user Guide

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# Introduction

DAAWN is a **D**igitised **A**ssessment for **A**phasia of **W**riti**N**g. **DAAWN** was initially developed as an assessment of single word typed naming as part of a Newcastle University MSc Computing Science dissertation by **Alex Smith**, following a collaboration between Computing Science and Speech and Language Sciences. The software in its current form contains an expanded set of writing assessment tasks and was produced thanks to funding from the **Newcastle University Humanities and Social Sciences Faculty Research Software Engineering Fund**.

DAAWN Team

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With thanks to: **Ella Creet** for support with stimulus items, members of the Newcastle University Speech and Language Sciences aphasia lab group for comments on the student dissertation version, and **Christos Salis** and **Janet Webster** for testing the software and providing comments.

# About DAAWN

DAAWN provides tools for the assessment of typed written language designed to be used by **Speech and Language Therapists** with people with aphasia. DAAWN is a set of assessment tools designed to be used by **Speech and Language Therapists** with people with aphasia. The website currently contains: 1. A single word typed naming task, 2. A sentence level copy task for words and non-words, and 3. A free text generation task with a choice of stimulus prompts.

These tools are not intended to be final polished versions of assessments. Instead, we have developed pilot them to demonstrate the type of information that could be available as part of a digitised clinical assessment. Our longer-term aim is to continue to develop DAAWN and to explore the potential for the technology, so it can be of use in clinical practice and for research.

Please feel free to use the DAAWN tools as much as you like. They can be conducted face to face with people with aphasia but may also be carried out via telehealth assessment. This would be possible via screenshare and remote-control using Zoom, Microsoft Teams, Jistsi or Google Meet with a Chrome extension. Please see the RCSLT guidance on telehealth for [further support](https://www.rcslt.org/members/delivering-quality-services/telehealth/telehealth-guidance#section-5).

If you are using DAAWN for research, please let us know. For further information or to get in touch, please contact **fiona.menger@ncl.ac.uk**.

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# Daawn Tools

The following sections provide detail on each of the DAAWN tools.

## Written naming task

The SLT can choose from one of four stimulus picture sets to carry out the assessment.

**Sets 1-3** contain:

* 7 x 3-letter words
* 7 x 4-letter words
* 5 x 5-letter words
* 4 x 6-letter words
* 3 x 7-letter words
* 1 x 8-letter words
* 1 x 9-letter words
* 1 x 10-letter words

The sets are matched for frequency and concreteness (See appendix one). Data on spelling regularity is not currently available for this set as the images were obtained from a study on spoken naming. However, we have attempted to include a mix of regular and irregular orthographic forms. The items within the sets will be presented in random order.

**Set four** only contains three and four-letter words (42 items in total). We have offered this set as an option for assessment with people with severe writing difficulties who may struggle beyond this level. The items will appear in order with three-letter words first. For information on the word sets, see Appendix one.

The word sets could be used to compare performance using different types of text entry, e.g., mobile phone vs keyboard. They might also be used to provide control and treatment sets for therapy (alongside personally selected vocabulary). If you would like to assess more than 30 items, you would currently need to repeat the test using a different set each time.

The report generated will record:

* Summary of items attempted and no. correct, broken down by word length,
* Summary of scores using the Comprehensive Aphasia Test scoring system, broken down by word length,
* The client’s final response,
  + Whether this was correct or incorrect
* Levenshtein distance score,
* CAT score,
* Reaction time,
* Response time,
* Mean and median response times,
* Process response,
* No letters in the target word,
* No. keystrokes used to generate the final response,
* No. of deletions used to generate the final response.

Further information on DAAWN output is available in the glossary of terms below.

## Copying task

Copying can be used as a simple measure of ability to locate and select letters on a keyboard and of typing speed in the absence of more demanding linguistic demands. Copying requires attention, visual scanning, visual orthographic analysis, visual memory (for keyboard location), and motor dexterity. The DAAWN copying tasks has two elements:

1. Copying a 35-character well-known phrase
2. Copying a 35-character non-word sentence

The report generated will record:

* the client’s final response alongside the copying target,
* the process response,
* reaction time,
* response time,
* mean inter-key typing speed,
* minimum keystrokes required/no. of keystrokes used,
* and a tally of no. of words correct/incorrectly typed plus words correctly/incorrectly edited during the typing process.

