Introduction to Psycholinguistics and Neurolinguistics

Teangacha Iar-bhunscoile Éireann
Post-Primary Languages Ireland

AILO
All Ireland Linguistics Olympiad
The Problem Solvers' Challenge

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Department of Education

Overview of this Linguistics Module

- Topic 1 Introduction to areas of linguistics and problem-solving
- Topic 2 Historical Linguistics
- Topic 3 Phonetics
- Topic 4 Sociolinguistics
- Topic 5 Writing systems
- Topic 6 Language Acquisition
- Topic 7 Morphology
- Topic 8 Syntax
- **Topic 9 Psycholinguistics / Neurolinguistics**
- Topic 10 Machine Translation

What is Psycholinguistics?

- Psycholinguistics is the psychology of language.
- Psycholinguistics aims to help us understand of how language is represented and processed in the mind and brain.
- In this unit, we are going to look at different speech disorders that inform us on how humans use language to communicate ideas and feelings, and how these communications are processed and understood.

What is Psycholinguistics?

We are going to look at the following topics:

- Specific Language Impairment (**SLI**), also referred to as Developmental Language Disorder (**DLD**)
- William Syndrome (**WS**)
- Broca's Aphasia
- Wernicke's Aphasia

Specific Language Impairment (SLI) and Williams Syndrome (WS)

- These two conditions are particularly interesting as they appear to be each other's mirror images:
  - Children with **SLI** otherwise have largely normal cognitive development and intelligence. Only their language is impaired.
  - In contrast, children with **WS** have relatively fluent speech while other cognitive functions are impaired.

- SLI and WS are interesting in that they show a **double dissociation:** A double dissociation means that two mental processes can be shown to function independently of each other. In other words, language is an independent mental process within cognition.

- **SLI** is nowadays also referred to as **Developmental Language Disorder (DLD)**.

Task 9.1: What is Specific Language Impairment (SLI) / Developmental Language Disorder (DLD)?

Task 9.1: Specific Language Impairment (SLI)/DLD

- Watch the video on SLI/DLD and complete Exercise 1 on Worksheet 9.1:https://www.youtube.com/watch?v=8gHoyoM5wC8 or click below

Feedback Exercise 1

1. What difficulty do people with DLD/SLI have?
They have problems with: • Sounds • Coming up with words (word-finding difficulties) • Stringing it all together (syntax – sentences) • Processing what other people are saying (comprehension)
2. How many students (roughly) have DLD/SLI?
• About two students in a class of 30.
3. What are the difficulties that students have often attributed to?
• Laziness • Naughtiness
4. How do people describe having DLD/SLI?
• People are speaking a foreign language to them. • All the words and sounds are jumbled up before it gets to them. • They can't get the words out. • They can't think through their thoughts clearly.
5. What other areas in life can DLD/SLI have an impact on?
• Literacy • Friendships • Learning • Emotional well-being
6. How can DLD/SLI be diagnosed?
• By a speech and language therapist
7. How can people with DLD/SLI be helped?
• Speak more slowly • Use simple words • Extra time • Extra allowances

Specific Language Impairment (SLI)/DLD

People with SLI:

- have normal hearing,
- have a nonverbal performance IQ of 85 or higher,
- have normally developed oral structure and oral motor function,
- don't have any neurological difficulties (e.g. seizure disorders, cerebral palsy, brain lesions),
- don't generally have an underlying behavioural, emotional, communicative or social difficulty (e.g. no autism).

Specific Language Impairment (SLI)/DLD

- The language emerges late.
- Language development is slower than in typical developing children.
- Children with DLD have difficulties with receptive and expressive language skills.
- Morphology (words) and syntax (sentences) are the most affected aspects of their language.
- They often have difficulties with phonological rules (i.e. how sounds contribute to meaning), and therefore their speech becomes less intelligible.
- Word-finding difficulties are common.

