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CAST | Clinical
Applications of
Speech
Technology

Barnsley Hospital **NHS**
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Speech Technology for E-Inclusion and Rehabilitation

Mark Hawley



- Access
- Control
- Communication
- Assessment
- Treatment

Focus on:

- physical disability
- dysarthria

Access

- Speech recognition provides important means of access for some people with physical disability and ‘normal’ speech
- Recognition accuracy correlates with intelligibility
 - Speech recognition works for ‘normal’ speech, mild dysarthria and some moderate dysarthria
 - Does not work well for severe dysarthria
- Speaker dependent discrete word recognisers more successful than continuous for severe dysarthria





Control

- Control of the home environment an essential aspect of independence
- Current control methods can be slow and effortful
- Home control systems based on speaker dependent recognition are available
 - but do not perform adequately, especially for disordered speech

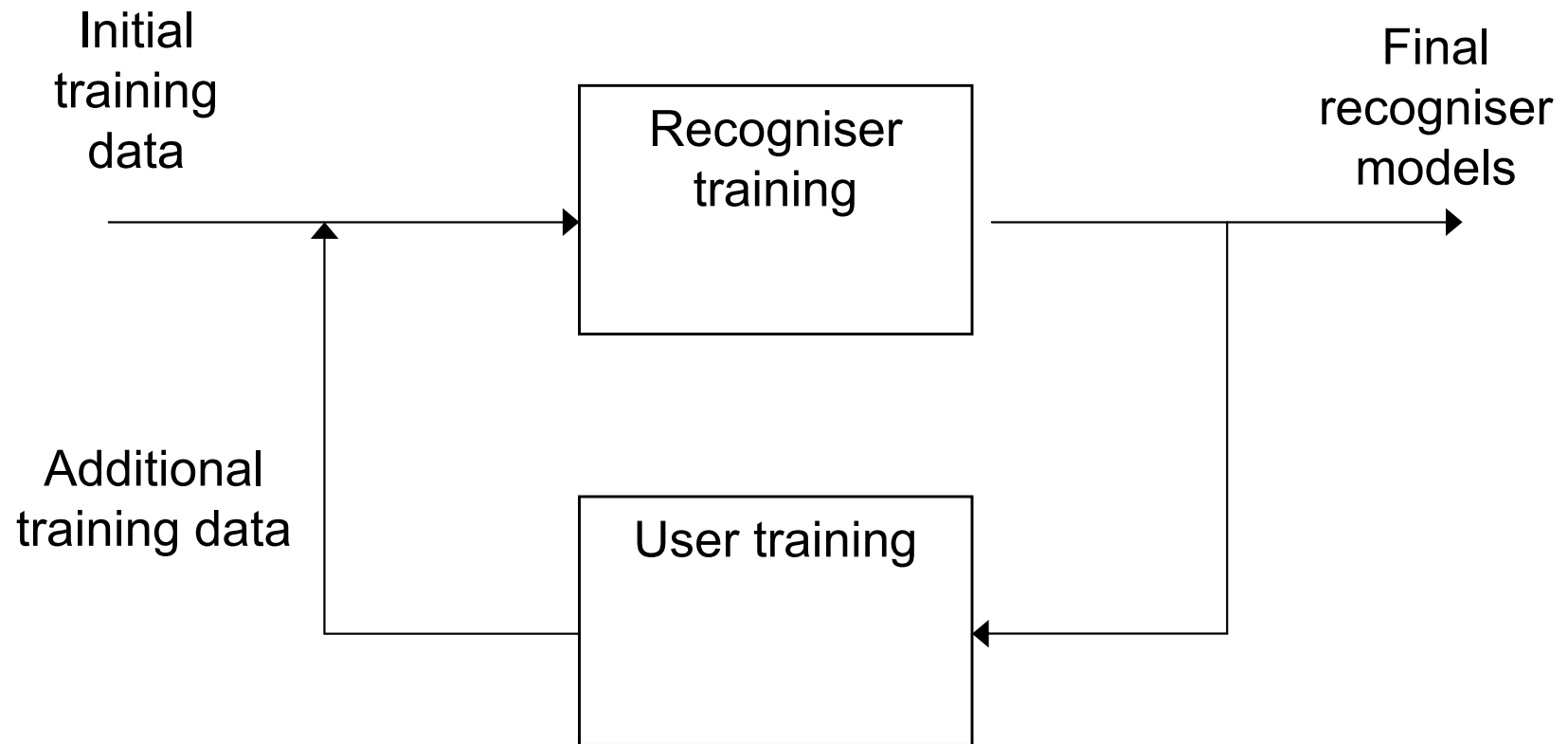


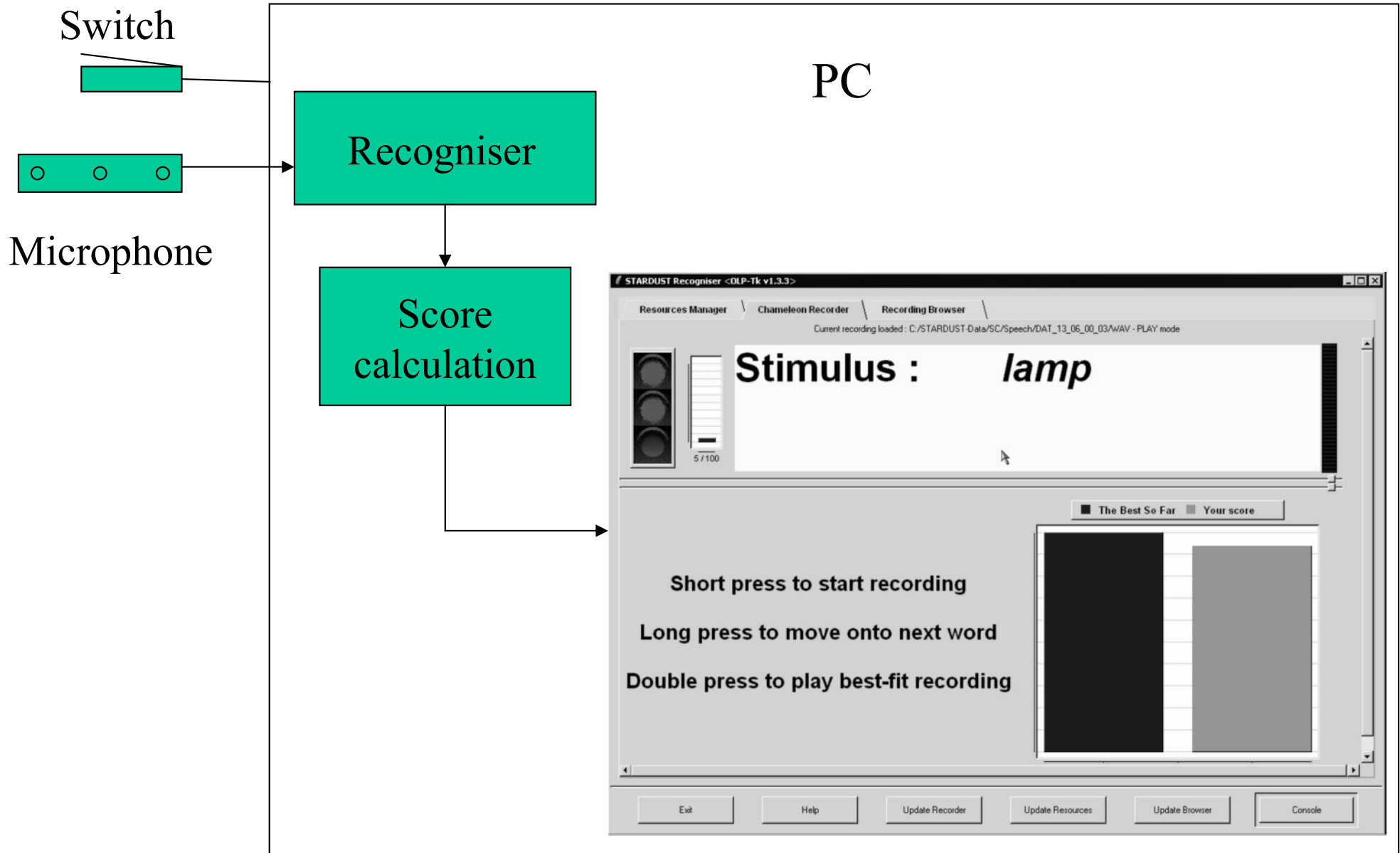


STARDUST

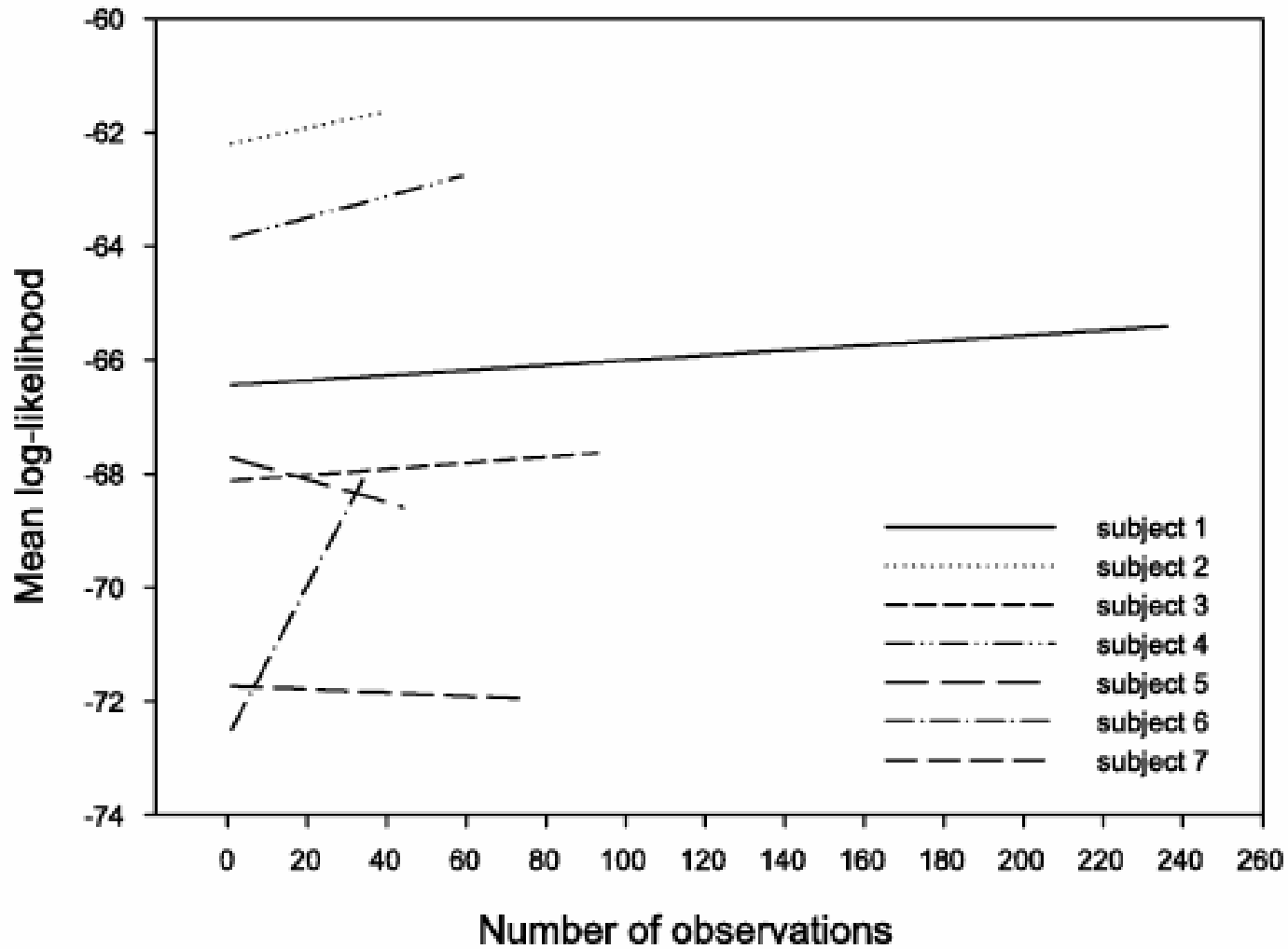
(Speech Training and Recognition for Dysarthric Users of Assistive Technology)