Further information on DAAWN output is available in the glossary of terms below.

## Free text tasks

Free text tasks provide more flexible opportunities to assess typed written language beyond the single word level and in response to functional scenarios. For each of these tasks, DAAWN provides simple keystroke logging information on:

* the client’s final response,
* the process response,
* reaction time
* response time
* mean inter-key typing speed,
* no. of words produced,
* and number of keystrokes/mouse clicks used to generate the response.

Further information on DAAWN output is available below. SLTs can select tasks at short phrase, sentence, or narrative level. The choices are:

|  |  |  |
| --- | --- | --- |
| Short phrase | Sentence | Narrative |
| * Write your address * Write a shopping list * Write family names | * Respond to a posted picture on social media (family water fight) * Reply to a text message (asking to meet up) | * Write a diary entry * Write an email to a friend (on how you are) * Write about something important to you * Tell the story of a picture (helicopter rescue) |

# Glossary of daawn terms

#### Automated Scoring

The application automatically calculates a score based on the system used in the writing section of the Comprehensive Aphasia Test. For information, please see the CAT manual [1].

#### Damerau-Levenshtein distance

Damerau-Levenshtein distance [2-4] (LD) is a measure of how close the final attempt at writing the word is to the target item. The LD score is based on the number of single-character changes needed to transform the client’s attempt into the target word. Changes can be either insertions, omissions, transpositions or substitutions. DAAWN calculates LD automatically. The larger the number, the greater the distance between the attempt and the target word.

| **Target word** | **Final attempt** | **Scoring** |
| --- | --- | --- |
| CAT | CAR | 1 x substitution = **LD 1** |
| SMILE | SIMILES | 2 x insertions (I,S) = **LD 2** |
| SHOE | SOE | 1 x omission (H) = **LD 1** |
| SOAP | TAOP | 1 x substitution, 1 X transposition = **LD 2** |
| GIRAFFE | GIFAG | 2 x substitutions (R to F and F to G), 2 x omissions (F, E) = **LD 4** |

Clinicians should be aware that LD does not take errors of meaning into account. People with aphasia may, therefore, make some errors for which LD is not a good measure of accuracy. This would be problematic if a person produced a semantic error that was orthographically similar to the target, e.g, a target word of MONKEY and final attempt DONKEY. This example would lead to a LD of one.

Both CAT and LD scoring is automatically calculated from the person's final response. This includes items where the first letter has been provided by a hint. Where a hint was given, items are denoted with an [\*] in the assessment results.

#### Editing Accuracy

The copying tasks provides a tabular summary of how many of the target words were correctly produced with and without editing. It also tallies the number of words that were edited unsuccessfully.

#### Final Response

The final response is what is generated by the client after all editing and after the submit/next item button has been pressed. This can be compared with the process response.

#### Inter-key typing speed

A measure of the mean speed between individual keystrokes. This is a more accurate measure of typing than words per minute, which does not account for word length.

#### Keystrokes/mouse clicks

A record of the number of keystrokes and mouse clicks recorded during the response. This will include space bar, delete/backspace, commas, and return key. In the single word naming task and the copy task, DAAWN provides information on the number of letters in the target or the minimum number of keystrokes required to copy the sentence. This can be compared to the actual number of keystrokes used.

#### Mean and median response times

This measure from the single word naming task records the mean time taken to type single word responses. Median response time is also recorded to allow for any extended breaks during the assessment (e.g. client stops to comment on an item or there is a need to pause the assessment).

#### Process response

The process response records the keys pressed by the client when typing their response. This allows the SLT to see whether errors have been self-corrected during the typing process. It will also record any pause longer than one second. For example, the word ‘anchor’ could be typed as follows: [a, n, k, Backspace, c, (2.3secs), o, r] with the end result ‘ancor’.