Some types of grammatical errors produced by children with SLI:

- Noun plural omission:
  - *'And not **spot** on'*
    (Correct version*: 'And it didn't have spots on'*)
- Verb tenses:
  - '*He **say**, I'm a monster*'
    (Correct version: '*He said I'm a monster*')
- Genitive Inflection (Possessive 's):
  - '*My sister use my **Dad** car but she keep smashing it'*.
    (Correct version: '*My sister used my Dad's car but she kept smashing it.'*)
- Wrong pronoun:
  - '*And **him** jumped on the television*'
    (Correct version: '*And he jumped on the television*')
- Omission of 'to be' as main verb (*copula be*):
  - '*Cos they her favourites*'
    (Correct version: '*Cos they're her favourites*')
- Determiner (article) error:
  - *'Maybe have **a** chickenpox, or maybe have something'.* (Correct version: *'Maybe he has chickenpox or something'*)
- Omission of subject in obligatory context:
  - 'Bit Daddy leg no notice'
    (Correct version: '*He bit daddy's leg but he took no notice*')

Task 9.1 Worksheet 9.1

- Complete Exercise 2 on worksheet 9.1

Noun plural omission	Verb tense
Possessive *'s*	Wrong pronoun
Omission of *to be* as a main verb	Omission of subject in obligatory context

	Error type
1. Eat up Bernard except training shoes.	
2. Cakes erm sandwich	
3. He went up the stairs with Bernard teddy bear.	
4. He a Jack Russel.	
5. And they had like a round circle and they hide in it.	
6. Them can rush to try to help him.	

Feedback Exercise 2

	Error type
1. Eat up **Bernard** except training shoes.	**Possessive *'s***
2. Cakes erm sandwich	**Noun plural omission**
3. He went up the stairs with Bernard teddy bear.	**Omission of subject in obligatory context**
4. He a Jack Russel.	**Omission of *to be* as a main verb**
5. And they had like a round circle and they **hide** in it.	**Verb tense**
6. **Them** can rush to try to help him.	**Wrong pronoun**

Task 9.2: What is Williams Syndrome?

Task 9.2: Williams Syndrome

- Watch the video (https://www.youtube.com/watch?v=M6n4z0XjPh4) and answer Exercise 1 on Worksheet 9.2:

Williams Syndrome (WS)

- Children with WS have mild to moderate intellectual difficulties.
- They have distinctive facial features.
- They often have heart and blood vessel problems.
- They have difficulties with everyday tasks, such as tying shoelaces.
- They have difficulties with cognitive tasks, such as putting items in order from larger to smaller or higher to lower.
- They have difficulties with drawing.
- WS is caused by missing more than 25 genes from a specific are of chromosome 7.

Williams Syndrome (WS)

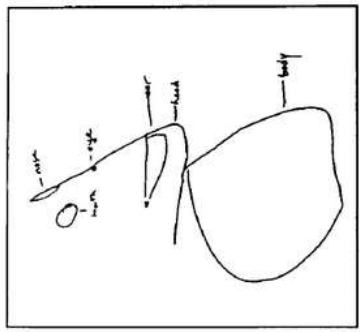
- The language of children with WS is relatively intact.
- By the time children with WS reach puberty, their language skills outperform their other cognitive skills, although their language remains below chronological age level (e.g. they perform worse than typically developing children of the same age do).
- Language emerges later than in typically developing children of the same age.

Task 9.3

- **Worksheet 9.2: Exercise 2**
- Look at the Figure and answer the following questions:
- 1. Describe the picture.
- 2. Read the person's description of an elephant. What can you say about the language? Consider the choice of vocabulary and the grammar.
- 3. What can you say about the person's cognitive abilities?

Contrast Between Visuo-Spatial and Language Abilities in Williams Syndrome

a.



b.

