

Inf1B: Data and Analysis
 Methods for Collecting Data to Inform System and Interface Design

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Stages of system development

1. Task and requirements analysis
2. Design
3. Evaluating design
4. Prototyping
5. Re-design and iterate
6. Internal evaluation of content
7. Satisfaction of design requirements
8. Usability
9. Effectiveness
10. Conclusions

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Task-Centered User Interface Design
Lewis and Rieman (1994)

- a. figure out who's going to use the system to do what
- b. choose representative tasks for task-centered design
- c. plagiarize (from other systems)
- d. rough out a design
- e. think about it
- f. create a mock-up or prototype
- g. test it with users
- h. iterate
- i. build it
- j. track it
- k. change it

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From Waller et al, 2005

Early user involvement in the design of software systems is essential if the system is to be usable
(Preece, et al, 1994; Shneiderman, 1998)

Moving from "system-centred" to "user-centred" design has enabled great improvements to be made in the effectiveness of user interfaces
(Wood, 1998)

"The UCD approach is vital in the area of assistive technology this approach presents a challenge when designing for people with severe communication impairments who may not yet have acquired effective communication strategies"
(Waller et al, 2005)

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Informing the design of Standup

To help children with complex communication needs (CCN) **create jokes** and **play with language**

1. By generating jokes on **topic**, by **keyword**, from **templates**
2. Using **templates**, **schema** and **lexicon** (plus **word frequency**)
3. Incorporating **scanning** and **speech** access
4. Use by: **children with CCN**, **TD children**, **CCN adults**, **experts**
5. Usable, accessible

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1. Data Collection Methods

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Methods for informing Standup design

- Observation
- Mock-ups
- Video Recording
- Interview
- Focus groups
- Task analysis
- Questionnaire

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Direct Observation

Commonly used in **early stages of system design** or **hypothesis formation**
Identify potential **interactions between parameters** that might otherwise be missed

To help focus and record observations:

- **use tools** e.g. *event counters, checklists, structured behavioural annotation sheets*
- **restrict bandwidth** e.g. *via chat interface*

Very useful when used with other methods

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Observation issues

Disadvantage: *presence of the observer may affect behaviour being observed*

To reduce observer effects:

- **repeated sessions** enable participants to become accustomed to the observer's presence
- **careful placing of the observer** to avoid intrusion
- **train the observer** to resist interceding
- **explaining the role of the observer** to the participants

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Mock-ups and paper prototypes

Goal: to get feedback on early design ideas before any commitment is made, mock-ups or prototypes of the system are used

1. **electronic prototypes** can be developed and presented on computer screen
2. **paper-based interface designs** can be used to represent different screen shots

Elicits responses to actual interfaces and not other issues surrounding the operational access of technology

Facilitates more imaginative feedback, actively encourages "hands on" interaction

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Video recording

Videoing user and system (or user and expert in WOZ studies) interaction **enables all visible user behaviour** (verbal and non-verbal) **to be used as data**

Video can be used for:

- **detailed behavioural analysis of user**
- in less detail, **for reference**, to determine interesting episodes in the interaction
- **to transcribe verbal interactions** between expert/tutor and student in WOZ studies

Video recording of screen interactions **also enables data capture of keyboard use and mouse movement**

Tools that permit replay of the interaction including all interface actions are becoming more common and reliable.

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Interviews

Used **to elicit knowledge from a user by direct verbal questioning**, and can be:

1. **very structured:** pre-determined questions in specified order with little room for elaboration in responses
2. **semi-structured:** permits variation in order of coverage of questions, open-endedness in responses, flexibility in question selection and potential generation of new questions
3. **open-ended:** with few specific pre-determined questions and further question generation being determined by the previous response

Generally easy to administer and to respond to...

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Interviews, contd.