#### Response time

The response time is measured from when any stimulus is presented to the first keypress.

#### Reaction time

The time taken to type a response. DAAWN stops measuring when the arrow key is pressed to move onto the next item or the ‘done’ button is pressed.

# References

1. Swinburn, K., Porter, G. and Howard, D., 2005, The Comprehensive Aphasia Test. Hove, UK: Psychology Press.
2. Damerau, F. J. (March 1964) *"A technique for computer detection and correction of spelling errors"*, Communications of the ACM, 7 (3): 171-176, doi:10.1145/363958.363994
3. Levenshtein, V. I. (February 1966) *"Binary codes capable of correcting deletions, insertions, and reversals"*, Soviet Physics Doklady, 10 (8): 707-710
4. Boytsov, Leonid. *"Indexing methods for approximate dictionary searching: Comparative analysis."* Journal of Experimental Algorithmics (JEA) 16 (2011): 1-1.

# USEFUL READING

This is not an exhaustive list but may be a useful start if interested in written/typed language and aphasia.

Behrns I., Wengelin Å., Broberg M., Hartelius L. (2009). A comparison between written and spoken narratives in aphasia. *Clin Linguist Phon* 23:507–28. <https://doi.org/10.1080/02699200902916129>

Cardell, E. A. and Chenery, H. J. (1999). A cognitive neuropsychological approach to the assessment and remediation of acquired dysgraphia. *Language Testing,* 16(3), pp. 353-388

Cook, F. A. B., Makin, S. D., Wardslaw, J., & Dennis, M. S. (2013). Dystypia in acute stroke not attributable to aphasia or neglect. *Case Reports,* pp. 1-4. Available from: doi:10.1136/bcr-2013-200257

Otsuki, M., Soma, Y., Arihiro, S., Watanabe, Y., Moriwake, H. and Naritome, H. (2002), Dystypia: isolated typing impairment without aphasia, apraxia or visuospatial impairment. *European neurology,* 47(3), pp. 136-140

Ellis, A. W. (1988), Normal writing processes and peripheral acquired dysgraphias. *Language and cognitive processes,* 3(2), pp 99-127

Johansson-Malmeling C, Hartelius L, Wengelin Å., et al. (2020) Written text production and its relationship to writing processes and spelling ability in persons with post-stroke aphasia. *Aphasiology* 00:1–18. <https://doi.org/10.1080/02687038.2020.1712585>

Johansson-Malmeling C, Wengelin Å, Henriksson I. (2020) Aphasia and spelling to dictation: Analysis of spelling errors and editing. *Int J Lang Commun Disord* 1–16. <https://doi.org/10.1111/1460-6984.12591>

Menger, F., Morris, J. and Salis, C. (2019), The impact of aphasia on Internet and technology use, *Disability and Rehabilitation,* 42(21), pp 1-11

Thiel, L., Sage, K. and Conroy, P. (2015), Retraining writing for functional purposes: A review of the writing therapy literature. *Aphasiology,* 29(4), pp. 423-441

Whitworth, A., Webster, J. and Howard, D. (2013), A cognitive neuropsychological approach to assessment and intervention in aphasia: A clinician’s guide. (2nd ed.) Hove Psychology Press.

# Appendix one: DAAWN Word sets



Please contact [fiona.menger@ncl.ac.uk](mailto:fiona.menger@ncl.ac.uk) if you would like the excel file for these items.

# Appendix two: DAAWN image credits

The photographs used as stimulus images in the single word naming DAAWN task were initially selected as part of a PhD research project by **Dr Ella Creet** and were obtained from various sources: *Hemera Photo Object Library (Hemera Technologies Inc, 1997-2000)*, Newcastle University picture library or from other open access sources.

Free text task images:

Water fight by Rudy Anderson from Pixabay

Helicopter rescue by Inge Wallumrød, CC0, via Wikimedia Commons

Text message image created using iFakeTextMessage.com