

Signs for the future

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Animating Sign Language

- How can Virtual Human Signing provide services for deaf people?
- How does Virtual Signing work?
- How can we create new Virtual Signing sequences?

Deafness: Some Background



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Deafness in the UK

- 1 in 7 are deaf or hard of hearing
 - Hearing aids, lip-reading English, Teletext
- 1 in 1000 born deaf
 - Signing is closest to natural language
 - BSL as first or preferred language
- 50,000+ people born deaf in the UK
 - British Sign Language (BSL) has its own dictionary and grammar
 - Reading age (for English) is often quite low

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British Sign Language

- A purely visual natural language
- A language of gestures
 - Gestures with the hands and body
 - Facial expressions and lip movements
- Not based on English
 - Different structure and grammar
 - Order of signs is not the same as English words

Why Use Virtual Human Signing?



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When do we need Signing?

- Events
- TV
- High Street
- Web and Communications

Sign Language Interpreters

- Excellent for Events and TV
- Not enough interpreters to accompany all Deaf people
- Not practical for short lived information
 - Newspapers
 - Web
- Takes time to book an interpreter

Videos of Signing

- Excellent for Fixed information sources
- Expensive for short lived information
- Need to blend video sequences
 - Hard/Time consuming
 - Inflexible for editing
- High Bandwidth
 - Becoming less important as a problem

Virtual Human Signing

- Can use realistic Captured motion
 - Visual quality improving
 - Possible to blend sequences
- Can be used to make Synthetic signs
 - Textual sign representation
 - User has freedom to create their own content
- Much lower bandwidth than video

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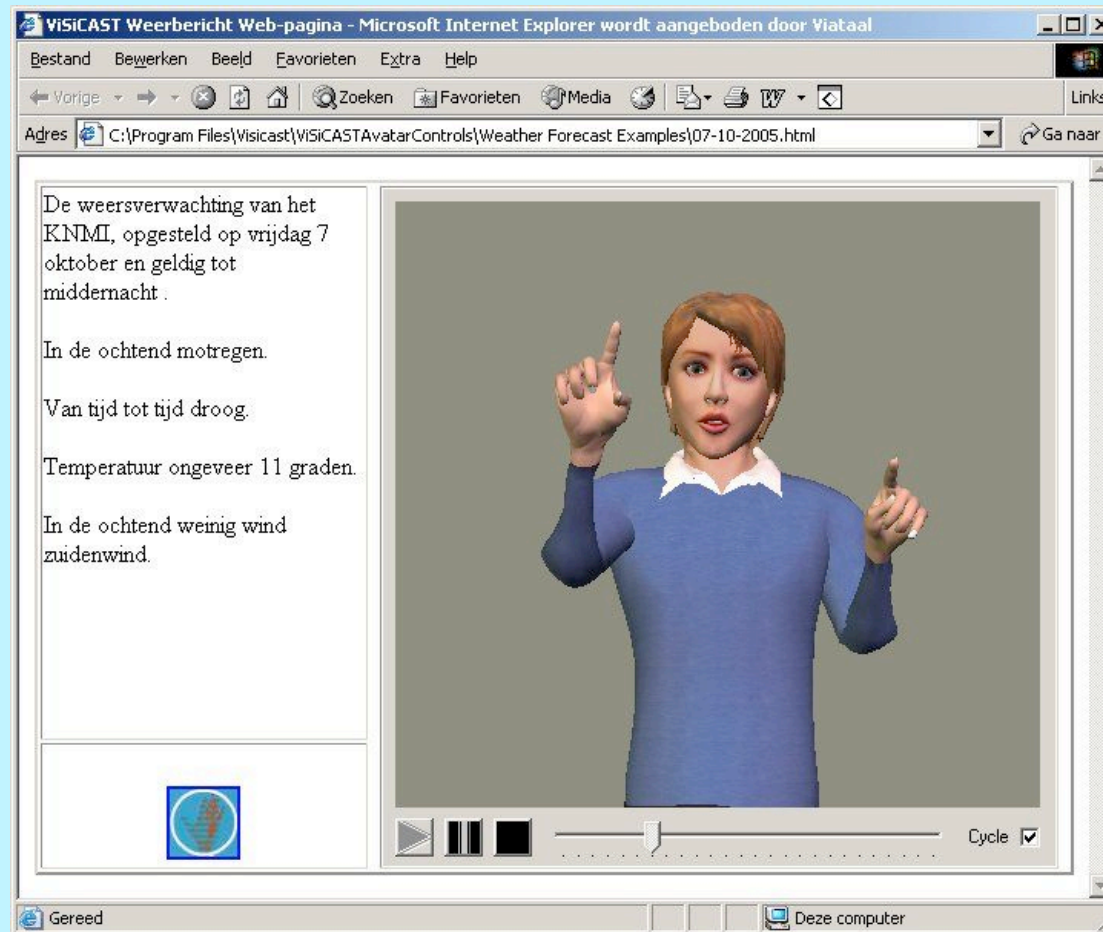
Web Applications



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Web Applications

Dutch Sign Language Weather Forecast



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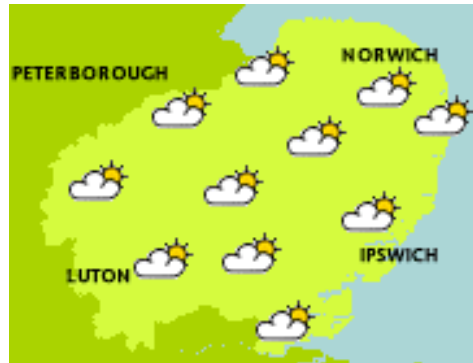
Web Applications Weather Forecasts

- Signed Weather Forecasts
 - NGT (The Netherlands)
 - DGS (Germany)
 - BSL (Britain)
- Form Filling for Forecast:

“Sunny spells but feeling fresher.”
Met Office Summary: Eastern Counties 07/09/2006

