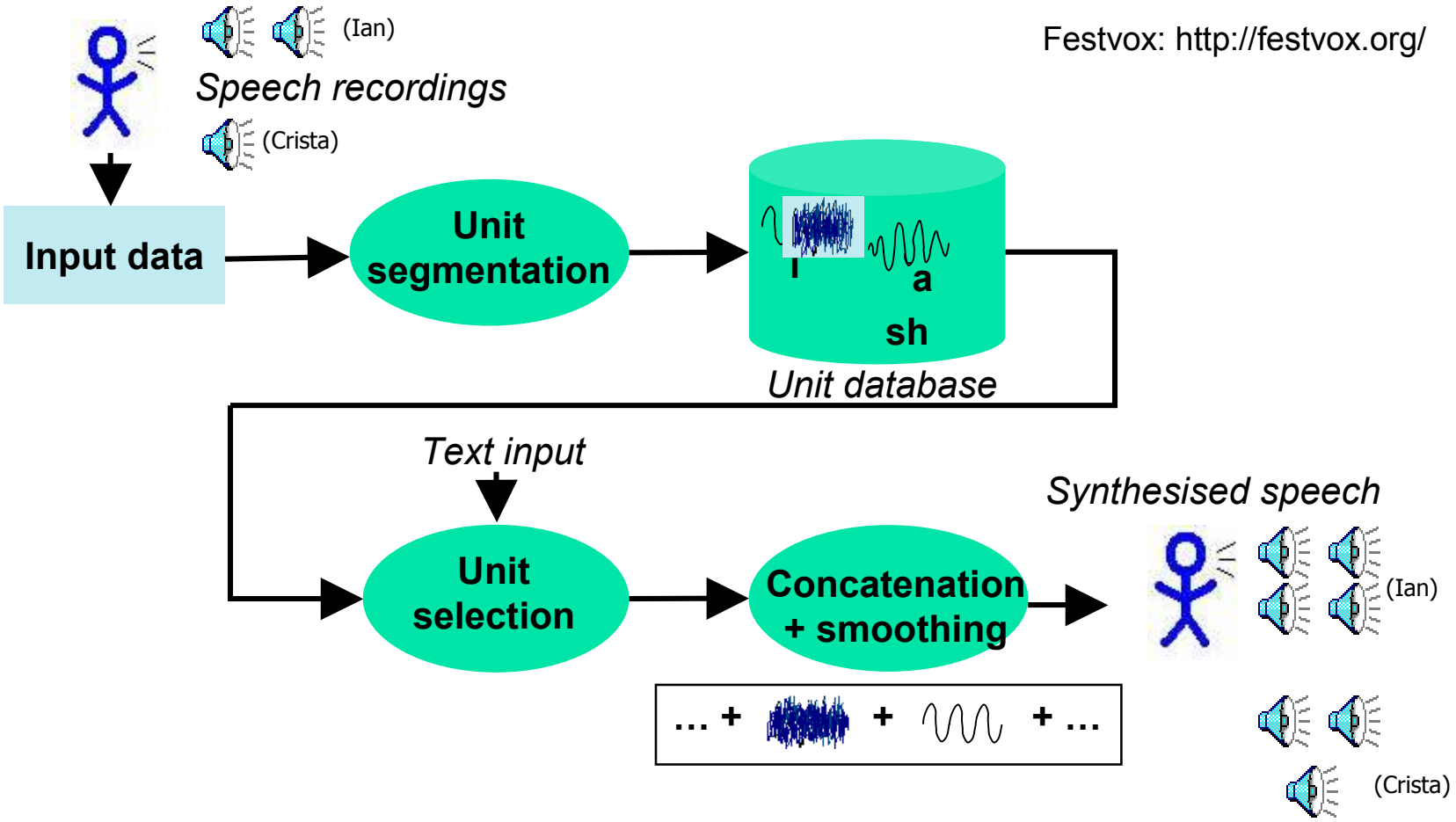
- Voice = identity
  - Gender
  - Age
  - Geographic background
  - Socio-economic background
  - Ethnic background
  - As that individual

- Maintains social relationships
- Maintains social closeness
- Sets group membership