- User-centred approach – aim to make it work for our users
 - Speaker dependent recognition
 - Small vocabulary of discrete words tailored to speech capabilities of individual
 - Closed loop between recogniser training and user training





Participant	Vocabulary size	Pre-training		Post-training	
		No. of examples of each word	recognition accuracy (%)	No. of examples of each word	recognition accuracy (%)
1	11	30	95.8	103-108	100.0
2	7	13	96.2	32-34	100.0
3	10	30	82.0	51-58	86.0
5	13	30	96.9	79-110	99.7
6	11	30	92.7	46-55	96.4
7	11	30	77.3	35-50	95.5
8	13	30	80.0	56-66	90.8
overall			88.5		95.4



STARDUST recognition accuracy

	Sex	Diagnosis	Intelligibility Rating (%)	Recognition Accuracy (%)		
				<i>Word (test)</i>	<i>Word</i>	<i>Phrase</i>
1	F	Cerebral Palsy (CP)	10	100.0	90.0	83.3
2	M	Multiple Sclerosis	22	100.0	81.6	76.7
3	M	CP	0	86.0	93.0	86.7
4	M	CP	22	99.7	86.7	76.7
5	F	CP	0	90.8	83.3	70.0

Recognition accuracy in the home in normal usage under uncontrolled conditions



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Communication

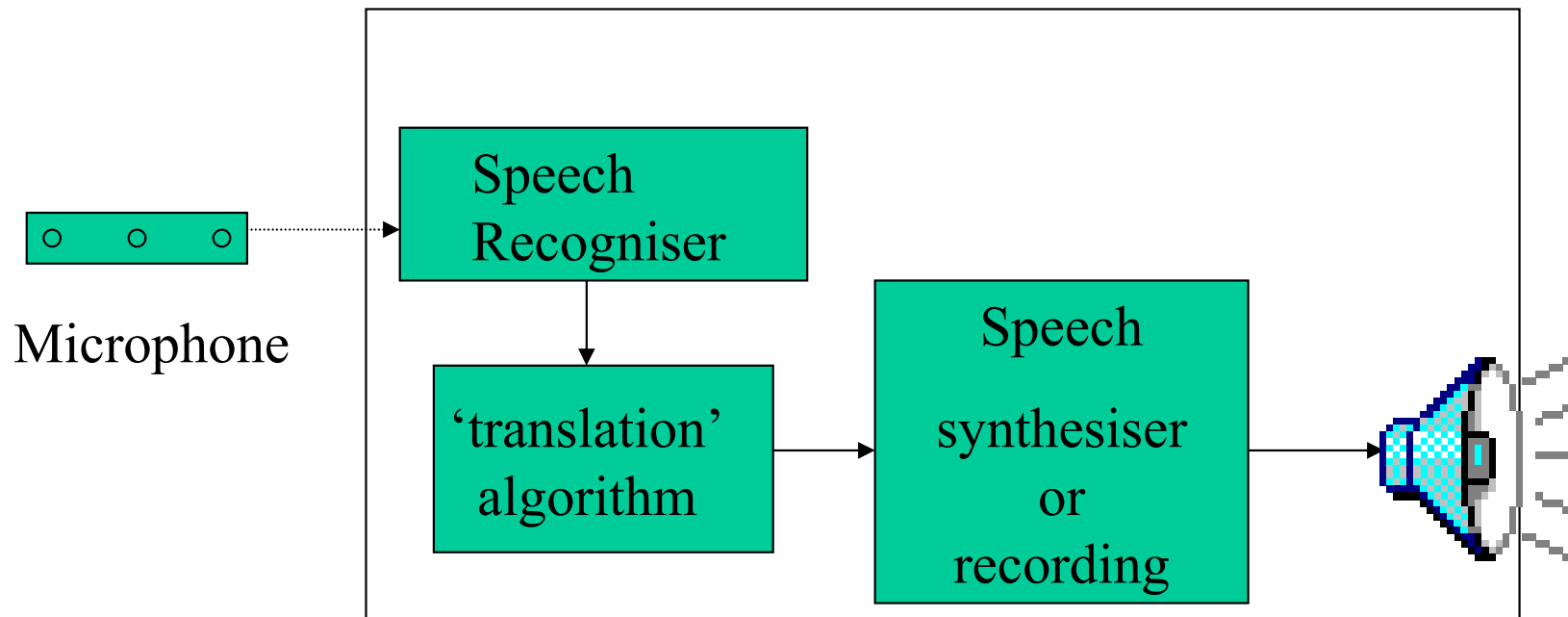
- Speech synthesis used extensively in assisted communication
- Much current research aims to increase the ‘naturalness’ of synthesised speech
 - Naturalness vs. intelligibility
 - Complex issues regarding acceptance of ‘natural’ voices by disabled people