Weather Forecast

Today

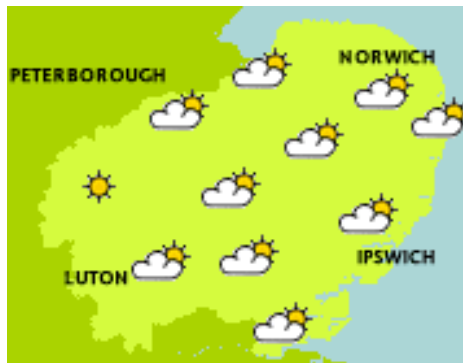


Thu 7 Sep 2006
Daytime weather

Today:

Bright with sunny periods but feeling noticeably cooler. Gentle northerly wind. Maximum temperature 19 deg C

Friday

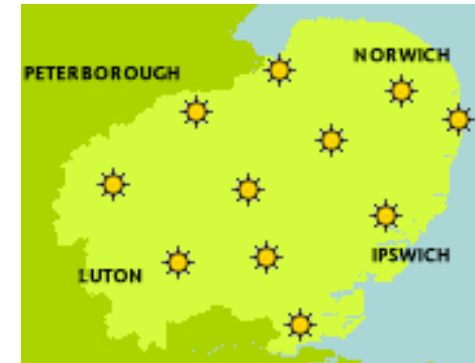


Fri 8 Sep 2006
Daytime weather

Outlook:

Dry with variable cloud and sunny spells. Light winds.

Saturday



Sat 9 Sep 2006
Daytime weather

Weather Forecast

Thursday 07 September 2006

Summary

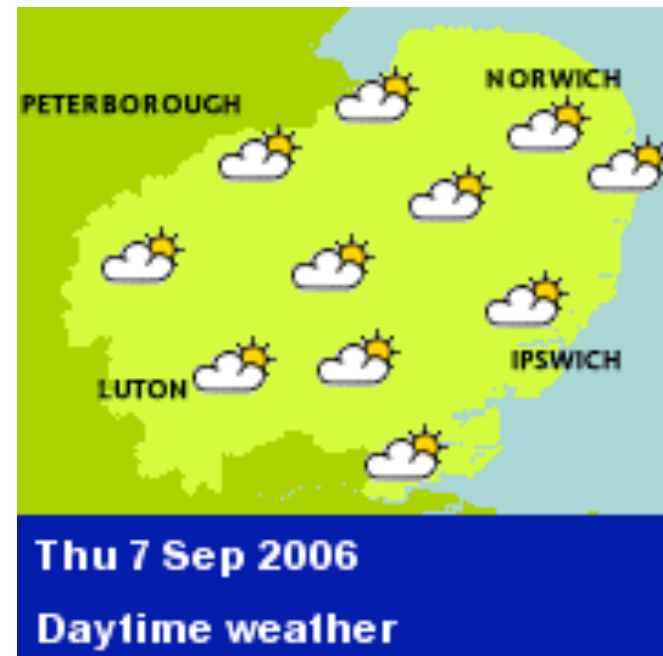
Sunny spells but feeling fresher. Dry with clear spells tonight.

Today

Bright with sunny periods but feeling noticeably cooler, particularly on the coast, with a gentle to moderate northerly wind. Maximum temperature 19 deg C (66 deg F).

Tonight

Dry with clear periods. Becoming chilly inland but milder near the coast. A gentle northeast breeze. Minimum temperature 7 deg C (45 deg F).



Web Applications Weather Forecasts

- Pattern for normal Weather Phrases
- Sign Language version for each Phrase
- Forecast is a sequence of Phrases
- Generate abstract Weather Model
- Processing for each Sign Language
- Processing for each Spoken Language

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Web Application: Demo



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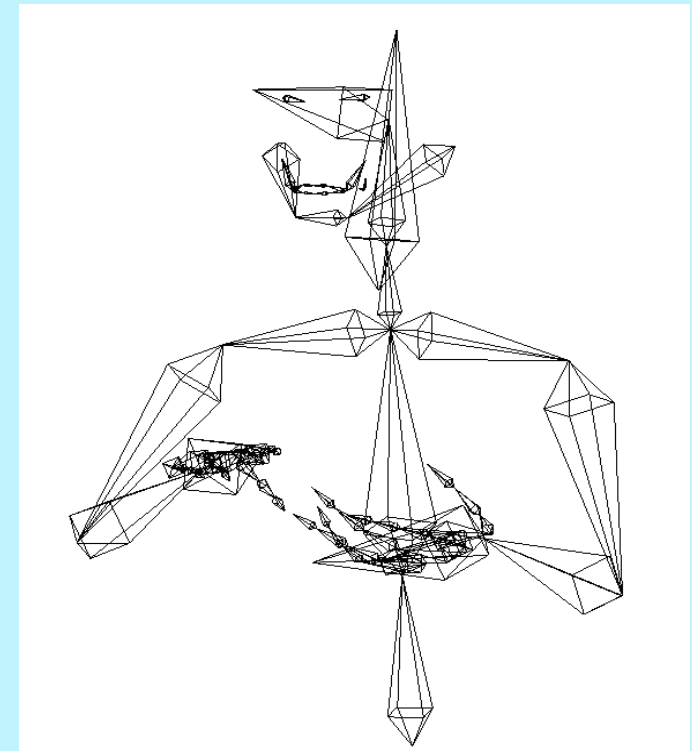
Virtual Human Signing Animation Process