VIVOCA: personalisation

- Sheffield/Barnsley user group
- Retain local accent
  - geographic identity
- Speaker database
  - Arctic database: 593 + 20 sentences
- Professional local speakers
  - Ian McMillan
  - Christa Ackroyd

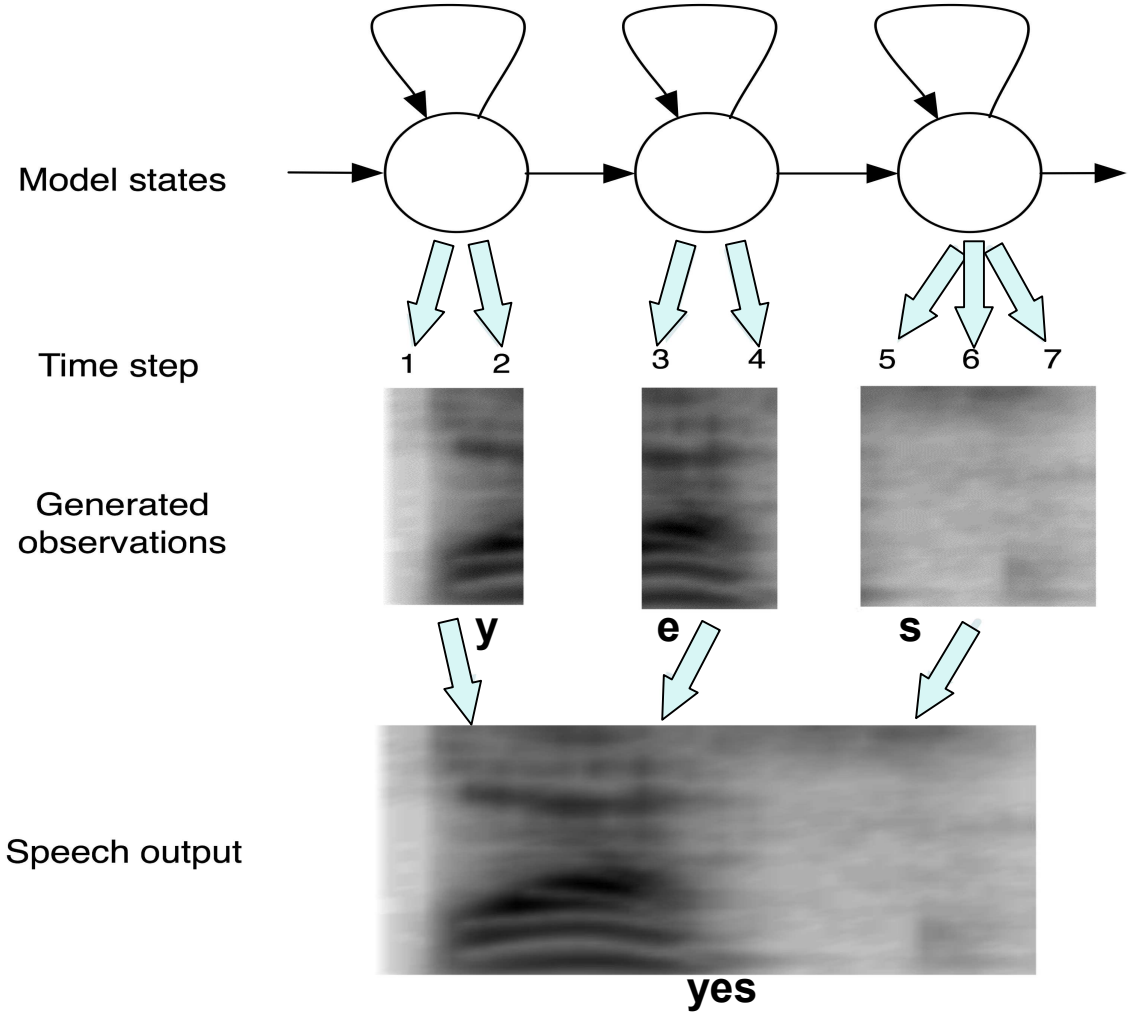
Concatenative synthesis



Concatenative synthesis

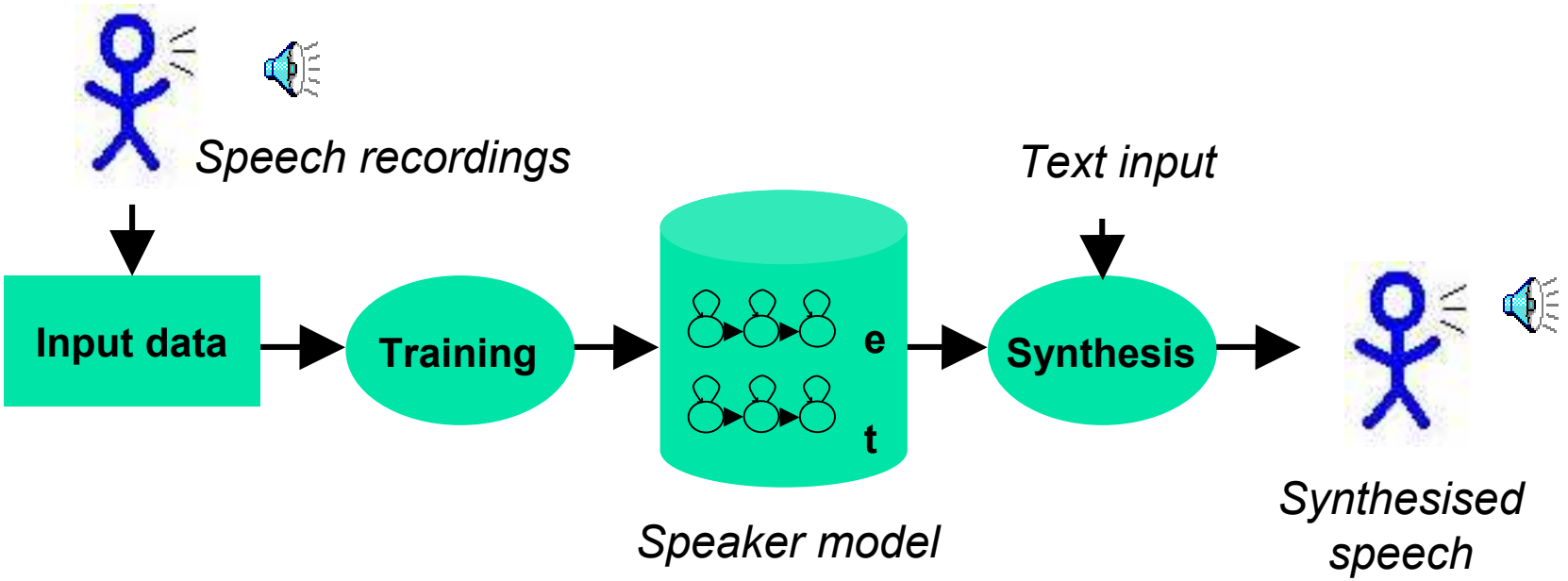
- ✓ High quality
- ✓ Natural sounding
- ✓ Sounds like original speaker
- ✗ Need a lot of data (~600 sentences)
- ✗ Can be inconsistent 
- ✗ Difficult to manipulate prosody

HMM synthesis



HMM synthesis procedure

HTS http://hts.sp.nitech.ac.jp/



HMM synthesis

- ✓ Consistent
- ✓ Intelligible
- ✓ Needs relatively little input (~20 mins)
- ✓ Can be adapted with small amount of data (>5 sentences)
- ✓ Easier to manipulate
- ✗ Buzzy quality
- ✗ Less natural than concatenative

Synthesis: Future research

- Further personalisation for individuals with progressive speech disorders
  - Capturing the essence of a voice
- Voice banking
  - Before deterioration
- Adaptation using HMM synthesis
  - Before or during deterioration

Summary

- Voice in-Voice out device based on a PDA
- Currently under development
- Recognising and improving discrete dysarthric words
- Regionalised, possibly personalised, speech synthesis

CAST Clinical Applications of Speech Technology

VIVOCA Team

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A Plug!!

- RAATE 2007
- 26th and 27th November 2007

www.raate.org.uk

- (session on voice recognition!)