VIVOCA

Voice-input voice-output communication aid





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User and professional consultation

Method

VOCA users
and speech
therapists

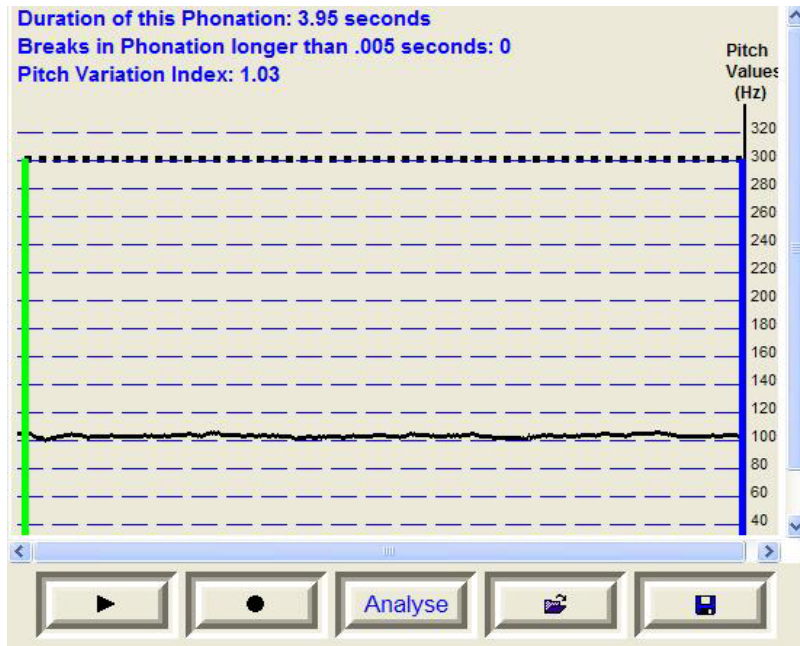
Semi-
structured
interviews
and focus
groups