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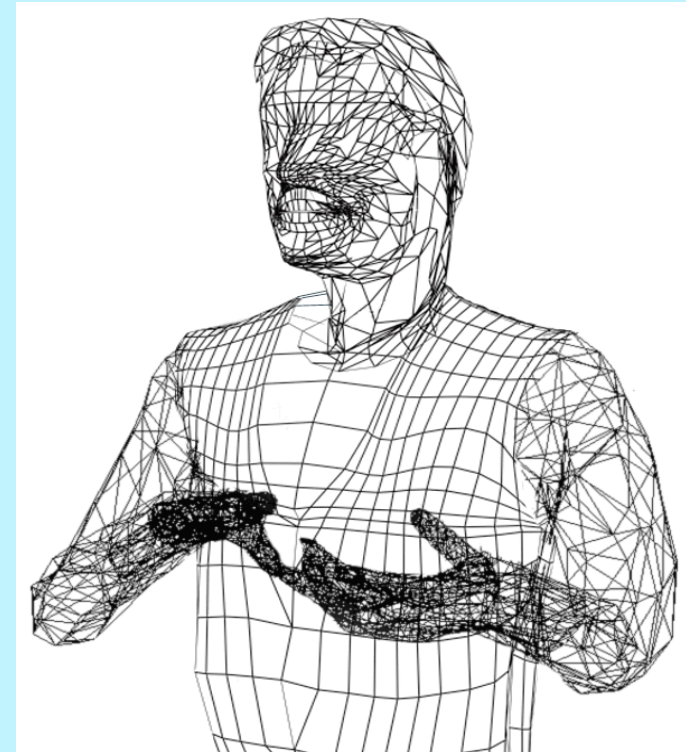
Virtual Humans: Animation

- Three dimensional model
- Skeleton of bones
- Driven by motion data



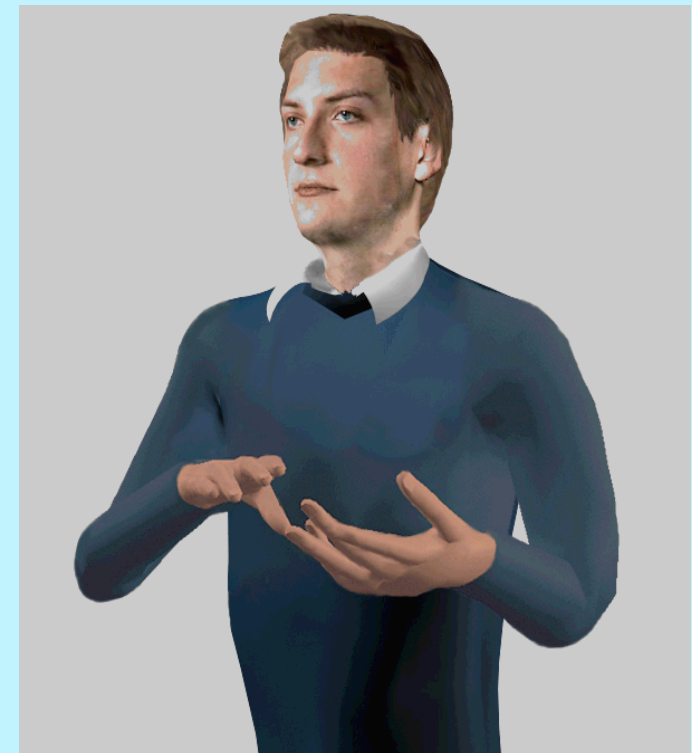
Virtual Humans: Animation

- Covered by a mesh
- Wire-Frame shape of body



Virtual Humans: Animation

- Apply an image to the mesh
- Texture for skin and clothing
- Gives photo-realistic image



Virtual Humans: Animation

- Good motion data combined with:
Fast real-time graphics
- Bones-Sets
 - Bone lengths and interconnection topology (“joints”)
 - Specify joint **angles** and **orientation**
- Rendering
 - Attach mesh (“wire-frame”) to Bones-set
 - Apply texture-mapping to mesh
- Animation
 - Sequence of rendered frames
 - Each defined by a Bones-Set configuration

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Virtual Human Signing Creating Sign Language Content



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Animation Approaches

- Hand-Crafted Animation
- Motion Capture
- Synthesis from Signing Notation

Virtual Human Signing Hand Crafted Animation



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Hand-Crafted Animation

- Traditional Animation technique
- Define Key Frames
- Interpolate between Key Frames
- Can give good animation
- Time consuming
- Blending of signs still required

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Virtual Human Signing Motion Capture



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Motion Capture

- Very lifelike animation
- Time-consuming to set up
- Blending of signs
- Can combine signs from different signers

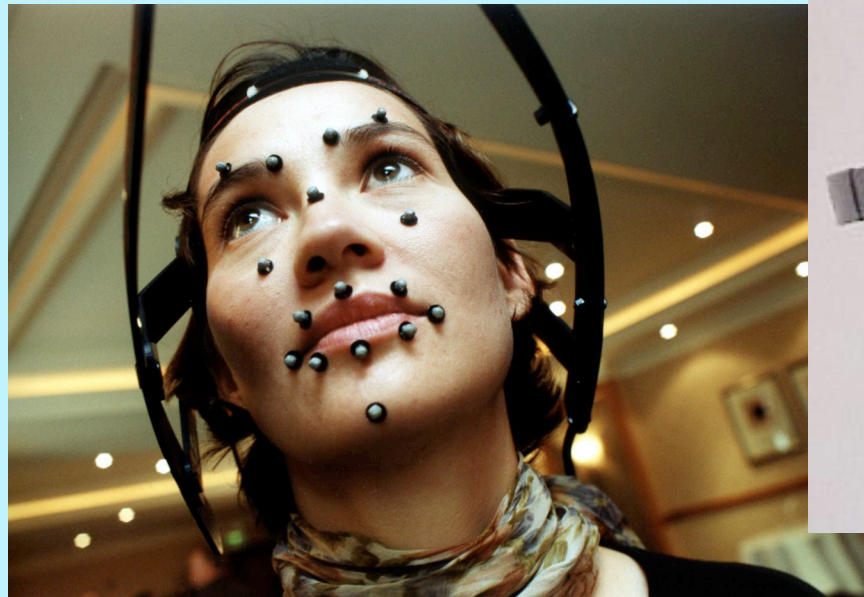
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Data Capture: Face Tracking

Face tracker

20 reflectors, helmet mounted camera

60/2 Hz



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Data Capture: Cybergloves

Cybergloves

18 resistors modulated by bend
sample rate, <50 Hz



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Data Capture: Magnetic Sensors

Magnetic sensors, 'Motion star'
Wrist, elbow, head, body
86/2 Hz



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Motion-Capture for Virtual Human Signing

