

Guidelines for Administering and Interpreting the Flu-ID Aphasia

The following guidelines are intended to ensure consistency across transcriptions so as to maximize intra-rater and inter-rater reliability, facilitating comparison across individuals and time points for a given individual.

CHAPTER 1. Understanding the Excel sheets

There are three sheets in the Excel file:

- a **Transcript sheet**, onto which the transcript will be typed or pasted and then coded;
- an **Analysis sheet**, which transfers the coded utterances from the Transcript sheet, and counts codes from the transcript (additional coding is also added here);
- the **Summary sheet**, which transfers information from the Analysis sheet to generate a summary of the factors affecting fluency.

1. Transcript sheet. The Transcript sheet is used to transcribe the original utterances and code the utterances. It contains 6 columns:

- **Column A** contains utterance numbers. Numbers are already provided up to 30 utterances.
- **Column B** is where the original utterances should be transcribed, one to a row. In this column, any transcription style can be used, if helpful for future reference.
- **Column C** is where the original utterance will be copied for subsequent coding. This column should follow the coding conventions described below.
- **Column D** is for coding whether or not the utterance sounds effortful (1=yes or 0=no). This element of coding is included on the Transcript sheet (rather than the Analysis sheet), as we considered it simpler to document effort while the transcript is being typed (presumably from an audio or video recording).
- **Column E** just contains labels for Column F coding.
- **Column F** is for recording the beginning and ending time of the transcript to calculate the length of the sample in minutes.

2. Analysis sheet. The Analysis sheet compiles coded elements from the utterances. It contains:

- **Columns A and B** contain content automatically transferred from columns A and C of the Transcript sheet, respectively.
- **Columns D and E** are used for trimming the utterances (explained below) to include just those words that contribute to the narrative (referred to as “narrative words” in the Quantitative Production Analysis system (QPA, Berndt et al., 2000).
- **Columns C and F** contain formulas that automatically generate word counts from the Coded Utterance and Narrative Utterance columns (B and E, respectively).
- **Columns H through O** contain formulas that count codes in the Coded Utterances (column B). The codes that each formula searches for are identified in row 2, so make sure not to type in or delete these cells or the search formulas will not work.
- **Column P** contains the effort codes automatically transferred from the Transcript sheet.
- **Column Q** is used to manually code the grammatical structure of each of the narrative utterances listed in column E (manual coding described below).

NOTE: In addition to these columns, the macro-enabled sheet contains formulas at the top of columns S and T to specify which codes the macro needs to search and replace in column D. If you want to use the macros, do not remove these codes.

3. Summary sheet. The Summary sheet contains data transferred from the Analysis sheet, which is used to generate a profile of linguistic elements contributing to fluency. More information about each sheet is provided below.

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4. Color-coding

- Columns containing formulas are coloured green to remind you not to type in them. If blank, they will show up green, but once filled they will revert to white.
- Columns colored blue will require manual entries or coding. Once a cell has content in it, the blue shading will disappear. This helps keep track of blank entries.
- Grey columns are empty (except for some text labels).
- Cells colored pink contain normative data for comparison (see article for details).
- Cells with thick borders identify which values correspond to the normative values.
- Bright yellow cells with **bold text** contain values that will be transferred from the Transcript sheet to the Analysis sheet, or from the Analysis sheet to the Summary sheet.

CHAPTER 2. Transcribing the utterances

1. **Sample length.** The form is designed to accommodate 30 utterances. A minimum of 20 utterances is recommended for analysis and, although additional lines can be added to accommodate longer samples, we consider 30 utterances to be sufficient. If samples are to be compared, it is preferable to examine samples of similar length, *i.e.*, 20-30 utterances.

NOTE: If there are fewer than 30 utterances, just leave the remaining lines on the Transcript sheet blank, but delete content from the empty lines on the Analysis sheet, so that the extra zeroes do not affect the formulas (highlight the range of unused rows and click 'clear contents' in the Excel editing menu (or press 'delete' on the keyboard) to remove content; do not delete the rows themselves).

If there are not enough rows to accommodate the sample, additional rows can be added, and the relevant formulas can be copied from previous rows.

TIP: After numbering the first utterance, the *Fill>Series* function in Excel can be used to automatically fill in the rest of the numbers.