Thematic
analysis

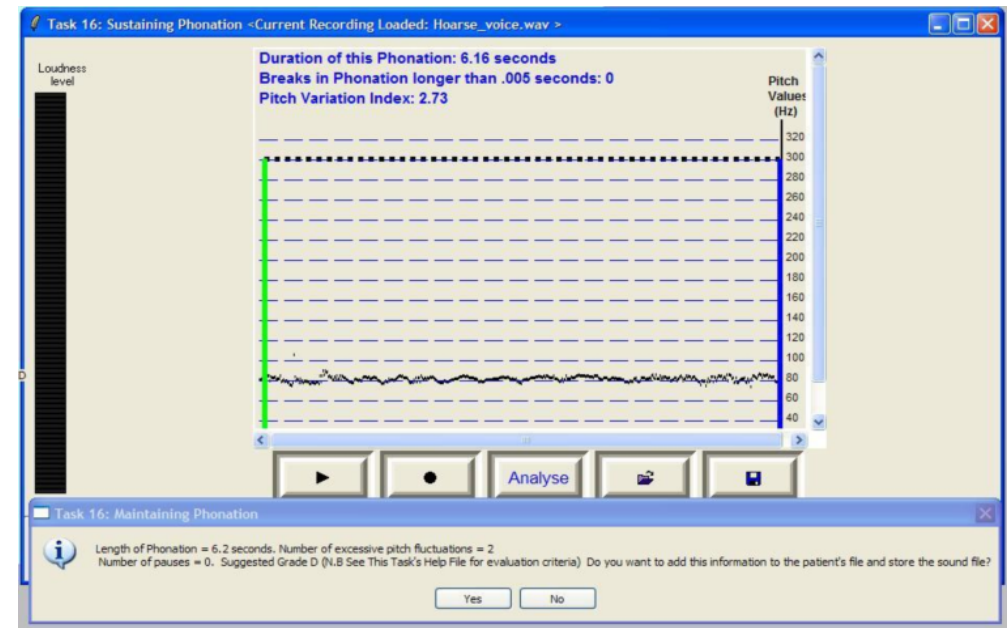
Results

- 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

Assessment



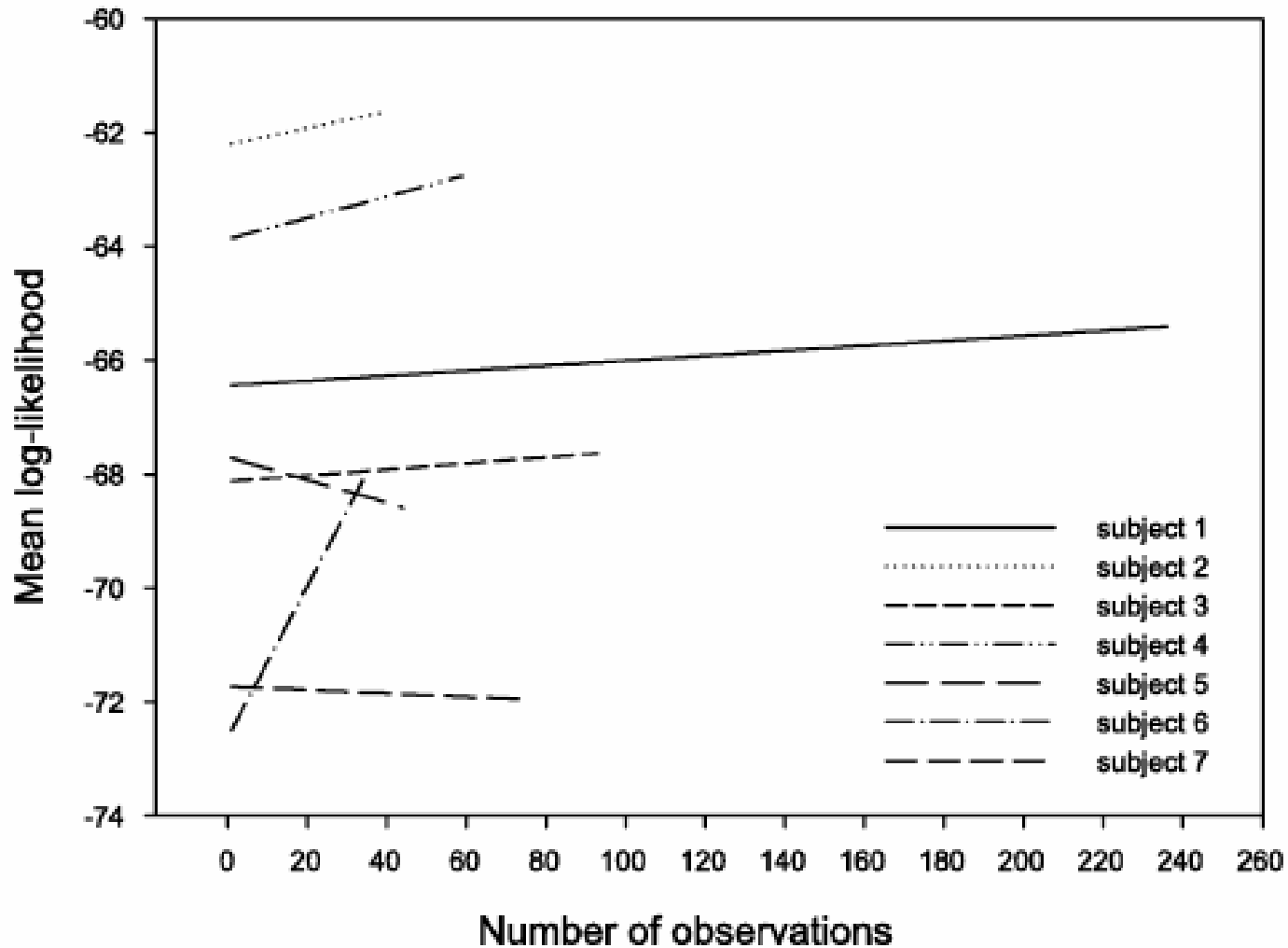
Normal voice quality,
low pitch variation
(PVI=1.03)