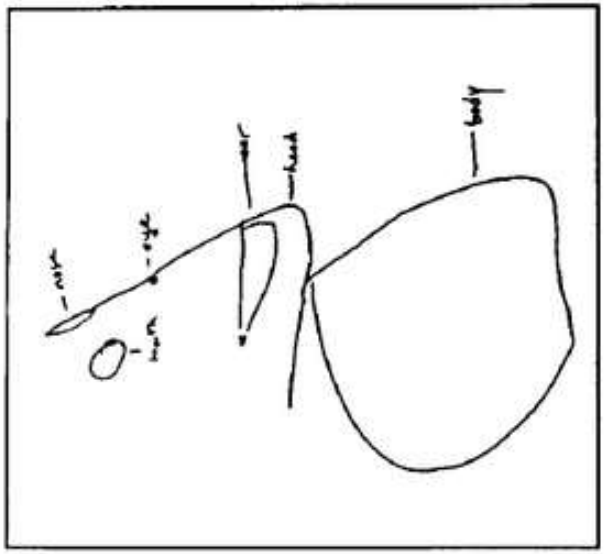
And what an elephant is, it is one of the animals. And what the elephant does, it lives in the jungle. It can also live in the zoo. And what it has, it has long gray ears, fan ears, ears that can blow in the wind. It has a long trunk that can pick up grass, or pick up hay....If they're in a bad mood it can be terrible...If the elephant gets mad it could stomp; It could charge, like a bull can charge. They have long big tusks. They can damage a car...It could be dangerous. When they're in a pinch, when they're in a bad mood it can be terrible. You don't want an elephant as a pet. You want a cat or a dog or a bird...

FIG. 2.6. Contrast between visuospatial and language abilities in WS. (a) Drawing of an elephant by an 18-year-old WS woman, whose IQ is 49. (b) Her verbal description of an elephant.

Task 9.2: Worksheet 9.2, Exercise 2

Contrast Between Visuo-Spatial and Language Abilities in Williams Syndrome

a.



b.

And what an elephant is, it is one of the animals. And what the elephant does, it lives in the jungle. It can also live in the zoo. And what it has, it has long gray ears, fan ears, ears that can blow in the wind. It has a long trunk that can pick up grass, or pick up hay....If they're in a bad mood it can be terrible...If the elephant gets mad it could stomp; It could charge, like a bull can charge. They have long big tusks. They can damage a car...It could be dangerous. When they're in a pinch, when they're in a bad mood it can be terrible. You don't want an elephant as a pet. You want a cat or a dog or a bird...

FIG. 2.6. Contrast between visuospatial and language abilities in WS. (a) Drawing of an elephant by an 18-year-old WS woman, whose IQ is 49. (b) Her verbal description of an elephant.

Feedback Task 9.2: Exercise 1

- The picture compares the drawing of an elephant with the verbal description of one by an 18-year-old person with WS with an IQ of 49. The drawing is disorganised. We would not be able to recognise the drawing if it were not for the verbal labels that the person provides.
- The verbal description of the elephant is fluent and rich. It includes information about what the elephant is, what it does, what it has ‘It has long grey ears, fan ears, ears that can blow in the wind. It has a long trunk that can pick up grass or pick up hay’. The grammar is intact. The person uses quite complex sentences, including relative clauses (It has long grey ears, fan ears, ears **that can blow in the wind**). Grammatical inflection is target like (as it should be).

Task 9.2: Worksheet 9.2, Exercise 3

The following are characteristics of either children with Specific Language Impairment or Williams Syndrome. Indicate whether you think the property applies to children with SLI or to children with WS. Some properties might apply to both groups.

	SLI or WS?
They have oversensitive hearing.	
They have normal hearing.	
Their language develops late in comparison with typically developing children who have a similar general IQ.	
They often have word-finding difficulties.	
Their language often has rich vocabulary.	
They have difficulty understanding language.	
Their general IQ is below average.	
They have problems with morphology (grammatical morphemes and inflections) and syntax (sentences)	
They sometimes have problems with cognitive tasks, such as putting items in order from smaller to larger.	
The problem is genetic.	