2. **Transcribe utterances** verbatim, including errors, pauses, fillers, and empty or automatic/stereotypical utterances.
 - Each utterance is transcribed on a separate row, without sentence capitalization or punctuation.
 - Some punctuation can be used if it aids later segmentation or grammatical analysis, but make sure all punctuation is attached to a word, so that it does not get counted as a word by the Excel formulas. In addition, some punctuation marks are used as codes (*e.g.*, parentheses, square bracket, exclamation marks), so these should not be used.
 - Capitalization should be used for proper names.
 - For monologic tasks like story retelling or picture description, do not include utterances that are direct responses to a communication partner's question (*e.g.*, *what did Cinderella do at the end* Response: **got married**).
 - Omit utterance-initial and utterance-final NONVERBAL fillers and pauses (*e.g.*, *um*, *uh*); VERBAL fillers (*e.g.*, *well*, *you know*) are retained for coding—details below.
 - As described in A Clinician's Complete Guide to CLAN and PRAAT (Ratner & Brundage, 2022), we recommend adopting standard forms that reflect the intended language, rather than normal pronunciation variations (*e.g.*, *goin' vs going*). Unlike Ratner and Brundage, however, we do not recommend the use of assimilations (*e.g.*, *dunno vs do n't know*; *gonna vs going to*), as such distinctions are difficult to make reliably and are rarely of interest in assessing aphasia. Using standard forms helps ensure that words are counted consistently.
 - Errors with known targets are transcribed along with their intended targets (see below).

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- Indicate word fragments with a hyphen (e.g., *Ci- Cinderella lo- lost her shoe*). If fragments are incorrect, enclose them in slashes and use phonetic transcription (e.g., *Cinderella /lAs-/ lost her shoe*).
3. **Segment utterances** based on syntactic guidelines to the extent possible. As in AphasiaBank (MacWhinney, 2000), an utterance consists of a single MAIN clause along with any dependent clauses (MacWhinney, 2023, p.61), even if it does not include all obligatory elements.
- Compound sentences with two or more main verbs, each with their own subject (e.g., *she rode her bike and he walked*), should be split into separate utterances. Compound predicates, i.e., more than one verb with the same subject (e.g., *she got on her bike and went to the store*) should be transcribed as one utterance.
 - If syntactic criteria are ambiguous, as they often are for agrammatic speech, consider prosodic information (intonation contour, pausing) and semantic information (e.g., a completed proposition or thought) in segmenting utterances (Berndt et al., 2000).
 - Following guidelines for the measurement of Correct Information Units, or CIUs (Nicholas & Brookshire, 1993), delete utterance-initial conjunctions, such as *and*, *so*, and *then*, unless they contribute appropriate meaning (for example, *so* may provide a meaningful causal connection; *then* may provide a meaningful temporal connection).
4. **Transcribe words** such that they are counted consistently.
- **Hyphenated** (e.g., *father-in-law*) and compound words (e.g., *godmother*) will be counted as one word. Use hyphens or compounds if the assumption is that the word is retrieved as a whole; separate words with a space if the assumption is that the words are retrieved separately (e.g., *hard- working*).
 - **Contractions.** Transcribe contractions with a space, so that they are equivalent in number of words to their uncontracted versions (e.g., transcribe *don't* as *do n't* or *don 't*, *wanna* as *want to* or *wan na*).
- NOTE:** Although one might reasonably hypothesize that contractions are retrieved as a whole, there is considerable variability in how words are produced by speakers and how they are perceived by transcribers that has little to do with the retrieval process. Using a consistent method here reduces that variability.
- **Emphatic repetitions.** Following AphasiaBank CHAT guidelines for “linkages” (MacWhinney, 2023, p. 52), transcribe words that are immediately repeated for emphasis using an underscore (e.g., *Cinderella just work_work_work; stepsisters were really_really ugly*). This ensures that such repetitions, although meaningful, do not inflate utterance length and other measures.
 - Words that are repeated but integrated into a syntactic structure (e.g., *Cinderella danced and danced all night*) should not be linked in this way.
 - We also opted not to link “irregular combinations” (e.g., *how come*) as suggested by MacWhinney, because the identification of phrasal combinations that would fall into this category is too subjective.
 - Some titles that are considered to be retrieved as a whole may warrant linking (e.g., *New_York, Singin_in_the_Rain*).
5. **Transcribe errors.** Transcribe real-word errors orthographically (e.g., *king* for *prince*) and nonword errors in broad phonemic transcription (e.g., */pIns/* for *prince*).
- Immediately after any phonemically transcribed errors, include a **gloss of the target** in regular orthography, separated from the error by a colon but no spaces (e.g., */pIns/:prince*). Including the target will facilitate later grammatical analysis. Connecting the error and target without a space ensures that they will be counted together as one word.