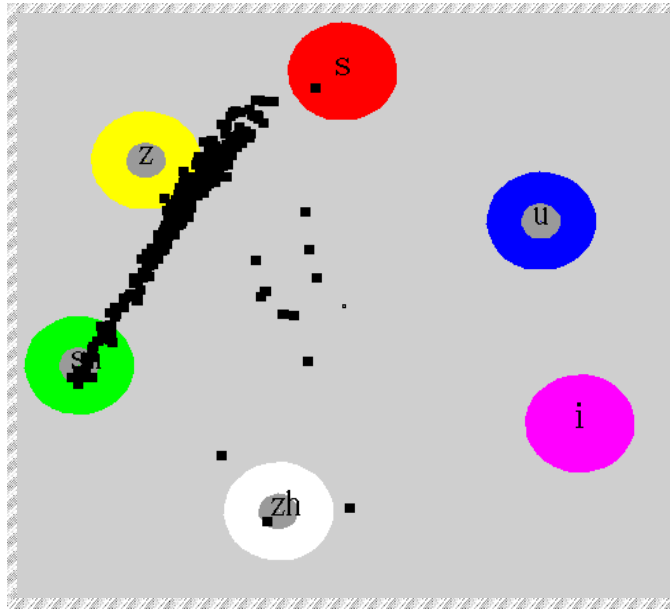


Hoarse / strangled voice, pitch variation
is greater (PVI=2.73); CFDA
objective measurement computes a
'D' grade