Feedback Exercise 3:

	SLI or WS?
They have oversensitive hearing.	**WS**
They have normal hearing.	**SLI**
Their language develops late in comparison with typically developing children who have a similar general IQ.	**SLI**
They often have word-finding difficulties.	**SLI**
Their language often has rich vocabulary.	**WS**
They have difficulty understanding language.	**SLI**
Their general IQ is below average.	**WS**
They have problems with morphology (grammatical morphemes and inflections) and syntax (sentences)	**SLI**
They sometimes have problems with cognitive tasks, such as putting items in order from smaller to larger.	**WS**
The problem is genetic.	**SLI/WS**

Worksheet 9.2: Exercise 4

	SLI or WS?
1. I would like to commentate it. It means that … like all the sportscasters do … they tell who's doing what.	
2. Sad is when someone dies; someone is hurt, like when you cry.	
3. A little boy want to tell someone how he get hurt.	
4. Music to me is like the soundtrack of the world.	
5. The grandmother look for son in room.	
6. Now us have lot of snow at … around this house.	

Feedback Exercise 4:

	SLI or WS?
1. I would like to commentate it. It means that … like all the sportscasters do … they tell who's doing what.	**WS** (Expressive language, the grammar is good)
2. Sad is when someone dies; someone is hurt, like when you cry.	**WS** (Expressive language, the grammar is good)
3. A little boy want to tell someone how he get hurt.	**SLI** (grammatical inflections missing: *want**s**/want**ed**, **got**)*
4. Music to me is like the soundtrack of the world.	**WS** (Expressive language, the grammar is good)
5. The grandmother look for son in room.	**SLI** (grammatical morphemes and inflections missing: ***is** look**ing**/look**ed**, for **the** son)*
6. Now us have lot of snow at … around this house.	**SLI** (grammatical errors: ***we** have,* missing article ***a** lot of snow)*

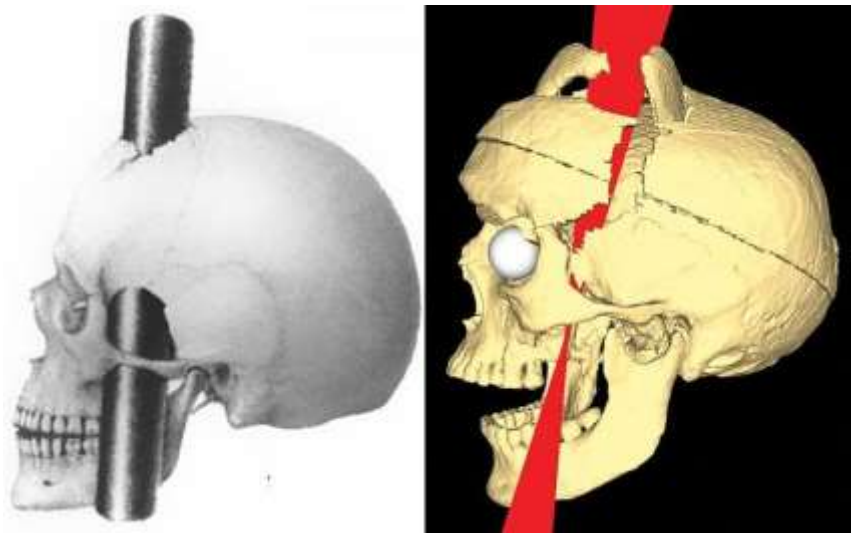
Neurolinguistics: Is there any evidence that there are regions in the brain that are specialized for language?

Task 9.3: Is there any evidence that there are regions in the brain that are specialized for language?