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TIP: Any transcription method could be used, but some symbols create problems in Excel. An Excel-friendly set of phonemic symbols is included in the Excel file. The symbols were adapted from the transcription system used in the Neighborhood Activation Model, which was itself adapted from Klattese (see Vitevitch & Luce, 2004).

- 6. Time the sample.** Record the length of the sample in minutes. This will be used to generate a speech rate.
- In column F, record the beginning time of the sample in minutes and seconds, in rows 1 and 2 respectively (or leave these values at zero if timing began at the beginning of the sample). At the bottom of the sample (rows 33 and 34), record the end time in minutes and seconds. The total time will be calculated automatically in minutes and fractions of minutes.
 - Alternatively, the time can be entered manually. If entering manually, enter as minutes and fractions of minutes, not seconds, *e.g.*, 3.5 minutes, not 3.30.
- 7. Code Effort (column D).** Each utterance should be manually coded for the presence or absence of effort by putting a 1 (effortful) or 0 (not effortful) in the Effort column.
- Perceived effort (like overall fluency) may arise from multiple dimensions of expression, including difficulties with word retrieval and sentence formulation (Grossman, 2012). Here, we define effort as arising primarily from articulatory difficulty, so as not to be redundant with measures of word retrieval and grammaticality, and to help identify the source of fluency disruptions.
 - Thus, effort should be coded if it is perceived to arise from a motor speech disorder (apraxia or dysarthria), and/or if it is characterized by articulatory distortions, such as devoiced consonants, prolonged vowels, and schwa insertions (Haley & Jacks, 2023; Haley et al., 2018; Odell et al., 1991; Strand et al., 2017).
- NOTE:** Not all articulatory distortions should be coded as effortful, as the goal here is to capture the extent to which dimensions such as motor speech impairments affect fluency. Although apraxia of speech typically sounds effortful, dysarthria may not.
- Another source of fluency disruption that sounds effortful is prosodic disruption, such as the stilted word-by-word delivery created by a flattening of intonational contour and/or word stress patterns, and/or frequent use of micro-pauses (*i.e.*, pauses that don't reach the 1 second criterion for coding pauses).
 - In addition, difficulty initiating (false starts or articulatory groping) is an important contribution to perceived effort (Ziegler, 2008), so should be considered in the effort rating, even though repairs are coded elsewhere.
 - Other sources of perceptual effort may include facial grimacing and reduced intelligibility of speech, as evident in the effort or attention expended by the listener (rater) to identify the sounds and words being produced.
 - Thus, an utterance should be coded as effortful if the speaker appears to struggle (through delay, prolongation and/or repeated tries, with or without sound-based errors) to produce word forms accurately and in a timely manner within an utterance.

CHAPTER 3. Coding of utterances on the Transcript sheet

Copy the transcribed (original) utterances from column B to column C. The utterances in column C will be coded for the existence of several relevant linguistic behaviors, as described below. Most of the codes serve one or both of the following two functions:

- They signal fluency disruptions.
- They identify text that will be removed to facilitate grammatical analysis of the core (narrative) utterance.

NOTE: Asterisks in the examples below are wildcards, standing in for any text.

- 1. Phonological paraphasias.** Identify phonological paraphasias with *identifiable* targets (*i.e.*, phonological, formal, and mixed paraphasias, *incorrect* fragments) by transcribing them phonemically and enclosing them in forward slashes */**, *e.g.*, */sInxrElx/*. Correct fragments should be transcribed orthographically, *e.g.*, *wo- woman*.

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NOTE: Transcribe any errors assumed to be of phonological origin, even if they form real words, e.g., *one two /fri/* (not *one two free*). This distinction between phoneme-level errors that *happen to* form words and word-level errors that are phonologically related (i.e., formal errors) stems from the two-stage error classification method of the Philadelphia Naming Test (Roach et al., 1996).

- Enclose phonological errors with *unknown* targets (i.e., abstruse neologisms; neologistic jargon) in exclamation marks !*!, e.g., *!bAsInxll!*. Following AphasiaBank conventions, these can also be transcribed using a series of x's, e.g., *!xxx!*, if the phonemes are too difficult to discern.

2. Pauses. Code *within-utterance* pauses that *exceed 1 second* using the **number sign #** (see main article for rationale).

NOTE: Attach the number sign to the preceding or following word, so that Excel's word-counting formula does not count it as a separate word (e.g., *\uh#*).

