The Learners’ User Classes
in the TERENCE Adaptive Learning System

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http://www.terenceproject.eu
The TERENCE Project

TERENCE is a 3-year EU project developing an adaptive learning system (ALS) for

(overall goal) improving the reading comprehension (RC) of
(learners) text poor comprehenders, hearing and deaf, 7-11 year old, in Italy and UK,
(educators) with the assistance of their educators,
(material) by reading books of stories and resolving games
The TERENCE ALS

expert model

educator model

learner model

user model

domain model

book and story models

smart and relaxing game model
The TERENCE ALS

- **user model**
- **domain model**
- **adaptation model**

**rules for**

- uses

**adaptive engine**

**uses**
The TERENCE ALS
how did we get there?
The TERENCE Project

TERENCE is a 3-year EU project aiming at an adaptive learning system (ALS) for:

(overall goal) improving the reading comprehension (RC) of
(learners) text poor comprehenders, hearing and deaf,…
(material) by reading books of stories and resolving games,
(methods) designed following the user centred design (UCD) and evidence-based design (EBD).
UCD Life Cycle Model

UCD is based on the ISO 13407 standard and requires:
- users (e.g., learners) at the centre
- an incremental and iterative design
- a highly multi-disciplinary team

start → context of use and user requirements

meets requirements?

development

evaluations

development
Structure of the Project

- Diagnosis + UCD
- Context of use and user requirements
- ALS design
- UCD + EBD evaluations
- ALS development

ALS models:
- User model
- Domain model
- Adaptation model

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Structure of the Project

ALS design

diagnosis + UCD
context of use and user requirements

UCD iterations

UCD + EBD evaluations

ALS development

user model
domain model
adaptation model

ALS models

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Once upon a time, there were certain types of learners…

And in the end of the analysis, we had learner classes.
Once upon a time, there were certain *types* of learners…

and in the end of the analysis, we had learner classes
The TERENCE Learner Types

The TERENCE learners are 7-11 year old children, hearing and deaf poor comprehenders, who
- fail to comprehend the relations conveyed by cohesive devices such as temporal connectives
- have problems with inference-making from distant parts of a text,
- fail to detect inconsistencies in texts
- but have low level cognitive skills like decoding

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The Learner Data for Classes

- **Data**: the main data are from for RC skills and UCD for interaction
  - brainstorming meetings and inquiries with experts
  - UCD and diagnosis field studies

- **Participants** in the field studies
  - 282 *learners* in Italy and 226 learners in UK, aged 7-11

- One of the main **goals**:
  - requirements concerning RC and *interaction*
# RC Skills of Poor Comprehenders

<table>
<thead>
<tr>
<th>RC Skills</th>
<th>Higher Level</th>
<th>Lower Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global coherence</td>
<td>Inference-making (global)</td>
<td>Integration (global)</td>
</tr>
<tr>
<td>Local cohesion</td>
<td>Inference-making (local)</td>
<td>Integration (local)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cohesive devices (local)</td>
</tr>
<tr>
<td>Lexical skills</td>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>

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### Example Data Gathering Activity

#### Console Activity

<table>
<thead>
<tr>
<th>Goal:</th>
<th>to learn about their favourite consoles and game consoles.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>learners have sheets with stickers for game consoles and a map. They put the sticker of their favourite console in the centre of the map, and answer the questions on the map, e.g., (1) where do you play this?, (2) why do you play with this?</td>
</tr>
<tr>
<td><strong>Material:</strong></td>
<td>stickers; sheets</td>
</tr>
</tbody>
</table>

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Example Data Gathering Activity

<table>
<thead>
<tr>
<th>Character Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal:</strong></td>
</tr>
<tr>
<td><strong>Description:</strong></td>
</tr>
<tr>
<td><strong>Material:</strong></td>
</tr>
</tbody>
</table>

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### Example Data Gathering Activity