- Motion Capture Streams
 - body
 - magnetic tracking
 - face
 - reflective markers + head-mounted camera
 - hands
 - gloves with bend-sensors



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Virtual Human Signing Synthesis from Notation



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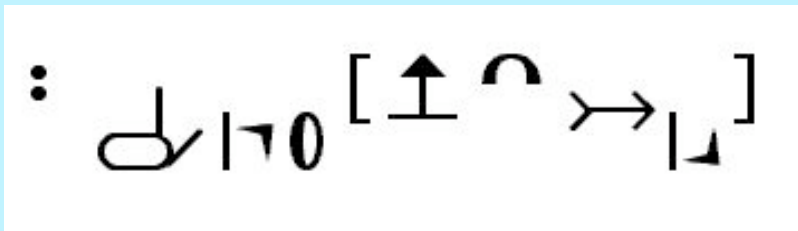
Gesture Notation for Signing

- Hamburg Notation System
 - HamNoSys
 - Code for hand shape and orientation, location, and movement
 - Uses special hieroglyphics for gestures
- Signing Gesture Markup Language
 - SiGML
 - Text format like HTML used on web pages

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HamNoSys Examples

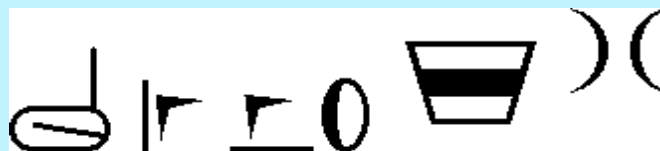
DGS (German) Sign: “GOING-TO”



BSL Sign: “NAME”



BSL Sign: “ME”



SiGML Notation : Name-Me

<sigml>



<sigmlsign>

<sign_manual both_hands="false">

<handconfig extfidir="ul" palmor="dl" handshape="point12"
thumbpos="across" location="forehead_right"/>

<directedmotion direction="or">

<handconfig palmor="r"/>

</directedmotion>

</sign_manual>

</sigmlsign>

<sigmlsign>

<sign_manual both_hands="false">

<handconfig extfidir="uil" palmor="l" handshape="point1"
thumbpos="across" location="chest_near"/>

</sign_manual>

</sigmlsign>



</sigml>

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Synthetic Signing: Demo Handshapes and Sign Creation



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Signed Content Creation using Synthetic Signs



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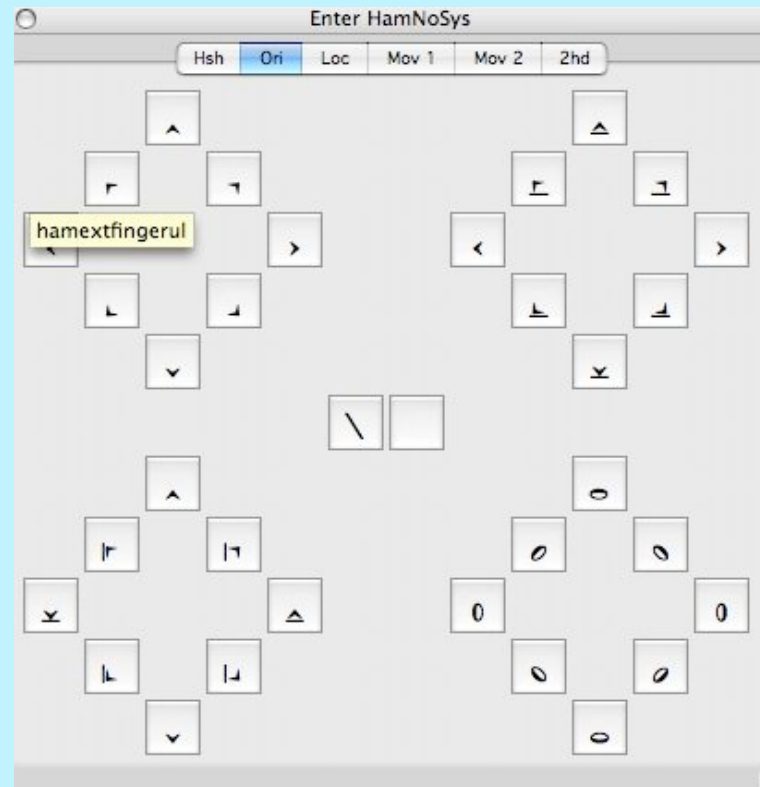
Signed Content Creation

- Create Notation for Signs
- Create Database/Lexicon
- Create Sequences from Lexicon Signs
- Build into Applications or Web Pages
- Animate using Virtual Human Player

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Sign Creation

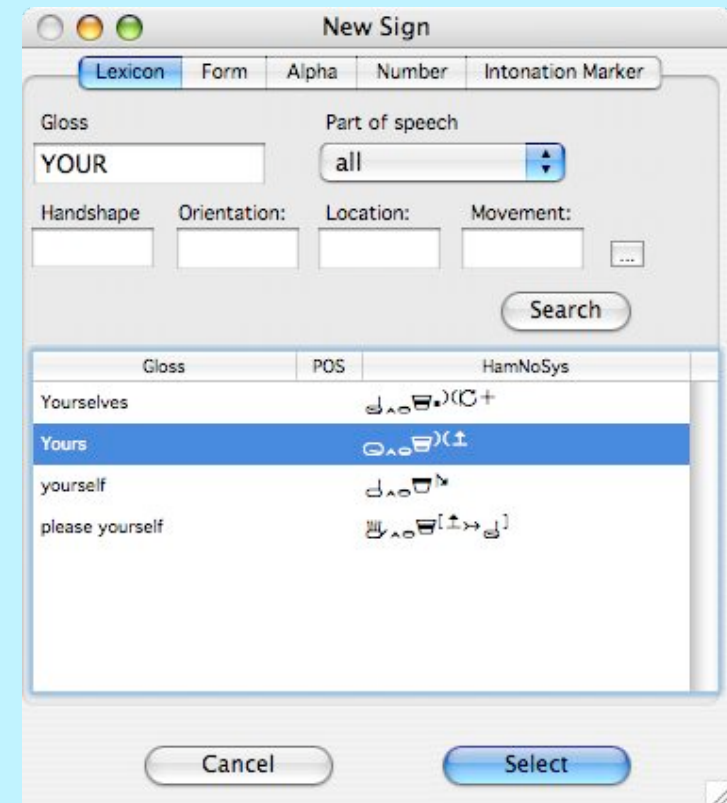
- HamNoSys



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Dictionary or Lexicon Creation