Commonly used:

1. for feedback on **interface design** and **usability**
2. to determine **users feelings** and **attitudes**
3. to determine **appropriate variables**
4. post-session to **confirm other data** collected

Interviews versus questionnaires:

- conducted **verbally** rather than in **written** form
- suitable for **eliciting** a wider range of **data** which **users may find difficult to elucidate** in writing and without prompting
- interviews **more objective** than open-ended, unstructured feedback

Risk of respondent being influenced by questioner

Questionnaires

Present questions to be answered in **written form** and are **usually structured**

To determine:

- **user characteristics** e.g. demographic, goals, attitudes, preferences, traits
- **users task knowledge**

Used as a means of expert evaluation:

- in the **design stage** and later development cycles
- to **validate system behaviour**
- to **evaluate system behaviour** e.g. comparison with other systems or human performance

2. Informing the Design of the Joke Generation Tool

Users: Domain and end-user experts

1. **Five Speech and Language Therapists (SLTs)**
2. **Two adults** with complex communication needs as **end-user experts**

Difficult to use real target users (children with CCN) in the design stage:

- hard to communicate needs and opinions
- would be easily fatigued

Adults with similar difficulties, but better technology and communication skills were used instead, as **expert end-users**

Design study stages

Goal: developing system requirements and alternative conceptual designs

1. **SLTs** in two focus groups sessions to discuss **the initial requirements** and **general design principles**
2. **Individual user consultation** with **expert-end users** with two different system prototypes

Data Collection from SLTs

- a. **Brainstorming sessions** on developing system requirements and alternative conceptual designs
- b. **Prototypes** presented and **semi-structured questionnaire** used to encourage discussion

Two prototypes represented each end of the literacy spectrum (both used pictures):

1. **"highly literate"** with text-based interface
2. **"highly pictorial"** based on journey metaphor

Composite interface of possible joke-generating sequence, using **sequence of interface screens**

'Highly literate' prototype

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Data collected from SLTs on 'highly literate' prototype

- It looks boring
- It is not how we teach early literacy skills
- It needs to be much more stimulating
- It needs to be able to give early rewards and this looks like it could be difficult
- I realise there will be auditory signals but it is still very unappealing for a child
- It doesn't appear to encourage use
- A small minority may be able to use something with this much language
- It looks fine for kids without any physical or learning difficulties

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Revised User Requirements

- Vocabulary - Appropriate for Young Children
 - No Unsuitable Words
- Appropriate for Children with Emerging Literacy
 - Preference for Familiar Words
 - Speech output
 - Symbol support using Rebus and PCS symbol libraries e.g.:

"market" →

"thyme" →

- Access to jokes using subjects – lexicon grouped into subject-areas (topics) and clustered into a hierarchy

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Requirements: Lexical Information

Part-of-speech (POS) tags

Phonetic spelling, for computing:

- homophones time thyme
- rhyme pub tub
- spoonerism brush/rake rush/brake

Compound nouns and their components
e.g. long time, traffic jam

Distinct senses of a word/phrase,
e.g. match=sporting event, match=ignition stick

Semantic relations:

- synonyms strange bizarre
- hypernyms thyme herb
- meronyms traffic car

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Led to 'highly pictorial' prototype

SLTs asked: **how would a child interact with joke generation software using symbols?**
(to keep literacy requirements to a minimum)

- Open-ended questions used to guide discussion
- 'Journey metaphor' with pictorial symbols viewed as more positive

Picture Communication System symbols added to support interface text and scaffold the child's language skills (Meyer-Johnson Inc, 2005)

Resulted in '**pictorial**' interface screens

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'Highly Pictorial' Prototype

Interim Home screen for journey metaphor

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'Highly Pictorial' Prototype

Interim screen for journey metaphor showing joke and answer to be 'spoken' by speech synthesiser

Data Collection from expert end-users

Videotaped to ensure non-verbal signs not missed

Semi-structured interview to discuss prototypes

- open-ended questions too difficult to communicate and understand responses too
- rephrased into closed questions (though harder for users to explain actions)

Usability test-scenarios: go through process of telling a joke by moving through screens

- number of key-presses required to complete task
- researcher revealed appropriate relevant screen which matched choice made by the participant