3. Fillers. Enclose *within-utterance* fillers in **backward slashes ***. This includes:

- **non-verbal fillers:** non-lexical sounds used to fill pauses, such as *uh, um, hm* (e.g., *she \um#\ could n't go to \uh\ the ball*)
- **verbal fillers:** words and phrases that are not part of the grammatical structure of the utterance and do not contribute meaning, but are used to facilitate word retrieval or to provide extra processing time, including:
 - **hesitation markers:** words or phrases that fill pauses, such as *well, like, and you know* (e.g., *\well\ the prince was handsome \you know*)

NOTE: Although utterance-initial and utterance-final NON-verbal fillers are removed, verbal fillers are retained for coding wherever they appear.

- **self-cues:** phrases used to help prompt recall (e.g., *\J-K-L-M\ mice*)
- **asides:** phrases commenting on word retrieval difficulties (e.g., */sInElx/ \or whatever her name is*)
- **hedges:** formulaic phrases expressing uncertainty about the task or the language (e.g., *he's a prince \I guess\; The fairy \I don't know*)

NOTE: Hedges used as fillers are coded, but those that are part of the story content are not coded (e.g., *Stepmother said {"um no I do n't think so"}; Prince thought {"I do n't know who she is"}; I do n't know what Cinderella was thinking*). In addition, hedges that are grammatically necessary are not coded, so that they will be retained, allowing accurate analysis of the grammatical structure (e.g., *I don't know why he 's up there*).

4. Repair behaviors. Enclose repairs in **triangle brackets <*>**. This includes:

- **repetitions** of words or phrases (e.g., *Cinderella <could n't> could n't <go> go to the ball*);

NOTE: Repetitions that serve to add meaning such as emphasis, e.g., *really_really bad*, or ongoing action, e.g., *dance_dance_dance*, or quantity, e.g., *stepmother stepsister and stepsister* should be retained, and therefore should *not* be enclosed in triangle brackets. (See transcription section above for when to use underscores to link repeated words.)

- **retraces and reformulations:** words or phrases that are abandoned and replaced with new words or phrases (e.g., *<the prince> Cinderella <did n't want to> could n't go*);
- **repair indicators:** words or phrases signaling an upcoming repair, even if unsuccessful, or awareness of the inadequacy of a preceding utterance (e.g., *<I mean>, <no>*);
- **subsequently corrected errors** (e.g., *</sInxrElx/ I mean> Cinderella*);

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- **word fragments**, whether correct (e.g., *she married the <pri-> prince*) or incorrect (e.g., *</sInx-/> Cinderella married the </kI-/> prince*).

5. Non-meaningful but grammatically essential speech. Enclose in **square brackets [*]** non-meaningful words and phrases that nevertheless form part of the grammatical structure of the sentence. This includes:

- **Empty speech**: real words or phrases that may be accurate but so vague as to contribute no (or almost no) meaning (e.g., *something, whatever, all of that*). Empty speech is typically used to substitute for a more specific but inaccessible word and MAY include:
 - **pronouns with no identifiable referents**, even in the context of the story, e.g., *the ball was !riwan! and we like [them];*
 - **empty nouns** used to substitute for a more specific noun AND whose meaning is unclear or ambiguous, e.g.,
 - *then the prince gave the shoe to [the person];*
 - *now she 's into [one];*
 - *at the end of [that] she left;*
 - *she won [it all];*
 - *she cleaned the kitchen and the [other stuff].*
 - **light verbs** (*be, do, have, get, make, give, take, come, go*) used to substitute for a more specific verb, AND whose meaning is unclear or ambiguous, e.g., *the new shoe [came in].*

NOTE: We recommend being conservative in coding such words as empty, particularly pronouns, as pronoun use is often somewhat ambiguous linguistically but still clear pragmatically (i.e., there may be more than one possible referent but the discourse context provides sufficient information to identify it). Similarly, empty nouns and light verbs are commonly used by typical speakers and may be appropriate to the context. If their meaning can be inferred from the context with a reasonable degree of confidence, they should not be considered empty.

- **Real-word errors with unknown targets**: includes semantic jargon, stereotypes and other perseverations:
 - **semantic jargon**: real-word strings that have no identifiable target, e.g., *[the present] was supposed to be [thirty or something]; the poor little [interest] she can not [be];*
 - **perseverations**: inappropriate repetitions of previously produced real words or phrases, e.g., *the sandals would not fit ... the [sandals] became Cinderella's boyfriend; [all o' sudden] they lived happily after;*
 - **stereotypical utterances**: perseverative utterances which tend to occur repeatedly in relatively frozen form and in inappropriate contexts;
 - any other **unrelated real-word errors**, e.g., *she was introduced and given a job to a [beautiful camp]; the fairy [window] has her only time to come.*

NOTE: Do not put errors with *known* targets in square brackets if they are *related* to the target either phonologically (e.g., *the /pAns/:prince married Cinderella*) or semantically (e.g., *clodhoppers is horses: one of her legs is left at the palace*). If the target is recognizable and related, the error is assumed to carry some meaning.