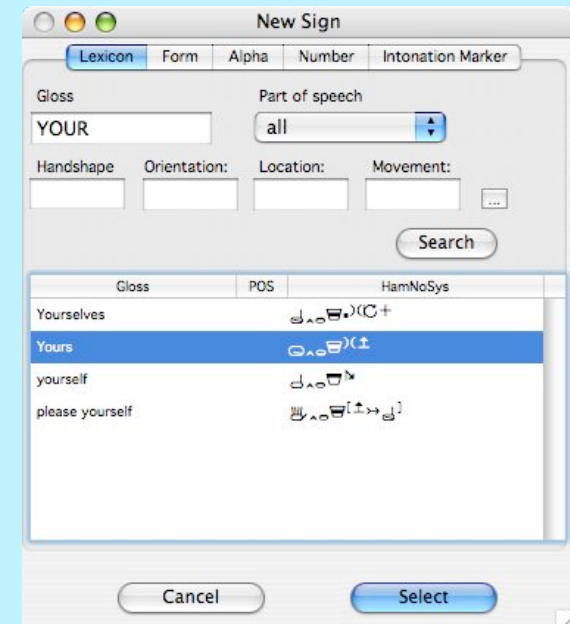
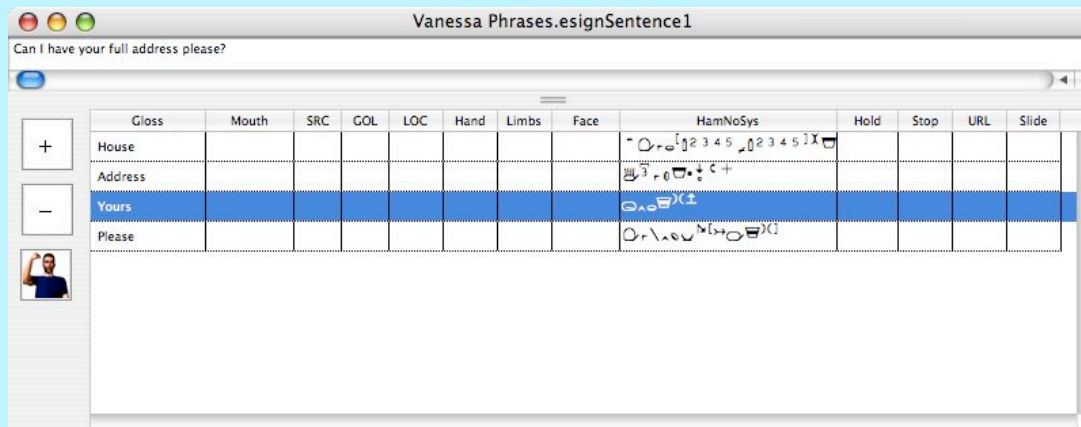
- Save Signs in Database
- Search database
 - by Gloss (sign name)
 - by Handshape
 - by Mouthing
 - by other features



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Sequence Creation

- Select signs from Lexicon
- Compose BSL Sequence
- Check using Virtual Human
- Save as SiGML text



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Customer Support Applications



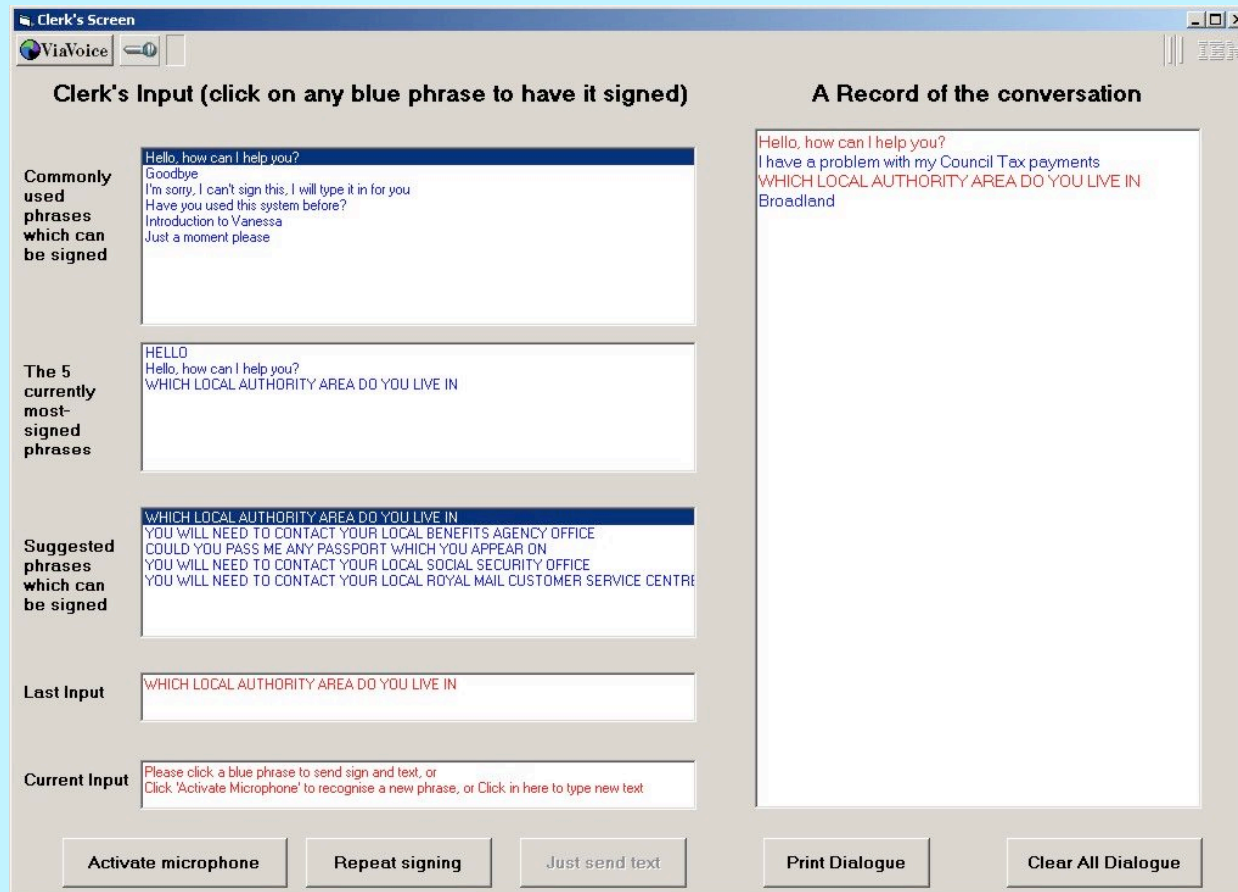
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VANESSA

