Using assistive technology to facilitate writing in aphasia:

The CommuniCATE Project

Dr Celia Woolf, Dr Anna Caute and Katie Monnelly
UCL ARG
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Technology in aphasia therapy

Offers many potential solutions:

- compensatory strategies
- improving access to therapy
- increasing intensity of therapy

Technology may also present barriers for people with aphasia
Writing in our daily lives

- Increasingly technology-based and important (Dietz et al., 2011)
- Risk of digital exclusion (Menger, Morris & Salis, 2016)
Thiel et al., 2015: review of functional treatments for writing

- Impairment based – **words** 49 studies
- Impairment based – **sentences** 5 studies
- Assistive technology - 14 studies
  - 6 studies to augment impairment based therapy (e.g. predictive writing)
  - 8 studies to compensate (e.g. voice recognition)
The CommuniCATE Research Team

Speech & Language Therapy Researchers

Celia Woolf
Jane Marshall

Human Computer Interaction researchers

Katie Monnelly
Anna Caute
Madeline Cruice
Carol Stokes

Stephanie Wilson
Julia Galliers
The CommuniCATE Project
2014 - 2017

• Collaboration between
  – Division of Language & Communication Science, City University London
  – Centre for Human Computer Interaction Design, City University London
  – Barts Health NHS Trust
  – Homerton University Hospital NHS Foundation Trust
  – The Stroke Association
Aims

1. Provide technology-enhanced therapy services to people with aphasia
2. Enhance social participation and reduce isolation
3. Provide training in the use of technologies in aphasia rehabilitation
4. Research the benefits of technology-based treatment for aphasia
5. Explore accessibility of the technologies and participants’ views about the packages
Participants

85 people took part in therapy

✓ Aphasia due to stroke
✓ Had their stroke over 4 months ago
✓ Spoke English fluently before their stroke
CommuniCATE Project

Speaking

Supported conversation

Reading

Writing
Pilot studies

• City Aphasia Research Clinic: Case studies using Read & Write Gold, ClaroRead, WriteOnline, Dragon

• Dragon voice recognition software (Bruce et al. 2003; Estes & Bloom, 2011; Caute & Woolf, 2016)

• Reading with Kindles: “Rekindling the love of books” (Caute et al, 2016)
Initial stage

• Screening and background assessments
  – Case history
  – Cognitive Linguistic Quick Test
  – Subsections of Comprehensive Aphasia Test
  – Technology demonstrations

• Jointly decide on most appropriate therapy strand and technology
Study Design

Tech training pre-therapy 2 x hours

Therapy 2 x weekly, 1 hour sessions

Immediate therapy group

Delay therapy group

Tests

6 weeks rest

Tests

Therapy (6 weeks)

Tests

6 weeks rest

Tests

FINISH

CommuniCATE
Personalised content:
• Writing activities – stroke story, CV, emails

Goals:
• Technology
• Communication
• Participation
Writing assessments

• Handwritten and technology:
  ➢ 3 writing tasks
    – Email
    – Lottery
    – News

Highly constrained email generation

Write an email to a friend or family member asking them to meet you to eat or drink something.

You decide:

Who?

Where?
When?
Day

Time

What?
Technology for writing

- WriteOnline
- Dragon voice recognition software

Reducing our carbon footprint

Carbon footprint is the amount of carbon you put into the atmosphere. Cars that use petrol or diesel emit carbon, and so do power stations that run on coal, oil or gas.

We need to reduce our carbon footprint because carbon in the atmosphere traps the sun’s heat and causes the earth to get warmer. Global warming is a serious problem because it will disrupt weather patterns and cause sea levels to rise.
• Laptop

• App for iPad
WriteOnline: Software for dyslexia

- Word prediction
- Dictionary
This is an example of **Write on Line**.
It shows the predictive tool on the right and the Wordbar below.
The Wordbar is designed for writing about a History topic.
Words can be predicted from the Wordbar even if it is hidden.
Everything can be spoken and terms from the Wordbar can also be explained. Ki
Coastal Landscapes

The landscape on the coast is the result of processes that transport sand, pebbles, and mud. These particles are moved along the coast and form sedimentary deposits.