Two short sessions to avoid fatigue

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Data collected from expert end-users

Usability issues:

- able to complete the set tasks with some ease
- able to retrace steps by pressing the "Back" button
- understood concept of telling the first part of the joke followed by the punchline

Design feedback:

1. Preferred pictorial journey interface to text-based one
2. PCS symbols useful for word reinforcement
3. But users should have option to switch PCS off
4. Road metaphor was liked and found useful for navigation through hierarchy of screens
5. Prefer drop down box to typing-in for word input

Semi-structured questionnaire was inappropriate

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Conclusions from studies

Various methods used to collect different sorts of data to inform design requirements

But the methods of data collection have to be adapted to the users.....

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Next version

Welcome to the STANDUP Joke Builder!

First time

to play with jokes

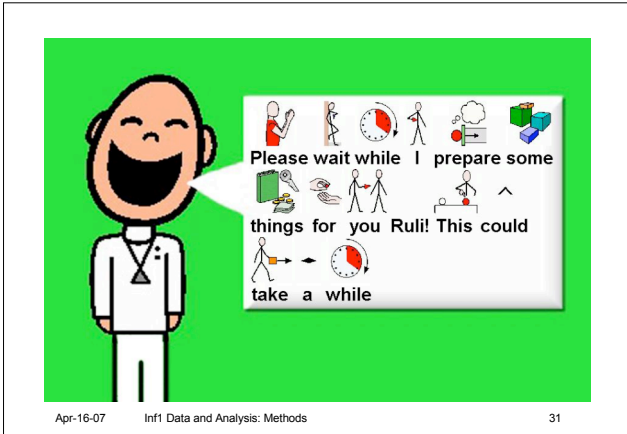
Coming back again

Please type your name in here

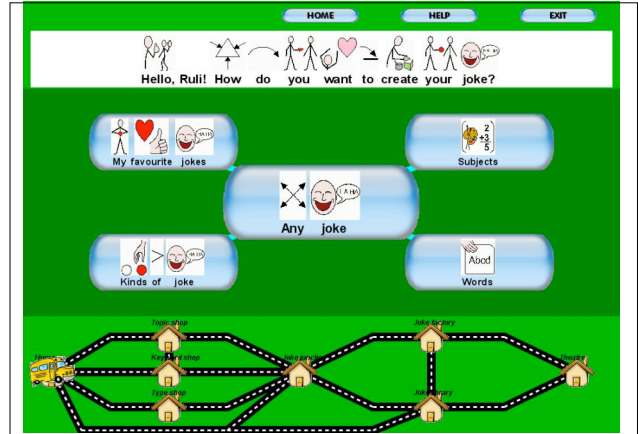
Finished name

No

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Later redesign

The basic interface was redesigned by a graphic designer

Pilot tested with small group of speaking children before use with target group

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Designing the Interface - Scanning

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"Are you ready?" – Using STANDUP

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References

Preece, J., Rogers, Y., Sharp, H., Benyon, D. Holland, S. and Carey, T. (1994). *Human-Computer Interaction*. Addison-Wesley

Dix, A., Finlay, J., Abowd, R. and Beale, R. (2004) *Human-Computer Interaction*. Prentice Hall

Lewis, C. and Rieman, J. (1994) *Task-Centered User Interface Design*. Shareware web publication, available at: <http://hcibib.org/ricuid/>

Meyer-Johnson. (2005). Picture Communication System (PCS) symbols are © Mayer Johnson Co., PO Box 1579, Solana Beach, CA 92075, USA.

Shneiderman B. (1998). *Designing the user interface: Strategies for effective human computer interaction* 3rd Ed. Addison-Wesley, Reading, MA.

Waller, A., O'Mara, D., Manurung, R., Pain, H. and Ritchie, G. (2005) *Facilitating User Feedback in the Design of a Novel Joke Generation System for People with Severe Communication Impairment. Proceedings of HCI 2005* (to appear).

Wood, L. (1998). *User interface design: Bridging the gap from user requirements to design*. (Florida: CRC Press).

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