Therapy





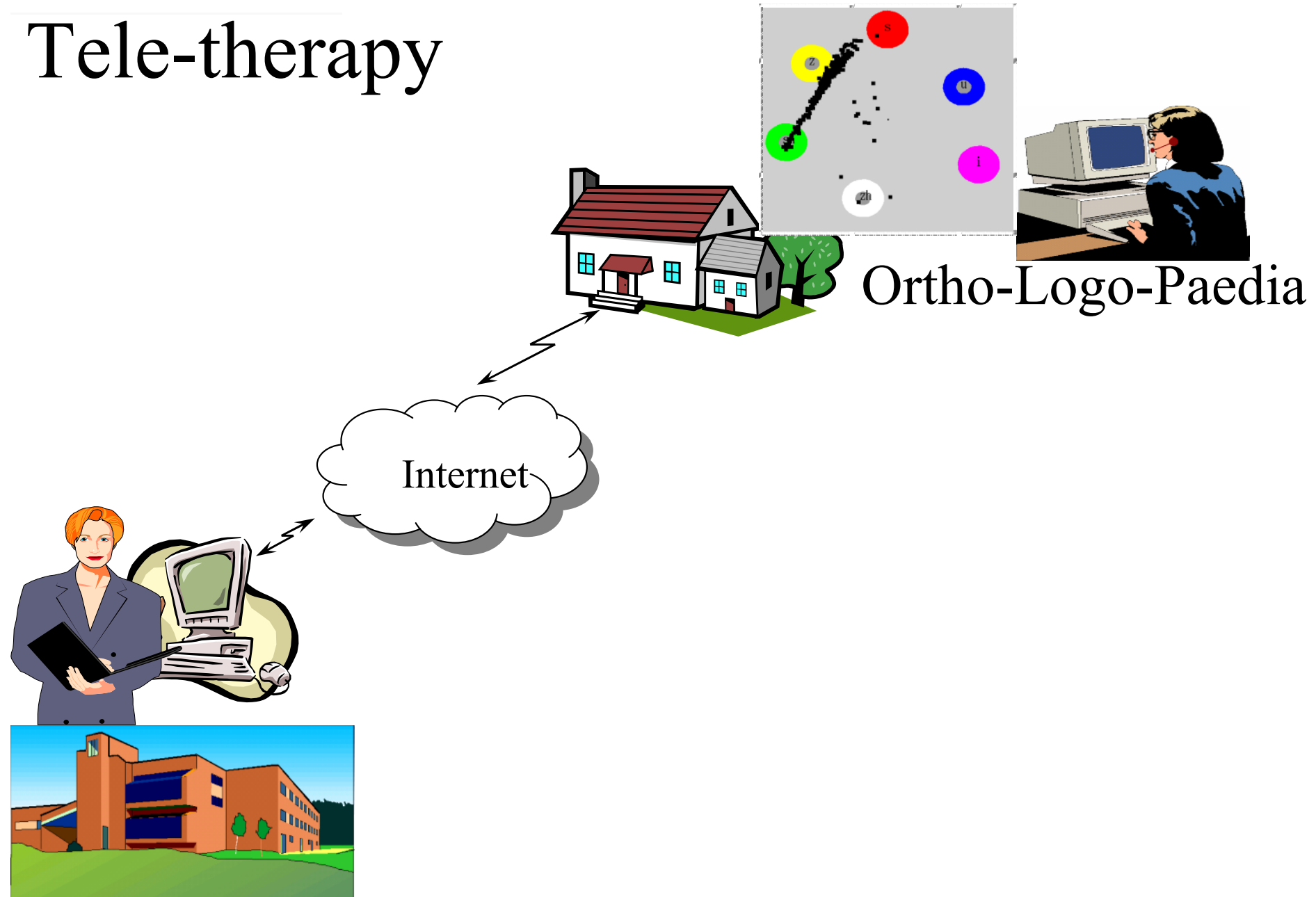
OLP (Ortho-Logo-Paedia)

A clinical trial (7 subjects) suggests:

- Computerised therapy can be as effective as traditional techniques
- Patients can practise independently
- Potential for intensive treatment with reduced routine therapist input



Tele-therapy





Summary

- Speech technology has an important role in assistive technology :
 - Access
 - Control
 - Communication
- And in therapy
 - Assessment
 - Treatment
- R&D in clinical applications of speech technology is multi-disciplinary
 - requires knowledge of disabled user, assistive technology, speech pathology and speech technology
- Role of speech technology for older people?



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