- Watch the following clip:

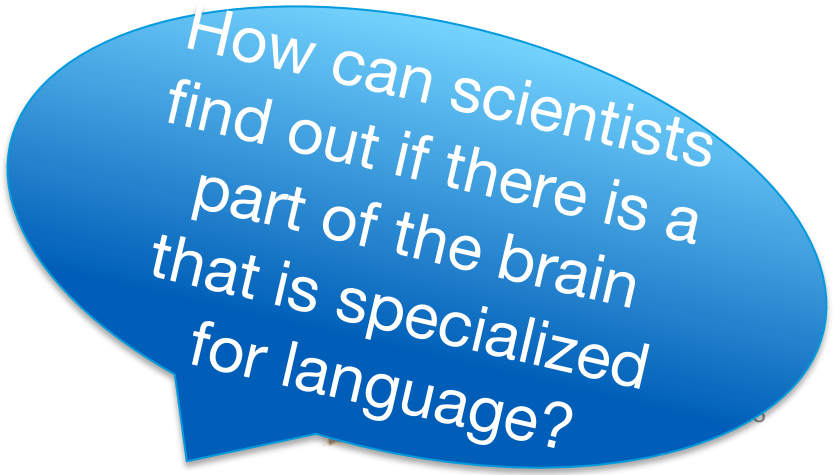
The miraculous survival of Phineas Gage

- The iron rod went entered Gage's head under his left cheek bone (as seen in the models on the right) and went completely out through the top of his forehead.
- Most of the front part of the left side of his brain was destroyed.
- It was assumed that no one could recover from such severe head injury.
- Phineas Gage recovered and was well enough to resume work a few months after the accident.



Why is Phineas Gage's story interesting for science?

- Damage to the frontal part of the brain did not have any effect on Phineas Gage's language (Gage still had the ability to speak and understand language).
- Even though the brain may be the location for language, it is not situated right at the front.
- The injury to Gage's brain produced some selective changes to his personality, but not to language and other intellectual abilities.
- This provides evidence for the assumption that the brain has a **modular structure**: different human abilities and behaviours can be traced to different parts of the brain.



Is there any evidence that there are regions in the brain that are specialised for language?

- Scientists look at patients who have specific identifiable language disabilities (that means that only specific areas of language are affected, while other areas of language and other intellectual abilities might be retained).
- If these patients have damaged specific areas of the brain, this suggests that the localized brain damage might cause the language problem.
- It follows that the area of the brain that is impaired is the locum (=the place) of a specialized language area in the brain.

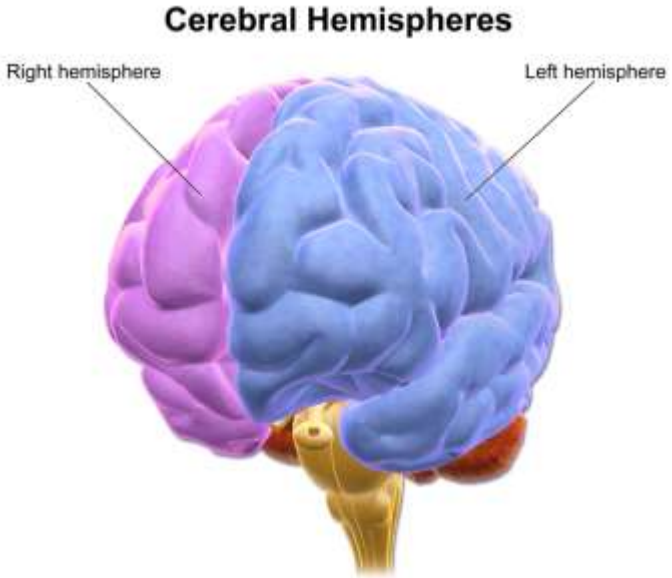
Evidence from patients with Aphasia

What is aphasia

- An impairment of language function due to damage to specific regions in the brain.
- Difficulty understanding and/or producing language.
- The causes for aphasia can be a stroke, head trauma, brain tumors or neurodegenerative disease (such as dementia).

Brain lateralization

- The brain is made up of cerebral **hemispheres**, the right and the left hemisphere.
- The two hemispheres are joined by a nerve tract called the **corpus callosum**. The two hemispheres communicate via the nerve tracts of the corpus callosum.
- By and large, the right hemisphere controls the left side of the body, and the left hemisphere controls the right side of the body.
- If you pick up something with your left hand, this action is controlled by your right hemisphere. In turn, if you point to something with your right hand, the action is controlled by your left hemisphere.