6. Grammatically extraneous empty speech. If the words or phrases are meaningless AND extraneous to the grammatical structure (i.e., their grammatical role is unclear), enclose them in **round brackets (*)**. For example:

- empty additions (real word or nonword), that are unnecessary to the grammatical structure and/or unclear in their grammatical structure, for example:
 - *I can dress you all up (and !dxdxdxdx!)*

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NOTE: Neologisms are not always grammatically unclear. For example, in *Cinderella got all !gfornd! up*, the neologism clearly fills a verb slot, as evidenced by its position and the word-final past tense marker.

- she cleaned the kitchen (*and whatever*)

NOTE: In this example, the marked section may stand in for a single noun or a whole phrase, so the grammatical structure is unclear and extraneous to the rest of the utterance. This is distinct from the empty speech in *she cleaned the kitchen and the [other stuff]* in which the empty speech is clearly marked as a noun by the article and fills a necessary grammatical slot in the sentence.

7. Other coding notes

- When enclosing items in slashes, brackets, or parentheses for the coding described below, ensure that there are no spaces between the enclosure marks and the word(s) they are enclosing, e.g., **[word]** not **[word]**.
- Multiple consecutive words that meet criteria for a given code should be coded together, e.g.,
 - I have to get back /brY fwElv okat/:by twelve o'clock;*
 - \uh um\; </dIn- rEn-/> Cinderella.*
- The same material can be coded with more than one code. For example, in *</dIn- rEn-/> Cinderella*, the false starts are marked both as phonological errors and as repaired material, whereas in *<Cin- > Cinderella*, the false start is coded as a repetition, but not a phonological error.
- When utterances are coded, the codes will be tallied in the following columns, which contain formulas to count codes from column B of the Analysis sheet:

H	I	J	K	L	M	N	O	P
PhonErr	Abstr Neol	Pause	Filler	Repair	Empty	Extraneous	All Empty	Effort
/*/	!*	#	*\	<*>	[*]	(*)	[*] or (*)	
-	-	-	-	-	-	-	-	-

CHAPTER 4. Trimming the utterances on the Analysis Sheet

Once the utterances have been coded as above, open the Analysis Sheet and ensure that the coded utterances have been automatically transferred from column C of the Transcript sheet to column B of the Analysis sheet, along with their associated utterance numbers.

- Add lines if necessary. If there are not enough rows to accommodate the sample, you may **add rows somewhere in the middle of the sheet** (rather than at the bottom), so that the formulas at the bottom automatically update to include the full range. If blank lines need to be added, you may need to **copy the formulas** in all the green columns to the new lines. After doing so, double check that they reference the correct rows.

TIP: The simplest way to ensure that formulas are copied correctly is to highlight all the formulas from the first utterance and drag them down to the last utterance using the little square on the bottom right corner of the highlighted section.

- Copy and paste the values of the range of utterances** from column B (starting at row 3) to column D, labelled "Narrative Utterances" (starting at row 3).

IMPORTANT NOTE: Make sure to use the *Paste Values* option when copying and pasting the utterances in Excel, so that the actual utterance is copied rather than the formulas in column B.

- If using the non-macro version of the Excel form, follow the following steps. (If using the macro version, skip to the next step.)

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- Highlight the range of utterances in column D, and use Excel's Find & Select function to remove pauses, fillers, repairs, phonological errors and extraneous empty utterances. More specifically:
 - a) Open the *Find & Select* function and click on the *Replace* tab. In the *Find what* field enter the code for **pauses #**.
 - b) In the *Replace with* field, do not enter anything.
 - c) Click the *Replace All* button.
- Repeat steps a) to c), putting the code for **fillers *** in the "Find what" field. The asterisk is a wildcard, so everything enclosed in back-slashes will be removed.
- Repeat for **repairs <*>**, **phonological errors /*/**, and **extraneous empty** utterances coded in round brackets (*).

NOTE: During this process, empty or stereotypical words that constitute a grammatical component of the utterance coded in single square brackets [*] are retained, so that the grammaticality of the utterance is not affected. In addition, phonological errors for which the target is identifiable are removed, but their target glosses are retained (e.g., /pɪns/:prince becomes :prince), to facilitate grammatical analysis of the utterance.