- Application to help clerks to communicate with deaf clients at Council Information Centres or similar facilities
- Signing avatar conveys signed information
- Text version also displayed
- Signs created synthetically
- Installed in Norwich Forum CIC

VANESSA

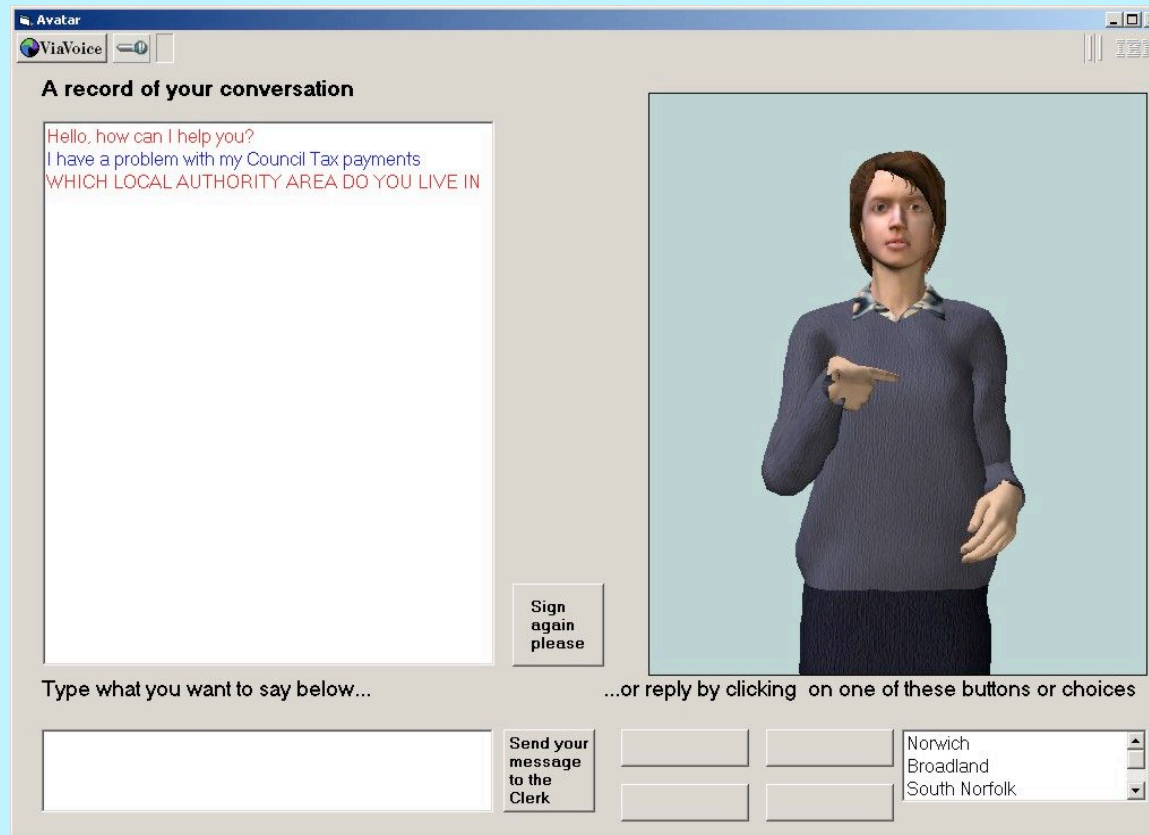
Graphical User Interface for Clerk



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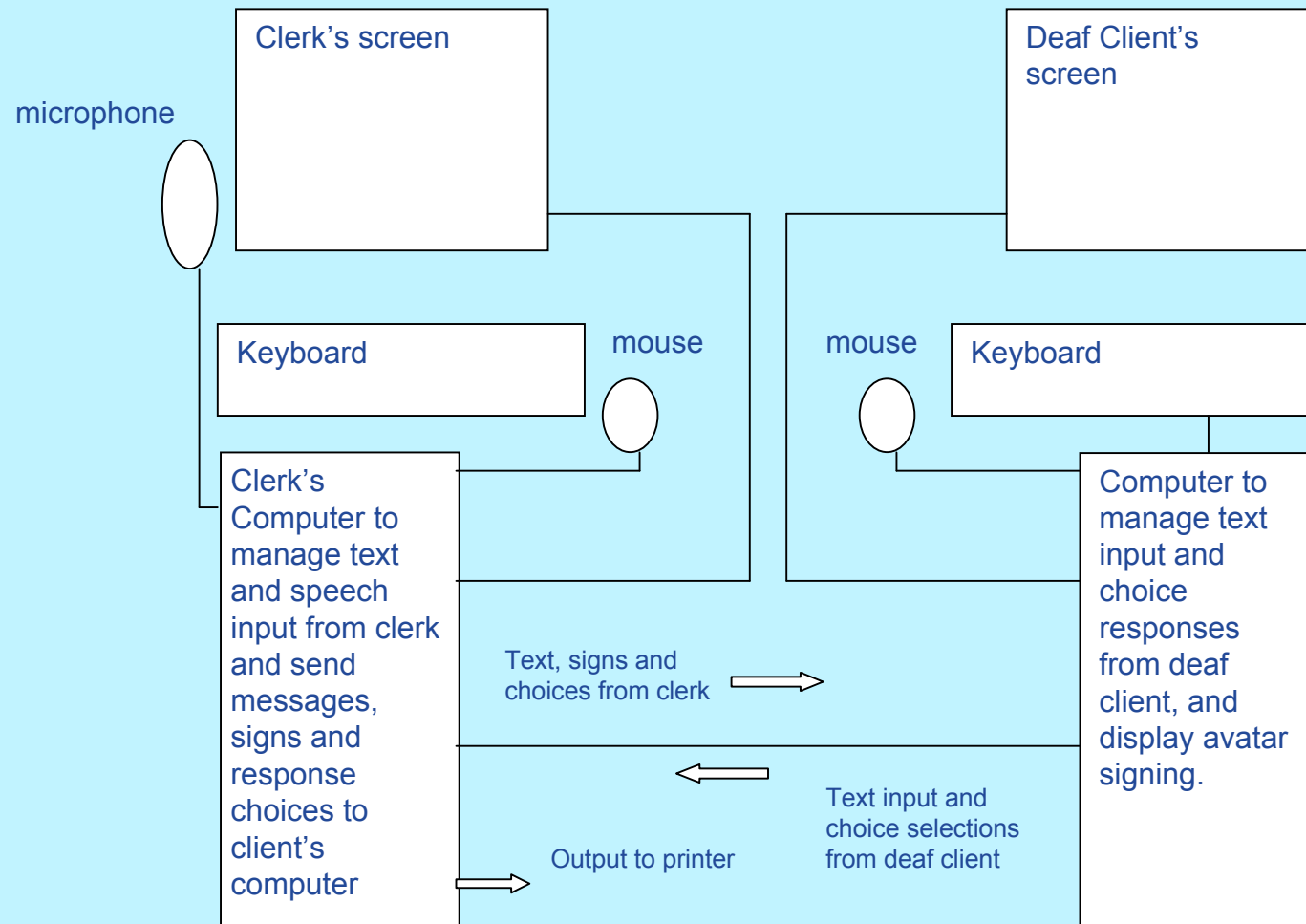
VANESSA

Graphical User Interface for Client



