Towards remote handwriting deficits therapy: a study on the use of a touch-screen in replacing paper

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Outline

• Background
  – Aphasia Therapy
  – Motivation for the study

• The study
  – Methodology
  – Results
  – Conclusions

• Implication for design
Aphasia

• Aphasia is an acquired communication disorder that impairs a person's ability to process language
  – Speaking, understanding, reading and writing.

• Causes: stroke, head injury, brain tumor or other neurological diseases
Aphasia therapy

• An EFFECTIVE rehabilitation program should:
  – start as soon as possible
  – be intensive
  – be carried out during the recovery phase

• Intensity and regularity are critical
  → patients SHOULD attend the rehabilitation centre on a daily basis
Obstacles and Difficulties

Mobility and transport are the most impacting obstacles

→ Relying on relatives’ help
→ Impact on caregivers’ life
ICT Solutions

For the patient:
- autonomously practice tasks at home

For the therapist:
- opportunity for improving the efficacy of job
- follow several patients simultaneously
- better data storage and analysis
A touch-screen...

Already used in tele-rehabilitation studies mostly for speech disorders

What is known about its usefulness in the case of writing disorders?
THE STUDY | objectives

• Investigate the effects of a touch-screen device in the context of dysgraphia treatment:
  – focus on the therapist and patient’s attitude towards the touch-screen
  – touch-screen’s efficacy and benefits for therapy

• Implications for a tele-rehabilitation system of handwriting deficits.
Application | design

Contextual Inquiry
therapeutic context,
setup of rehabilitation sessions
→ First set of user requirements
→ First set of system requirements
Application | Tasks

4 typical tasks of the rehabilitation of handwriting deficits

• *Dictation*: write stimuli presented auditorily
• *Naming*: write the name of a pictured object
• *Completion*: write the missing letter(s) in an incomplete stimulus word
• *Verification*: check (and correct) the spelling of a stimulus word
Writing space

Change Tasks

State

Lines

Undo/Redo

Flag

Previous/Next/Repeat
**The Device: Wacom, Cintiq 12WX**

sensitive, easy to move, thin and light

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Size</td>
<td>16&quot; x 10.5&quot; x .67&quot; (406.4mm x 266.7mm x 17 mm)</td>
</tr>
<tr>
<td>Active Area</td>
<td>10.3&quot; W x 6.4&quot; H (261.6mm x 162.6mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>4.4 lb with video control unit (2 kg)</td>
</tr>
<tr>
<td>Screen Size</td>
<td>12.1&quot; diagonal (307.3mm)</td>
</tr>
<tr>
<td>Pressure Levels</td>
<td>1,024 on pen tip and eraser</td>
</tr>
<tr>
<td>Native Resolution</td>
<td>WXGA (1280 x 800)</td>
</tr>
<tr>
<td>Aspect Ratio</td>
<td>16:10</td>
</tr>
</tbody>
</table>
Setting

Patient

Therapist
Participants

2 Patients

- **Patient A**: 55-yr old woman with a mild handwriting deficit
- **Patient B**: 40-yr old woman with a moderate dysgraphia
- Patients had already participated in therapy sessions for language disorders

2 Therapists

- Both therapists administered the therapy to both patients.
Method

• Two treatment blocks were designed for both patients:
  – Block_PP: standard procedure (pencil and paper; PP),
  – Block_TS: touch-screen and a digital pen (TS).
• Duration: 1 month (each block)
• Stimuli administration: computer loudspeakers
Data collection | therapy

Number of errors

Baseline | Start | PP | TS
1 month | 1 month | 1 month
Data collection | therapist’s questionnaire

• Therapist’s Questionnaire (in the middle and at the end of the TS phase):
  – list +/- aspects of the touch-screen
  – assess their level of satisfaction with the TS
  – provide a personal assessment of the involvement and anxiety of the patients.

<< The therapy session is >>

| Much more satisfying with TS | Equally satisfying | Much more satisfying with PP |
Data collection | patient’s questionnaire

- Assess the TS modality
- At the end of the study
- Administered by the therapist

<< Therapy with the touch-screen is tiring for the hand used for writing >>

| Absolutely not tiring | A bit tiring | I do not know | Tiring enough | Absolutely tiring |
## Results | therapy

(\% of Errors: Words vs Non-words)

<table>
<thead>
<tr>
<th></th>
<th>Patient A</th>
<th>Patient B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Words</td>
<td>N-Words</td>
</tr>
<tr>
<td>Baseline</td>
<td>28.3%</td>
<td>64.5%</td>
</tr>
<tr>
<td>After PP session</td>
<td>29.4%</td>
<td>69.1%</td>
</tr>
<tr>
<td>After TS session</td>
<td>23.4%</td>
<td>66.4%</td>
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</table>
Results | therapists

• Therapists reported a high satisfaction and a good attitude towards the touch-screen:
  – Negative judgments regarded specifically the technological side
  – Positive aspects regarded the support-to-work side

• They reported a higher patient’s involvement after the TS phase
# Results | patients

from 1: Absolutely not to 5: Absolutely yes

<table>
<thead>
<tr>
<th></th>
<th>Pat_A</th>
<th>Pat_B</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS is tiring for the hand used for writing</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>With TS the work field is tidier</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>TS allows a more natural writing posture</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>It is easier to manage the paretic arm</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>TS is appropriate for handwriting therapy</td>
<td>4</td>
<td>3</td>
</tr>
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</table>
Conclusions

• The use of the TS did not impact on the therapy outcome.
• The touch-screen was well accepted by patients.
• Therapists were satisfied with the TS because it supported them in session management and data storage and analysis.
Implications for Remote Therapy

- Important relationship therapist - patient
  - Watching patient’s face and hand
    - Eye-contact
    - Emotional support
  - Feedback on performance

Shorten the distance between patient and therapist for the creation of a (virtual) shared space.