4. On the macro-enabled version of the Excel sheet, once the utterances have been copied from column B to column D, click the *Click to Remove Coded Items* button at the top of column D. This automatically removes the coded items that would need to be manually removed (see above) if using the non-macro Excel sheet.
5. **Trimmed utterances:** When codes are removed from column D, extra spaces will remain in the utterance. Column E contains a TRIM formula, which will automatically remove the extra spaces from each utterance. This will ensure that the Narrative Word counts are accurate.
6. **Code counting:** All counts should automatically populate in columns H to O. Column Q (Grammatical Structure) will need to be manually coded as described below.

CHAPTER 5. Manually coding grammatical structure (column Q)

This column is used to manually code whether syntax in each narrative utterance is disrupted and whether the disruption is agrammatic or paragrammatic. Six types of grammatical structures are coded. These are listed at the bottom of column R:

- **Frag (fragment).** An utterance that has been abandoned by the speaker. The fragment is not considered to be structurally abnormal if it *might have been* correct if completed (e.g., *he did n't; her carriage was*). Prosodic cues are often helpful in distinguishing between fragments and agrammatic utterances.
- **Gram (grammatical).** An utterance that is both complete and grammatically well formed. Typically, an utterance needs to include a main verb and subject to be considered complete; however, the speech of unimpaired speakers can be elliptical at times (e.g., *okay; what; no; go away*). It is recommended that the judgement of grammaticality be made based on the absence of structural abnormalities in the utterance.
- **Agram (agrammatic).** An utterance characterized by omission of one or more obligatory elements (e.g., *prince fall in love with her; she dance all night; her wand*).
- **Pgram (paragrammatic).** An utterance characterized by substitution, addition, or misordering of grammatical elements (e.g., *she makes her all beautiful; she will played; she was looking happiness for a man to take her forever*).

NOTE: Lexical substitutions (paraphasias) are not considered paragrammatic unless the substitution is an incorrect part of speech (e.g., *she had a ranned from home* is paragrammatic, but *she covered from home* is not.)

- **Ag/Pg (agrammatic/paragrammatic).** An utterance that contains both agrammatic and paragrammatic elements (e.g., *stepmother and stepsisters was ugly woman; at the days were longer she begin*).

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- **UK (unknown).** The grammatical structure of the utterance cannot be determined.

NOTE: Code utterances as Agram, Pgram, or Ag/Pg if any instances meeting criteria for these codes can be identified. However, if the target syntax is too unclear to know what types of errors are made, code as UK.

- **NA (not applicable).** Use NA for any utterances containing no narrative words. These utterances will not be counted in the denominator of the calculated proportions of each utterance type.

CHAPTER 6. Calculations & interpretations

1. Numbers of words and utterances

- Under the rows of utterances, formulas calculate the total number of words (row 34) and total utterances (row 35) in both the Coded Utterance column (column C), which includes the coded fluency disruptions, and in the Narrative Utterance column (column F), excluding those coded items.
- For comparison, normative data (means and ranges) are provided for total words and total utterances. Note that these are only available currently for the Coded Utterance column, since AphasiaBank does not contain a version of the utterances analogous to the Narrative Utterances column.

2. Speech rate

- Rate of speech is calculated by dividing the number of narrative words by the total transcript time. On the Summary sheet, it is interpreted relative to the normal speech rate range calculated from AphasiaBank samples (shown in pink in column C of the Analysis Sheet). Although the normative data are calculated as total words (minus repetitions and revisions), we believe it is more appropriate to compare this to the *narrative* word counts from PwA. This ensures that PwA do not get “credit” for production of fillers and other deleted elements, which are much more common in samples of aphasic speech than in typical speech.

3. Utterance lengths

- Below the word counts are calculations of minimum and maximum utterance lengths (in words) in the sample, along with several measures of central tendency: the mean (or average); the median (or middle, *i.e.*, the value with an equal number of utterances shorter and longer than it); and the mode (*i.e.*, the most frequently occurring) utterance length. A fourth measure (adapted from the ADP, Helm-Estabrooks, 1992) calculates the average of the 3 longest utterances in the sample. If the distribution of utterances is skewed (for example, many short utterances with a few long utterances), the median and mode values are likely to be more meaningful measures than the mean.

- Analogous values are provided in columns C (Coded Utterances) and F (Narrative Utterances).

NOTE: Utterance lengths are calculated without including zero values. Narrative utterances of zero words may occur if the utterance consists entirely of excluded items (such as empty and extraneous words, fillers, and repairs) or nonverbal elements (*e.g.*, gestures or sound effects).