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VANESSA Networked Architecture



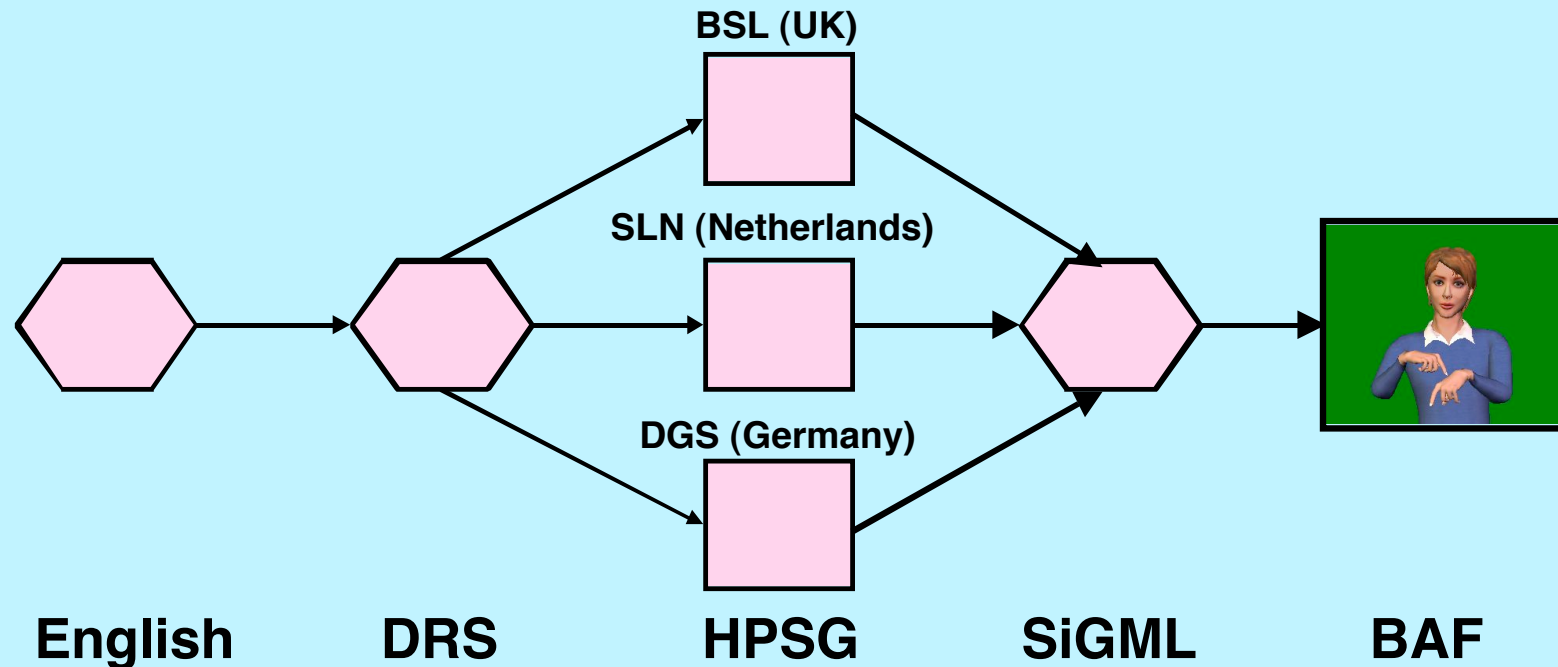
Translation from English



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English to Sign Early Experiments

- Translation via intermediate code:
Discourse Representation Structure



Blender Demo Web Page



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Conclusions



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Key Role of Deaf Organisations