Broca's Area

- Language was the first cognitive function to be localised in the brain on the basis of empirical evidence.
- In 1864, Paul Broca, a French surgeon, linked the ability to produce language to the left side of the brain.

Broca based his claim on the observation that damage to the left side of the brain caused loss of language. In turn, damage to the right hemisphere did not cause language loss.

How did he do that?

Broca's Area

- Broca examined the brains of eight patients who had language impairment following a brain injury.
- Broca performed an autopsy and found damage to the frontal lobe of the left hemisphere (the red area on the image on the right).
- We say that patients with injuries to Broca's area have **Broca's aphasia** (remember that aphasia is the term used to describe language disorders that occur after brain damage to a specific area of the brain).

Task 9.3: Worksheet 9.3: Exercise 1

- Watch Sarah's experience of Broca's aphasia and answer Exercise 1 on Worksheet 9.3:

	Yes	No
The speech is fluent and without hesitation.		
The articulation is clear and intelligible (easy to understand).		
The speaker uses the correct content words (such as nouns and adjectives).		
The speaker uses the correct grammatical morphemes and inflections (such as past tense, plural, prepositions).		
The speaker understands the questions.		

Task 9.3: Worksheet 9.3 Broca's Aphasia

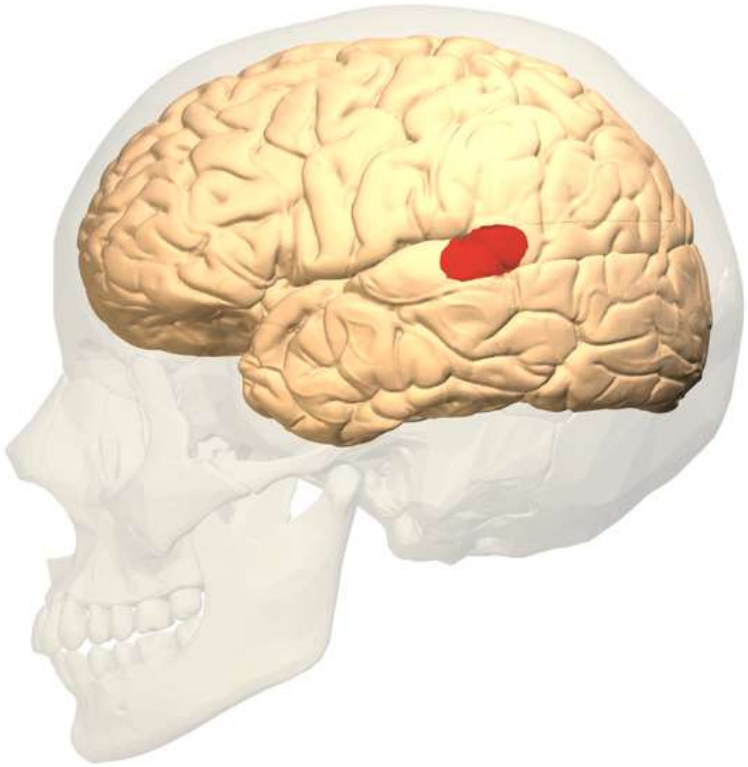
https://www.youtube.com/watch?v=IP8hkopObvs

Feedback Exercise 1:

	Yes	No
The speech is fluent and without hesitation.		√
The articulation is clear and intelligible (easy to understand).		√
The speaker uses the correct content words (such as nouns and adjectives).		√
The speaker uses the correct grammatical morphemes and inflections (such as past tense, plural, prepositions).	√	
The speaker understands the questions.	√	

Wernicke's Area

- In 1874, Carl Wernicke described another type of aphasia.
- His patients had injuries in the back part of the left hemisphere.
- This region is now known as **Wernicke's area** (it can be seen in the red part in the image on the right).
- Patients who suffered injury to Wernicke's area are said to suffer from **Wernicke's aphasia**.