- In the Summary sheet, we use the mean (MLU), to represent a speaker’s typical performance, and the maximum average (MaxLU), to represent their potential competence. If preferred, different values can be substituted by changing the cell references in the Summary sheet.
 - Both are calculated from the Narrative Utterances, which better represent syntactic competence because they do not include elements (*e.g.*, fillers, repairs) that can inflate MLU measures.
- Below the utterance length calculations, normative data are provided for utterance length values (minimum, maximum, mean, median, and mode) from the Cinderella story samples of control participants in AphasiaBank.

NOTE: These normative values are calculated from the MLUs (mean utterance lengths) of each participant. Thus, Min MLU for the normative data represents the *lowest average* across all participants; Max MLU represents the *highest average*, and Modal MLU represents the *most frequently occurring average value* of utterance length.

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4. Incidence of coded elements

- At the bottom of columns H to P are total counts and proportions for the coded behaviors: phonological errors, abstruse neologisms, pauses, fillers, repairs, empty/stereotyped (non-meaningful) speech, and effort.

NOTE: The formulae do not count the number of occurrences of each behavior, but the number of *utterances* that contain at least one such behavior. We consider this measure to be a more helpful way of reflecting the extent to which fluency is affected, as multiple occurrences of a given behavior within an utterance can disproportionately inflate the counts relative to their impact. Below the raw counts are proportional measures, reflecting the proportion of utterances that contain at least one instance of each behavior. It is the proportional data that are transferred to the Summary sheet.

- Effort codes for each utterance are automatically transferred from the Transcript sheet.

5. Grammatical Structure

- At the bottom of column Q are the total counts and proportions of each of the six types of grammatical structures described above.
 - The proportion of fragmented (**Frag**) utterances is calculated out of all narrative utterances.
 - The proportions of utterances coded as grammatically correct (**Gram**), agrammatic (**Agram**), paragrammatic (**Pgram**), both agrammatic and paragrammatic (**Ag/Pg**), or of unknown grammaticality (**UK**) are all calculated as a proportion of *complete* narrative utterances (*i.e.*, not including fragments or utterances without any verbal elements, which are coded as **NA**).
 - The total of the 5 grammaticality codes (Gram, Agram, Pgram, Ag/Pg, UK) adds up to the number of complete utterances. The total of complete utterances plus fragments (Frag) adds up to the number of verbal narrative utterances. The total of verbal narrative utterances plus NA adds up to the number of original utterances.

CHAPTER 7. Summary Sheet

- Several of the totals on the Analysis Sheet will automatically be transferred to the Summary Sheet. These cells are highlighted in yellow, and include:
 - Rate of narrative speech (from column F)
 - Mean length of narrative utterances (from column F)
 - Maximum average length of narrative utterances (from column F)
 - Proportion of utterances containing phonological errors (from column H)
 - Proportion of utterances containing abstruse neologisms (from column I)
 - Proportion of utterances containing significant pauses (from column J)
 - Proportion of utterances containing fillers (from column K)
 - Proportion of utterances containing repairs (from column L)
 - Proportion of utterances containing empty speech (calculated by adding utterances that contain either [*] from column M or (*) from column N, total in column O)
 - Proportion of utterances coded as effortful (from column P)
 - Proportion of complete utterances that are agrammatic or both agrammatic and paragrammatic (from column Q)
 - Proportion of complete utterances that are paragrammatic or both agrammatic and paragrammatic (from column Q)

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- The Summary Sheet lists each of these 12 dimensions contributing to fluency. The proportional measures from the Analysis sheet are transferred to the relevant cell in column C of the Summary sheet. Proportions are then binned (as described in the main article) and transformed into a point on a 5-point rating scale (column D).

NOTE: The correspondence of proportions to the 5-point scale is reversed for some of the measures, since some reflect more fluent behavior (e.g., MLU), while other scores reflect less fluent behavior (e.g., agrammatism, pauses, effort). Thus, on the 5-point scale, *higher scores always represents better performance*.

- The **4 Summary Scores** underneath the 12 dimensions combine relevant dimensions according to whether they are hypothesized to reflect grammaticality, lexical availability, or articulatory facility:
 - **Grammatical Competence (GC)** averages the scores corresponding to speech rate, mean and maximum utterance length, and agrammatism. Note that the paragrammatism score—despite indicating disrupted grammatical competence—is not included in the summary score, because paragrammatism does not disrupt fluency in the same way as the other behaviors (see main article for further discussion).
 - **Lexical Availability (LA)** is the average of the scores for speech rate, mean utterance length, pauses, fillers, and repairs. Similar to the rationale above for leaving paragrammatism scores out of the GC summary, the empty speech score is not included here. Although empty speech indicates reduced lexical availability, the occurrence of empty speech actually tends to help maintain, rather than disrupt, fluency.
 - **Articulatory Facility (AF)** is an average of the scores for speech rate, pauses, phonological errors, abstruse neologisms, and effort.
 - **Overall Fluency (OF)** averages the 3 component Summary Scores above.

