How can *Serious Games* help to improve the assessment of children’s language capacities in authentic communicative settings?

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Homepage: http://www.sprachstandsermittlung.daf.uni-muenchen.de
Objectives & Overview

Assessment of the proper communicative potential & educational needs of 4- to 5-year-old children
The Potential of Serious Games for Assessment

- Promoting user engagement in assessment
- Providing meaningful and authentic (e.g. ecologically valid) contexts for assessments through interactive immersive environment
- Reducing the players test anxiety through a „stealth approach“
- Applying innovative technology → Advantages of digital software environment
Interactive App(s) for Language Assessment
Serious Game & Authentic Language

- Game versus examination
- Childfriendly background story incorporating inspiring characters
- Player’s quest → Children are asked to help the game’s character
- To accomplish this task, the child talks to the character on the tablet
- Inherent motivation
- Test items are embedded in communicatively relevant situations

Realistic Setting

speaker  |  addressee

message
**Corpus Studies:** Spontaneous speech recordings of four children aged 4;0 to 4;11 years from German longitudinal corpora in CHILDES (MacWhinney 2000)

- Questions and answers:
  - Children do not give full answers at once
  - Elaboration on a topic takes several turns
    - Providing specific follow-up questions helps the child to focus on the precise information that is requested.

- Spatial expressions are highly frequent
  - (approx. 30% of utterances contain spatial information)
• Languages show strikingly different lexicalization patterns in the expression of motion events (e.g. Slobin 1996; Talmy 2000).

• Cross-linguistic differences affect the speakers’ focus of attention (Thinking-for-Speaking: Slobin 1996, 2004).

• When verbalizing a motion event, speakers choose among several means of expression those which are typical of their native language.

**Implications for early L2 acquisition**

- L2 learners produce spatial descriptions deviant from target language norms (e.g. Engemann et al. 2012; Ochsenbauer & Hickmann 2010).
- Even with a contact time of 24 months, children with L2 German differ from L1 children (Bryant 2012).
### Discourse Type

<table>
<thead>
<tr>
<th>Discourse Type</th>
<th>(Figure) Ground</th>
<th>Relation</th>
<th>Event</th>
<th>Event Type</th>
<th>Canonicity</th>
<th>Complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>instruction</td>
<td>(Du) Gras</td>
<td>durch</td>
<td>springen</td>
<td>motion</td>
<td>path</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(you) grass</td>
<td>through</td>
<td>to jump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>narration</td>
<td>(Willi, Hut) großer Korb</td>
<td>in</td>
<td>legen</td>
<td>position</td>
<td>ground</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Willi, hat) big basket</td>
<td>in</td>
<td>to put</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>description</td>
<td>(Flasche) Tisch</td>
<td>auf</td>
<td>stehen</td>
<td>localization</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(bottle) table</td>
<td>on</td>
<td>to stand</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Graphs

- **Discourse Type**
  - instruction (14 items)
  - narration (12 items)
  - description (4 items)

- **Event Type**
  - motion (14 items)
  - localization (12 items)
  - position (10 items)

- **Non-Canonicity**
  - ground (14 items)
  - path (12 items)

- **Complexity**
  - ground (14 items)
  - path (12 items)
Why are you afraid, dog?

How do I get to the hat?

You can swim yourself, too? Can’t you?

Or you jump onto the stone? Or are you afraid?

But how?

You can [uh] swim yourself.

Mhm.

Or jump on the stone then.

Okay. I’m gonna try that.

Good job, dog! You made!
Assessment Process

In the Nursery
- Game Situation
  - iPad
    - child plays game
  - iPod
    - examiner controls game
  - PC with internet connection
    - examiner transfers biographical data from parental questionnaire and consents

Database
- Children’s Speech Data (audio snippets)
- Transcripts
- Biographical Data
- Consents
- Results
  - for nursery
  - for research group
- Educational Needs

OCTRA
- orthographic transcription

Transcription Team
- transcribes audio snippets

Administration
- maintains database and web-access

Research Group
- analyses transcripts and results
- defines automatic analysis

Archive
- for archive authorised
  - Children's Speech Data (audio snippets)
  - Biographical Data
  - Transcripts
  - Educational Needs

Parental Questionnaire, Declaration of Consent
- filled in by parents
- precondition for testing
Transcription of Speech Data

- Orthographic + Tags (for e.g. noise, incomprehensible, self correction)
  - Transcription guidelines
  - Normalized speech:
    - standard language (possibly grammatically erroneous)
  - Natural Language Processing

- Web application for orthographic transcription OCTRA (IPS, LMU)
  - Variable work place and time
  - Transcription of audio snippets
  - Immediate and fast transcription

https://www.phonetik.uni-muenchen.de/apps/octra/octra/login
Data Analysis

• Measurements for analysis of language use based on orthographic transcripts
  o Focus of analysis on pragmatical aspects

• Expert ratings for
  a) language capacities (covered by test systematics)
  b) educational needs

• How are a) and b) distributed?

• How are c) linguistic features distributed?
  o e.g. diversity in use of adverbs

• Are there differences in a), b), c) between groups with different e.g. L1, age, contact time with German?
Automatic Prediction of Educational Needs

- Which *computational* linguistic features are suitable to model the language capacities and educational needs?
  - Which language capacities require assistance?

- Computational features
  - Pragmatics modelling through game set up (known story, scenes)
    - e.g. coverage of intended use of motion verbs
  - General language use
    - e.g. use of lexical resources

- Connection to data analysis: Which linguistic features are most discriminative?
Projection of Feature Space

Projection of feature vectors by Multidimensional Scaling (sklearn.manifold.MDS(metric=True)). Included features: features from test systematics, features for adverbs and prepositions based on diversity in usage. Light color for no educational needs, intense color for high educational needs.
Overview Preliminary Features
Prediction Error

Prediction Error Distributions of Monte Carlo Cross-Validation for linear SVR

- Mean errors
- Max errors
Future Perspectives

- Pilot testing of the App: 120 children aged 4;6 to 6;0 years with German as a first and second language
- Validation studies: Expert ratings, correlations with existing tests
- Usability testing of the Apps
- Adding more domains to the assessment tool (discourse, definiteness, possession)
- Standard setting
- Incorporation of spoken language features
Unspecific prompt: Mmmh?

Verbal prompt (1): How do I get to the hat?

Verbal prompt (2): Oh no, how exactly? I don’t get it.
Thank you for your attention!
Acknowledgments

• **Daimler and Benz Foundation** and all members of the Ladenburger Kolleg:
  Wolfgang Klein, Gabriele Kecker, Svenja Uth, Stefanie Haberzettl, Maike Schug, Giulio Pagonis, Natalia Kapica, Elisabetta Terrasi-Haufe, Christoph Draxler, Heike Behrens, Katrin Skoruppa, Karin Madlener, Dirk Ifenthaler, Jan Delcker, Frank Thissen, Marcus Hasselhorn, Wolfgang Woerner

• **Student assistants:** Sarah Faidt, Mitra Shateri, Agnieszka Kubacka-Mauer, Nicole Vogl

• **NEXT Munich**

Reference