**Interaction with Parents Activity**

<table>
<thead>
<tr>
<th>Goal:</th>
<th>to learn about what they do with their parents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>learners received a sheet with a picture of a mum, and another with that of a dad. They were asked to list six (or less or more) activities they often do together with their mum or dad</td>
</tr>
<tr>
<td>Material</td>
<td>post-it</td>
</tr>
</tbody>
</table>
Data Analysis

- Data **management**: data were stored in a DB
- **Statistics**: $\chi^2$ and Fisher’s analysis; natural variables like gender and age were defined; other dichotomy variables were derived from statistics
- Data **analysis** for observations
  - building classes: using associations of variables, we derived a first classification that stems from orthogonal dimensions (e.g., North/Centre)
### Some Learner Classes and Personas

<table>
<thead>
<tr>
<th>Classes</th>
<th>Persona</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Maria</td>
</tr>
<tr>
<td>Younger, rural, male</td>
<td>Julius</td>
</tr>
<tr>
<td>Younger, urban, male</td>
<td>Henry</td>
</tr>
<tr>
<td>Older, male</td>
<td>Andrew</td>
</tr>
</tbody>
</table>
## The TERENCE Persona Framework

<table>
<thead>
<tr>
<th>PIC</th>
<th>Fictitious name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio</td>
<td>...</td>
</tr>
<tr>
<td>Personality</td>
<td>...</td>
</tr>
<tr>
<td>Console technology</td>
<td>...</td>
</tr>
<tr>
<td>Role in/out of class</td>
<td>...</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>PIC</th>
<th>Fictitious name</th>
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</thead>
<tbody>
<tr>
<td>Time with family</td>
<td>...</td>
</tr>
<tr>
<td>Time with friends</td>
<td>...</td>
</tr>
<tr>
<td>Homework</td>
<td>...</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>PIC</th>
<th>Fictitious name</th>
</tr>
</thead>
<tbody>
<tr>
<td>L I F E</td>
<td>Outdoors activities</td>
</tr>
<tr>
<td>L I F E</td>
<td>Indoor activities</td>
</tr>
<tr>
<td>S T Y L E</td>
<td>Home activities</td>
</tr>
<tr>
<td>S T Y L E</td>
<td>Sport activities</td>
</tr>
</tbody>
</table>
### Persona

**D1.2**

<table>
<thead>
<tr>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Persona</strong> Name: Carla.</td>
</tr>
<tr>
<td><strong>Age:</strong> 11.</td>
</tr>
<tr>
<td><strong>Gender:</strong> Female.</td>
</tr>
<tr>
<td><strong>Classroom:</strong> III.</td>
</tr>
<tr>
<td><strong>Comprehension skill:</strong> Poor Comprehender.</td>
</tr>
<tr>
<td><strong>Deaf/hearing:</strong> Deaf.</td>
</tr>
</tbody>
</table>

### Summary of the class represented by this persona

Represents the class of children aged between 7 and 11 years old. Deaf belonging to an Italian school. Has passion for drawing. She writes every day in her secret diary. Good use of technologies for research on Internet.

### Personality

- She is polite and quiet.

### Role in classroom

- She is active, careful, and diligent.

### Role out of the class

- She is nice, responsible, and kind.

### Console/Technology

- She plays with the Nintendo WII and DS. She uses the computer to browse and chat with friends. She uses the technology alone.

### Socio-Cultural Level of his/her own family

- High.

### School performance

- She learns very easily. Differently than 2 years ago, her level of frustration is increased with age.

### Environment

#### Time spent with family

- She does her homework with her parents, she spends her time with her mother and she draws and reads stories with her father.

#### Time spent with friends

- She meets her cousin every day to do homework or to play with her. She goes out with her friends after her homework.

#### Homework

- She does her homework in the afternoon supported by parents.

### Life style

#### Outdoors Activities

- She likes to see friends regularly, she likes to going out and plays with her dog, and she likes to do shopping with her grandmother.

#### Indoors Activities

- She plays with Nintendo WII and DS. She read, writes, and draws. She likes to play with her cousin.

#### Home activities

- She read fairy tales with dad, she watch TV and she chat with her friends.