NOTE: Some of the dimensions (e.g., speech rate) are represented in more than one Summary Score. This is because these behaviors may be multiply determined. For example, reduced utterance length may be due to difficulty formulating grammatical structures or to word retrieval difficulty. Their repeated counting in the Overall Fluency score reflects their greater weight in contributing to fluency perceptions (see main article for discussion).

- **Graph:** Once the cells containing scores for each of the 12 fluency dimensions are populated, the associated chart will display them graphically. On the graph, the dimensions are grouped and color-coded according to which Summary Score(s) they reflect (GC, LA, and/or AF).

NOTE: Scores of 1 are represented by values of 1.1 in the graph, so that the bar will show up once the score is calculated.

CHAPTER 8. Using the Quick Version of the Flu-ID

If time does not allow for the coding process described above, a quicker but less reliable use of the Flu-ID involves the following steps:

- a) Transcribe the utterances verbatim as described in Chapter 2 above.
- b) On the Summary sheet, use the verbal descriptions and the numeric values corresponding to fluency scores to *estimate* scores for speech rate, typical utterance length, maximum utterance length, and the proportions of utterances affected by each fluency behavior.
- c) Manually enter the fluency scores corresponding to each verbal and numeric description in the corresponding yellow highlighted boxes, overwriting the formulas that are there.
- d) Once entered, the fluency scores will automatically populate in the graph, as described above.

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REFERENCES

- Berndt, R. S., Wayland, S., Rochon, E., Saffran, E., & Schwartz, M. (2000). *Quantitative production analysis: A training manual for the analysis of aphasic sentence production*. Psychology Press.
- Grossman, M. (2012). The non-fluent/agrammatic variant of primary progressive aphasia. *The Lancet: Neurology*, 11, 545-555.
- Haley, K. L., & Jacks, A. (2023). Three-dimensional speech profiles in stroke aphasia and apraxia of speech. *American Journal of Speech-Language Pathology*, 1-10.
- Haley, K. L., Smith, M., & Wambaugh, J. L. (2018). Sound distortion errors in aphasia with apraxia of speech. *American Journal of Speech-Language Pathology*, 28, 121-135.
- Helm-Estabrooks, N. (1992). *Aphasia Diagnostic Profiles*. PRO-ED.
- MacWhinney, B. (2000). *The CHILDES Project: Tools for Analyzing Talk*, 3rd ed. Lawrence Erlbaum Associates.
- MacWhinney, B. (2023). *Tools for Analyzing Talk, Part 1: The CHAT Transcription Format* [Manual].
- Nicholas, L. E., & Brookshire, R. H. (1993). A system for quantifying the informativeness and efficiency of the connected speech of adults with aphasia. *Journal of Speech & Hearing Research*, 36, 338-350.
- Odell, K., McNeil, M. R., Rosenbek, J. C., & Hunter, L. (1991). Perceptual characteristics of vowel and prosody production in apraxic, aphasic, and dysarthric speakers. *Journal of Speech & Hearing Research*, 34, 67-80.
- Ratner, N. B., & Brundage, S. B. (2022). *A Clinician's Complete Guide to CLAN and PRAAT*. Carnegie Mellon University. <https://aphasia.talkbank.org/>
- Roach, A., Schwartz, M. F., Martin, N., Grewal, R. S., & Brecher, A. (1996). The Philadelphia Naming Test: Scoring and rationale. *Clinical Aphasiology*, 24, 121-133.
- Strand, E. A., Duffy, J. R., Clark, H. M., & Josephs, K. (2017). *The Apraxia of Speech Rating Scale (Version 3.0)*.
- Vitevitch, M. S., & Luce, P. A. (2004). A Web-based interface to calculate phonotactic probability for words and nonwords in English. *Behavior Research Methods, Instruments, & Computers*, 36(3), 481-487.
- Ziegler, W. (2008). Apraxia. In G. Goldenberg & B. L. Miller (Eds.), *Handbook of Clinical Neurology* (Vol. 88: Neuropsychology and Behavioral Neurology, pp. 269-285). Elsevier.