“sedimentary”
Dragon Voice Recognition Software

• Uses spoken output to bypass writing difficulties

• Speak into microphone

• Can be used with reading software (ClaroRead)
Laptop
- Create user profile
- Software learns to recognise voice
- Can train it to recognise names

iPad
- Voice transcribed by server
- Send text to email/Facebook/Twitter
- Copy text into other apps
Dragon 13 for laptop/PC

• DragonBar can be opened in any programme

• Can use voice commands, e.g. “Wake up”, “new line”, “comma”.
Recruitment criteria

- Spoken output better than written output
- Reasonable level of auditory OR reading comprehension
- No significant motor speech disorder
- Ability to learn to use technology
Ideally...

• Clear and consistent speech
• Standard British or American English
• Ability to plan for writing
• Ability to “perform” for the microphone

• Good spelling (at least for first letters)
• Able to use Phoneme to Grapheme Conversion
• Sentence construction
• Ongoing support as more complex (often more severe)
What participants chose

24 participants

• 12 used Write Online

• 12 used Dragon
Goals for writing

• Writing reminder notes on the iPad

• Sending emails/ text messages

• Making comments on Facebook

• Writing greeting cards

• “My stroke story”
Learning to use Dragon

Challenges
• “Thinking for writing”? 
• Monitoring 
• Correcting mistakes 
• Editing longer passages

Strategies
• Verbal rehearsal 
• Writing prompt words 
• Narrative planning 
• Email structure (greetings/ending) 
• Facilitation to monitor/edit writing
Learning to use Write Online

Challenges

• More impaired language, need more language support

• Poor monitoring of errors (more impaired receptively), even with support of read back function

Strategies

• Repetitive tasks using WordBars to develop familiarity with content

• Multiple productions of same task, e.g. greetings for emails
Realising goals

• Strategies to support transfer of skills to authentic uses of writing:
  – Encouraging and facilitating contact with others via email
  – Texting friends to ask for their email address
  – Inviting family members/friends to sessions
CASE STUDY
Case study- WriteOnline on iPad

“KB”
Aged 60

- 2.5 years post stroke
- Severe writing impairment- often word initial letter only
- Cognitive issues- severe memory impairment and executive functioning difficulties

Background
- Originally from India
- High level accountant dealing with international companies
- Pre-stroke proficient technology user
Goals

**Technology goals:**
• To learn how to use the WriteOnline app alongside news apps to send emails

**Writing goals:**
• To learn how to structure simple sentences to write about recent events
• To be able to write emails including content about his interests (news, economy, business)

**Participation goals:**
• To re-connect with friends and family living overseas via email
Technology features and activities

**Write Online features used:**

- Predictive text
- Word bars
- Text to Speech

**Therapy Activities**

- Developing new word bars with target vocabulary
- Practice emailing therapist
- Sequencing & structuring activities
- Identifying suitable contacts to email
Pre therapy

Write an email to a friend sharing some news...

Post therapy (using Write Online)

England's housing market is "broken", ministers have admitted, as they unveil plans to build more affordable homes.

This is challenging.

What should be done?