#### Sport activities

- She loves walking and cycling with her mom.
how did we use personas in the design of the ALS and learning material?
## Bio in the Learner Model

<table>
<thead>
<tr>
<th>Relevant bio information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age range</td>
</tr>
<tr>
<td>younger, older</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>male, female</td>
</tr>
<tr>
<td>Reading comprehension</td>
</tr>
<tr>
<td>4 levels</td>
</tr>
<tr>
<td>Deafness</td>
</tr>
<tr>
<td>With/without cochlear implants,...</td>
</tr>
<tr>
<td>Area</td>
</tr>
<tr>
<td>Urban, rural</td>
</tr>
</tbody>
</table>
Usage for Illustrations

• Avatar design: age, gender and area affect the type of preferred avatar:
  – all, independently of their age, prefer human-like avatars to fantasy or animal avatars;
    • the illustrators design more human-like avatars
  – female learners definitely prefer fantasy avatars to animal avatars
    • the illustrators design more fantasy avatars than animal ones, etc.
Usage for the Adaptation

• If **low RC** then provide a story at level low-medium
• If **rural** then first propose books with rural setting
• **Avatar:**
  – if female learner then present fantasy animals before animal avatars
  – if older then present photorealistic avatars as first
## Personality in the Learner Model

<table>
<thead>
<tr>
<th>Relevant personality traits</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Takes up challenges</td>
<td>yes, no</td>
</tr>
<tr>
<td>Concludes work</td>
<td>yes, no</td>
</tr>
<tr>
<td>Attention span</td>
<td>high, low</td>
</tr>
<tr>
<td>Reading attitude</td>
<td>high, low</td>
</tr>
<tr>
<td>Frustration management</td>
<td>high, low</td>
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Usage for Adaptation of Books and Games

- **Book** model, e.g.,
  - the willingness to take up challenges
denotes a preference for adventure books
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- **Game** model, e.g.,
  - the RC skill affect the levels of games and the points
  - whether the learner is willing to take up challenges and the management of frustration can affect the maximum resolution time and feedback (invited to re-read or not)
Usage for Adaptation of Books and Games

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- **Game** model, e.g.,
  - the RC skill affect the levels of games and the points
  - whether the learner is willing to take up challenges and the management of frustration can affect the maximum resolution time and feedback (invited to re-read or not)
What does Sophie do in the story?

Instructions:
Your avatar needs help. Drag and Drop the correct image. Careful: two mistakes and you lose!

- Sophie sits in the back row of the bus
- Sophie dives into cold water
- Sophie visits the new Sport Complex
Which is the cause?

Instructions
Your avatar needs help. Choose the correct image. Careful: two mistakes and you lose!

The passengers do not remove Anabel from the roadside

Cause

Effect

The dog stands right in front of Anabel

Sophie sits in the back row of the bus

Sophie visits the new Sport Complex
dulcis in fundo...
Conclusions and Future (1/3)

UCD iterations

diagnosis + UCD
context of use and user requirements

ALS design

updates

UCD + EBD evaluations

ALS development

ALS prototype

EBD pedagogical aspects of learning material
UCD usability of GUI prototypes

UCD small scale on ALS

updates

updates

user model
domain model
adaptation model

ALS models

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Conclusions and Future (2/3)

**UCD** does not compare sw tools with non-sw tools

**EBD** enables to measure whether a sw can improve certain abilities, in comparison with non-sw
Conclusions and Future (3/3)

**UCD** helps reducing the bias concerning the introduction of a sw tool, since the tool is designed to be usable

**UCD** is flexible, it is easy to fit usability methods into the stricter EBD protocols

**EBD** experts may represent a disadvantage, especially with respect to the cyclic and iterative nature of the UCD process
EB-TEL’13

› The 2nd evidence-based TEL workshop (ebTEL’13) ebtel.usal.es

in parallel with PAAMS’13, brings together TEL and evidence-based design.

› **Venue:** Salamanca (Spain)

› **Important dates:**
  ‣ Deadline for papers: November 26th, 2013
  ‣ Workshop: May 22nd-24th, 2013

› **Publisher:** Springer