For many people with alexia, there is no one single cause for their reading difficulties. Rather, there are a variety of language processing components that are compromised and result in difficulty reading single words. Cognitive neuropsychological models such as the Dual Route Cascaded Model of Reading break reading down into a series of language processing components, each with their own unique contribution to the reading process (see Figure 1).

Using a cognitive neuropsychological approach, Johnson, Ross, and Kiran (2017) developed a multi-component reading treatment that aims to target all aspects of reading single words. Their hierarchy is as follows:

TREATMENT HIERARCHY (ADAPTED FROM JOHNSON, ROSS, & KIRAN, 2017)

1. Lexical Decision: The client is presented with 2 cards (one with the correct target word written and one with a nonword foil), and asked to identify the target written word. If the nonword foil is chosen, client is corrected and target written word is emphasized.

Language Processing Components Targeted: Orthographic Input Lexicon

2. *Oral Reading: Client is asked to read the written target word aloud. Feedback on accuracy is provided.

Language Processing Components Targeted: Orthographic Input Lexicon, Phonological Output Lexicon, Phonological Assembly

3. Repetition: Clinician says aloud the target word and the client is asked to repeat (written target word is kept in sight of client). Articulatory cues and/or syllable segmentation are provided if client's attempt is incorrect.

Language Processing Components Targeted: Orthographic Input Lexicon, Phonological Output Lexicon, Phonological Assembly

4. Word-Picture Matching: The written target word is kept in sight and 3 pictures are brought out (1 picture of the target word and 2 pictures of other words being trained). Client is asked to identify which picture matches the written target word. If client chooses an incorrect picture, remove the incorrectly identified picture and try again.

Language Processing Components Targeted: Orthographic Input Lexicon, Semantic System

5. Semantic Feature Analysis/Generation: Client is asked to perform a Semantic Feature Analysis of the target word using the correct picture from Step 4 (e.g., client is asked where target is found, what it looks like, etc). If it is difficult for the client to come up with semantic features, perform a feature verification task (i.e., "Does this object live in the water?")

Language Processing Components Targeted: Semantic System

6. *Grapheme-Phoneme Conversion: Letter tiles for each of the letters in the written target word are provided, as well as a few extra tiles for letters that are not in the word. Each letter is randomly presented to the client, and they are asked to give the sound/phoneme typically associated with that letter. Provide the correct sound and ask client to repeat if any letters are incorrect.

Language Processing Components Targeted: Grapheme-Phoneme Conversion

7. *Anagram Spelling: The letter tiles are scrambled and the client is asked to spell out the word using the correct letter tiles (extra letter tiles not in the target word can be placed to the side). Phonemic cues are given as needed.

Language Processing Components Targeted: **Orthographic Output Lexicon, Phoneme-Grapheme Conversion

8. *Grapheme-Phoneme Conversion: Each grapheme/letter of the word is pointed to and client is asked to say the corresponding sound/phoneme as it is used in the word (start with letters at the beginning of the word). Models for incorrect productions are provided, and client is asked to repeat.

Language Processing Components Targeted: Grapheme-Phoneme Conversion

9. *Phoneme-Grapheme Conversion: A random sound/phoneme from the written target word is produced by the clinician, and the client is asked to identify which letter/grapheme goes with it. For incorrect responses, the clinician points to the correct one and the client is asked to look at it while repeating the correct sound/phoneme.

Language Processing Components Targeted: **Phoneme-Grapheme Conversion

10. *Oral Reading: Client is asked to read the written target word aloud. Feedback on accuracy is provided.

Language Processing Components Targeted: Orthographic Input Lexicon, Phonological Output Lexicon, Phonological Assembly

11. Repetition: Clinician says aloud the target word and the client is asked to repeat (written target word is kept in sight of client). Articulatory cues and/or syllable segmentation are provided if client's attempt is incorrect.

Language Processing Components Targeted: Orthographic Input Lexicon, Phonological Output Lexicon, Phonological Assembly

12. *Delayed Reading: Client is asked to count to 10, and to then re-read the written target word. Models are provided for incorrect productions, and client is asked to repeat.

Language Processing Components Targeted: Phonological Output Lexicon, Phonological Assembly

13. Repetition: Clinician says aloud the target word and the client is asked to repeat (written target word is kept in sight of client). Articulatory cues and/or syllable segmentation are provided if client's attempt is incorrect.

Language Processing Components Targeted: Orthographic Input Lexicon, Phonological Output Lexicon, Phonological Assembly

*These are the treatment steps that Johnson, Ross, and Kiran thought to be the most important in treatment gains

**Note that these components are not in the Dual Route Cascaded model because they are part of written language processing; for a model that incorporates these components, check out Patterson and Shewell's (1987) Logogen Model

Results of this treatment study found participants to improve reading accuracy of both trained and untrained words, along with improvements in *spelling* of trained and untrained words! The researchers also theorized that the following steps were the most helpful in treatment gains: Oral Reading, Grapheme-Phoneme Conversion, Anagram Spelling, Phoneme-Grapheme Conversion, and Delayed Reading. Given the theoretical rationale and treatment gains from this study, consider adding a Multi-Component approach to your alexia treatment toolbox!

References:

Johnson, J., Ross, K. & Kiran, S. (2017). Multi-step treatment for acquired alexia and agraphia (Part I): efficacy, generalisation, and identification of beneficial treatment steps. *Neuropsychological Rehabilitation, 29*(4), 534-564.

Patterson, K., & Shewell, C. (1987). The cognitive neuropsychology of language. *Speak and spell: dissociations and word class effects. London: Erlbaum*, 273-94

Figure 1

DUAL ROUTE CASCADED MODEL OF READING

Written Word

Visual Feature Analysis

Letter Analysis

Lexical Reading Route

Orthographic Input Lexicon

Semantic System

Lexical Nonsemantic Reading Route

Nonlexical Reading Route

Grapheme-Phoneme Conversion

Phonological Output Lexicon

Phonological Assembly

Spoken Word

ARCH WAYS