The government which however. She

Sent from my iPad
Progress in therapy

- KB was able to consistently send emails with a range of content:
  - News information
  - Recent events
  - Questions
  - Opinions
  - Making plans
GROUP RESULTS
(MARSHALL ET AL., 2018)
Mean Grammatical Quotient Scores

- Time 1
  - GQ Tech Assisted Immediate
  - GQ Handwritten Immediate
  - GQ Tech Assisted Delayed
  - GQ Handwritten Delayed

- Time 2

Graph showing the comparison of Mean Grammatical Quotient Scores between different methods and time points.
Mean Social Validity Scores

- Mean Social Validity Scores
- Time 1
  - SV Tech Assisted Immediate
  - SV Handwritten Immediate
  - SV Tech Assisted Delayed
  - SV Handwritten Delayed

- Time 2
  - SV Tech Assisted Immediate
  - SV Handwritten Immediate
  - SV Tech Assisted Delayed
  - SV Handwritten Delayed
## Secondary outcome measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean (SD)</th>
<th>Pre-Therapy</th>
<th>Post-Therapy</th>
<th>Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston Naming Test (written)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>18.94 (17.13)</td>
<td>20.29 (18.63)</td>
<td>20.88 (18.89)</td>
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<tr>
<td>Communication Activities of Daily Living (CADL-2)</td>
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<tr>
<td></td>
<td>82.20 (7.44)</td>
<td>86.55 (5.96)*</td>
<td>87.70 (8.03)*</td>
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<tr>
<td>Visual Analogue Mood Scales (Sad)</td>
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<tr>
<td></td>
<td>52.09 (10.11)</td>
<td>52.38 (14.42)</td>
<td>49.52 (10.14)</td>
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<tr>
<td>Assessment of Living with Aphasia</td>
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<tr>
<td></td>
<td>2.48 (.57)</td>
<td>2.72 (.65)*</td>
<td>2.64 (.72)</td>
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</tbody>
</table>
Feedback from writing participants

• “Because before I can always ask my friend, boyfriend can you write, can you write for me this, can you write this for me, but now I not go there every time, so I just do it for myself”

• “Before I didn’t have confidence to write an email, but now oh I can write a little bit!”

• “I said there is no way I’m going to give [Dragon] back to [names therapist] until I know my own, because it’s like an opening wow, I can” (gesture opening arms)
Conclusions

• People with aphasia were able to learn to use Dragon and WriteOnline

• Gains generalised to everyday tasks, e.g. sending emails

• Technology compensated for writing difficulties

• Feedback from participants was overwhelmingly positive
Mainstream technologies in aphasia therapy

• Possible advantages of using mainstream technologies
  – Widely available
  – Low cost
  – Socially acceptable
  – Technically robust

• Possible disadvantages
  – Not designed for PWA
    BUT PWA were able to use these technologies successfully when provided with aphasia friendly support and training

• Bespoke technologies designed for PWA may also have accessibility issues - AWE method: Aphasia Walkthrough Evaluation
  
Technology accessibility for people with aphasia

• Look for tech with clear visual icons, few steps, few distractions, consistency of commands etc.

• See Language Light UX Guidelines
  (Wilson, Galliers, Roper, MacFarlane & O’Sullivan, 2016)
  • Guidelines for technology developers
  • Specify features to enable aphasia access
  • Based on HCID research with PWA carried out at City, University of London

http://languagelightux.org/
Be consistent

- Keep layout consistent
- Keep navigation patterns consistent
- Make the same action cause the same response

http://languagelightux.org/
Minimise Distractions

- Remove clutter
- Keep focus central
- Avoid peripheral visual movements
- Avoid extraneous sounds
- Limit content to one task per screen

http://languagelightux.org/
Technology training for PWA

• Individualised approach to training
  – take account of language, cognitive, perceptual and physical abilities
  – relate to personalised goals for how technology will be used in daily life
  – which tech features are important or can be skipped?

• Importance of aphasia friendly technology manuals

• Availability of repetitive practice with support and feedback for each new step or skill learned

• One to one support needed, especially early on
  – Not an ‘out of the box’ solution
Technology is always changing...

• SLTs need to adapt therapies
e.g. updating aphasia friendly tech instructions, new apps

• PWA need ongoing access to support
e.g. for trouble shooting when things go wrong, or top up training when software gets updated

... but general principles for technology enhanced therapies are transferable
Thank you for listening!
References


