Human Language Technology and communicative disabilities: Requirements and possibilities for the future

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Outline

- The Dutch Language Union and HLT
- Background and aims of this survey
- Procedure
- Results
- Conclusions

Dutch Language Union: aim

Established in 1980 by the Dutch and the Belgian governments, with the aim of implementing a common language policy for Dutch

Dutch Language Union: initiatives

aimed at creating the right conditions to make it easier for Dutch speakers to continue to use their language in as many different situations as possible

➔ in the digital world ➔ HLT

HLT initiatives:

- STEVIN programme: this session
- HLT Agency: Sustainability workshop

DLU future policy on HLT

Promoting HLT in new sectors and target groups related to DLU policy:

- education
- government organizations
- people with communicative disabilities

Human Language Technologies (HLT) for Communicative Disabilities

can be employed for:

- diagnosis
- therapy and monitoring
- for augmentative and alternative communication

Background of this survey

2005: Human language technologies and communicative disabilities. A report commissioned by the Dutch Language Union.

- The survey revealed very diverse desires, requirements, and possibilities.
- The diversity of disorders and requirements hampers the development of HLT products that can be used by large groups.

Aims of this survey

Identifying:

- HLT applications required for communicative disabilities.
- Possible underlying multi-purpose HLT modules (BLARK).
- Availability and quality of such modules.
- Priorities for research and development.

Procedure: Inventorisation

- Round table conference with experts from HLT and clinical field
- 20 interviews with representatives communicative disabilities
- In the Netherlands and Flanders

Procedure: BLARK approach

Matrices

- **Applications x conversions**: conversions required for applications
- **Conversions x modules**: HLT modules required for conversions

Application description: 4 dimensions

- **Purpose**: diagnosis, monitoring, therapy, AAC.
- **Communicative function**: reading, listening, speaking, writing.
- **Target group**: cognitive, sensory, voice and speech, motor.
- **Age**: children, youngsters, adults, elderly people.

Conversions between 5 modalities

1. Spoken language
2. Written language
3. Non-verbal: images, animations, symbols, gestures, or agents
4. Tactile: Braille or 3D-images
5. Concepts: data, pictures, or key words, such as stock market reports printed in newspapers.

Relation Conversions-Technologies

- 1 ➔ 2: speech recognition
- 2 ➔ 1: speech synthesis
- 2 ➔ 2: text modification, summarizing, indexing,etc.
- 2 ➔ 3: from text to virtual talking heads, agents, gestures, etc.

Requested HLT application: Writing Aid

Description: People with mild aphasia or dysorthographia need application supporting writing texts that provides: word prediction, sentence prediction, spell and grammar checker tools, and advice on register, with speech synthesis for monitoring and correct own writing.

(1) Application:

Purpose: AAC;

Communication function: writing

Target group: cognitive (aphasia, dysorthographia)

Age: all

(2) Conversions: 2 → 2; 2 → 1; 3 → 2

Results: Conversion hierarchy

Criterion: multi-purpose, 5 most cited

Conversions (*N* = 97)			Frequency (in %)
1	Speech synthesis	(conversion 2 → 1)	32
2	Speech recognition	(conversion 1 → 2)	26
3	Text modification	(conversion 2 → 2)	12
4	Non-verbal to speech	(conversion 3 → 1)	8
5	Text to non-verbal	(conversion 2 → 3)	7

Results: Modules

HLT experts indicated which modules are required for each conversion based on:

- BLARK matrices (Daelemans & Strik, 2002)
- Additional modules for communicative disabilities:
  - Recognition of gestures
  - Text-to-symbols
  - Recognition of symbols
  - Recognition of pathological speech

Results: Availability & Quality

HLT experts also indicated:

- availability of modules
- quality of modules
- research effort required for sufficient quality

		Hiërarchie 5 meest voorkomende conversies									
		1 (32%)	1 (26%)	3 (12%)	4 (8%)	5 (7%)					
		Spraak-synthese	Spraak-herkenning	Tekst-modificatie	Non-verbaal-naar-spraak	Tekst-naar-non-verbaal	Frequentie	Beschikbaarheid		Kwaliteit	Complexiteit
		2 → 1	1 → 2	2 → 2	3 → 1	2 → 3		C	E		
Taalmodules BATAVO	1. Grafeem-foneemomzetting	X	( )		X	X	3,5	j	j	G	n.v.t.
	2. Tekstvoorverwerking	X		X	( )	X	3,5	j	j	O	LC
	4. Lemmatisering & morfologische analyse	X		X		X	3,0	j	j	G	n.v.t.
	5. Morfosyntactische desambiguering	X		X		X	3,0	j	j	G	n.v.t.
	6. Syntactische analyse	X		X		X	3,0	j	j	V	n.v.t.
	7. Semantische en pragmatische analyse			X	X	X	3,0	n	n	S	HC
	8. Tekstgeneratie			X	X		2,0	n	n	S	MC
	9. Taalpaarafhankelijke vertaalmodules			( )			0,5	j	j	O	HC
Spraakmodules BATAVO	1a. Prosodieherkenning		( )				0,5	n	n	S	MC
	1b. Prosodiegeneratie	X			X	X	3,0	j	j	V	n.v.t.
	2a. Volledige spraaksynthese	X			X	X	3,0	j	j	G	n.v.t.
	2b. Volledige spraakherkenning		X				1,0	j	j	O	MC
	5. Foonstringbewerkingen		( )				0,5	j	j	G	n.v.t.
	6. Robuuste spraakherkenning		X				1,0	j	j	S	HC
	8. Sprekerherkenning		( )				0,5	j	j	V	n.v.t.
	9. Taal- en dialectidentificatie op basis van spraak		( )				0,5	n	n	V	n.v.t.
	10. Adaptatie		X				1,0	j	n	V	n.v.t.
	11. Betrouwbaarheidsmaten en uitingverificatie		X				1,0	j	j	O	MC
Toegevoegde modules	A. Tekst-gebarenomzetting					X	1,0	n	j	O	MC
	B. Gebarenherkenning				X		1,0	n	j	O	HC
	C. Tekst-pictogramomzetting					X	1,0	j	n	O	MC
	D. Pictogramherkenning				X		1,0	n	n	S	LC
	E. Lipbeeld- en (panto)mimiekgeneratie					X	1,0	n	j	O	LC
	F. Herkenning pathologische spraak		X				1,0	n	n	S	HC

Results: summary

1. **Speech synthesis**: all modules available, only one of low quality, could be improved with relatively little effort.
2. **Speech recognition**: most modules available, but average to high effort required to achieve sufficient quality.

Results: summary

3. **Text modification**: not all modules available, missing modules require average to high effort.
4. **Non-verbal speech**: several modules missing, average to high effort required.
5. **Text to non-verbal**: most modules available, but not all of sufficient quality, low to high effort required.

Conclusions

- Survey provides information for policy makers
- Different choices can be made, depending on policy priorities
- Procedure adopted for general BLARK applicable to communicative disabilities