- Bridge between the project partners and the deaf people who could benefit from the technology
- Wide dissemination of project aims
- Collation of UK feedback by RNID through visits to deaf clubs and groups
- Evaluations of prototype systems by deaf people to influence how systems can be improved

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Achievements

- Virtual Human Avatar Player
 - PC Plugin
 - Java Applet
 - Shockwave
- Web Scripting for Sign-Enabled Pages
- Tools for Lexicon Creation
- Tools for Content Assembly

- Status: Practical Prototypes

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Current Projects

- Focus on applications in education:
 - Digital Curriculum materials for BBC JAM to encourage English and BSL literacy for deaf children
 - Sign language support for assessment of IT skills for the Scottish Qualifications Authority
 - Development of Primary Modern Foreign Language tools using signing gestures to accompany language learning

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Signs for the Future



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Partnerships

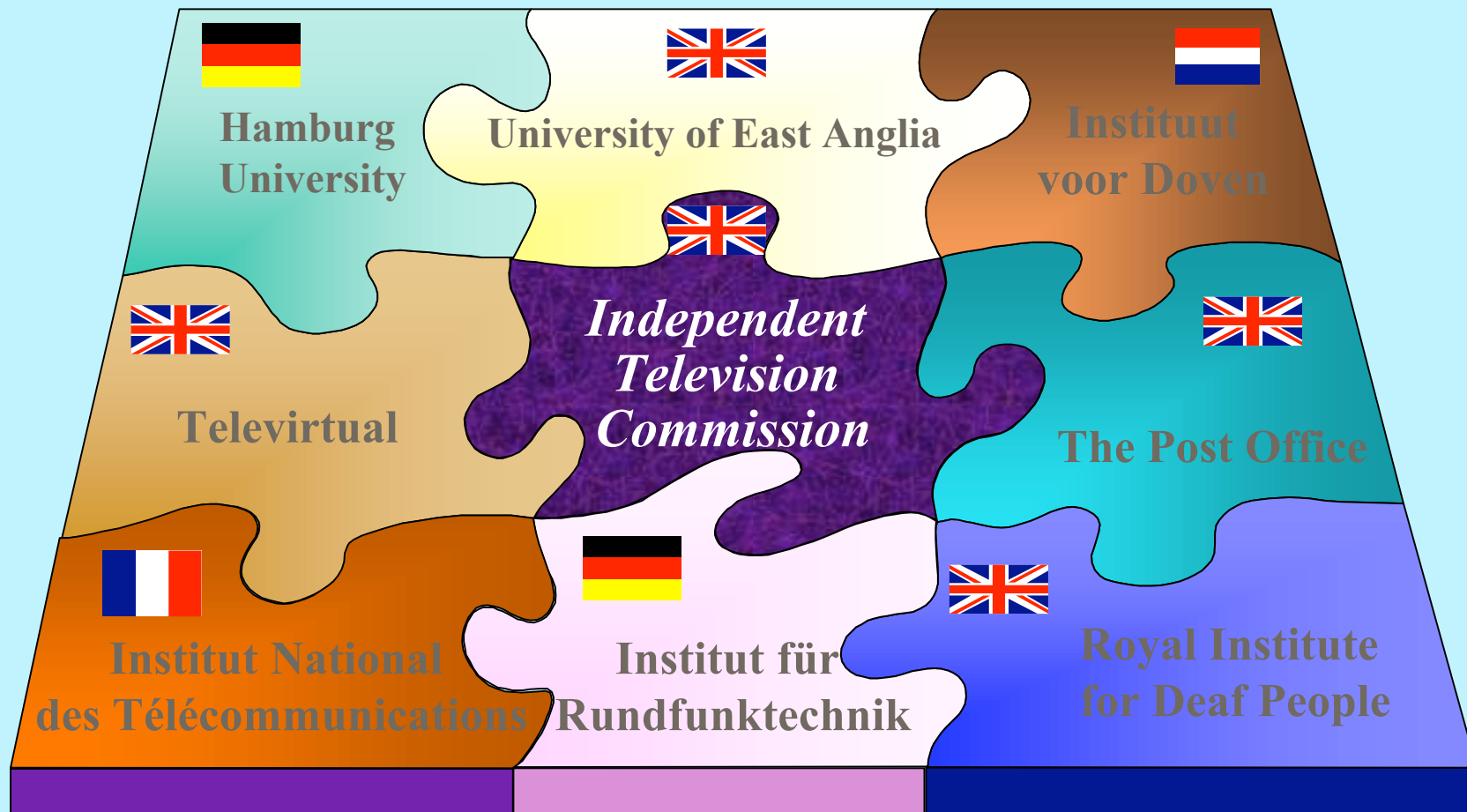


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Colleagues at UEA

- John Glauert, Andrew Bangham, Stephen Cox, Ralph Elliott, Ian Marshall
- Éva Sáfár, Richard Kennaway, Mike Lincoln, Barry Theobald, Farzad Pezeshkpour, Judy Tryggvason, Vince Jennings, Kevin Parsons

The ViSiCAST Project



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The eSIGN Project



UK Partners

UEA Norwich : Processing of language, speech & signing

RNID : Creation of sign lexicon and evaluation

Norfolk County : e-Government deployment

Televirtual Ltd, Norwich : Avatar creation

With:

BBC : Realtime capture and transmission

Post Office : Face-to-face transaction systems

ITC : Project co-ordination

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EU Partners

IDGS, Hamburg, Germany : Sign language notation

Viataal, Netherlands : Multimedia content creation

With:

INT, France : Broadcast imaging & animation standards

IRT, Germany : Broadcast technology

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Contact Details

- **Web sites:**
 - www.visicast.cmp.uea.ac.uk
 - www.cmp.uea.ac.uk
 - www.visicast.co.uk
 - www.sign-lang.uni-hamburg.de/eSIGN
 - www.sign-lang.uni-hamburg.de/esign/Forum.html
- **Email:**
 - **John Glauert:** jrwg@cmp.uea.ac.uk

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