Task 9.3: Worksheet 9.3: Exercise 2

- Watch Byron's experience of Broca's aphasia and answer Exercise 2 on Worksheet 9.3:

	Yes	No
The speech is fluent and without hesitation.		
The articulation is clear and intelligible (easy to understand).		
The speaker uses the correct content words (such as nouns and adjectives).		
The speaker uses the correct grammatical morphemes and inflections (such as past tense, plural, prepositions).		
The speaker understands the questions.		

Wernicke's Aphasia

- Watch the short clip and describe the person's symptoms:

Feedback Exercise 2:

	Yes	No
The speech is fluent and without hesitation.	√	
The articulation is clear and intelligible (easy to understand).		√
The speaker uses the correct content words (such as nouns and adjectives).		√
The speaker uses the correct grammatical morphemes and inflections (such as past tense, plural, prepositions).	√	
The speaker understands the questions.		√

Difference between Broca's and Wernicke's Aphasia

Broca's Aphasia:

- Reduced amount of speech.
- Distorted articulation.
- Slow, often effortful speech.
- Lots of hesitations.
- Speech mainly has lexical morphemes (mostly nouns, verbs and adjectives).
- Frequent omission of functional morphemes (e.g. articles, prepositions) and inflectional morphemes (e.g. plural *–s*, past tense *–ed*): **The grammatical markers are missing**.
- Broca's aphasia is also referred to as **agrammatic aphasia.**

Wernicke's Aphasia:

- Can produce very fluent speech.
- Speech is often difficult to make sense of.
- Difficulty in finding the right word.
- Speakers use strategies to overcome word-finding difficulties, such as trying to describe objects or talking about their purpose.
- Wernicke's aphasia is also referred to as **fluent aphasia.**

Worksheet 9.3: Exercise 3

The following utterances were said by people who were suffering either from Broca's aphasia or Wernicke's aphasia. Indicate which were made by Broca's or Wernicke's aphasics and give one reason for your answer (examples from Fromkin, Rodman & Hyams, 2003):

1. Goodnight and in the pansy I can't say but into a flipdoor you can see it.
2. Well … sunset … uh horses nine, no, uh, two, tails want swish.
3. Oh, … if I could I would, and a sick old man disflined a sinter, minter.
4. Words … words … words … two, four, six, eight, … blaze am he.
5. In girls we see many happy days.
6. I'll challenge a new bike.
7. Yes … ah … Monday … ah … Dad … and Dad … ah … Hospital … and ah … Wednesday … Wednesday nine o'clock and ah Thursday … ten o'clock ah doctors
8. Me? Yes sir. I'm a male demaploze on my own. I still know my tubaboys what for I have that's gone hell and some of the go. (Reply when asked if he was a doctor)

Feedback Exercise 3: Sentences 1 – 4

Exercise 3:

1. Goodnight and in the pansy I can't say but into a flipdoor you can see it.

Wernicke's aphasia – speaker uses words that make no sense in context

2. Well … sunset … uh horses nine, no, uh, two, tails want swish.

Broca's aphasia – grammatical morphemes are missing. Content words are ok. Hesitant speech.

3. Oh, … if I could I would, and a sick old man disflined a sinter, minter.

Wernicke's aphasia – the speaker makes up new words. The sentence makes no sense. However, the speaker manages to add the regular past tense -ed to the novel word (which seems to be intended as a verb).

4. Words … words … words … two, four, six, eight, … blaze am he.

Broca's aphasia – Hesitant speech, repetition of words. The grammatical words the speaker uses are wrong (*am* does not agree with *he*).

Feedback Exercise 3: Sentences 5 – 8

5. In girls we see many happy days.

Wernicke's aphasia – The sentence is grammatically correct, but it makes no sense.

6. I'll challenge a new bike.

Wernicke's aphasia – Just as the previous example, the sentence is grammatically well-formed but does not make any sense.

7. Yes … ah … Monday … ah … Dad … and Dad … ah … Hospital … and ah … Wednesday … Wednesday nine o'clock and ah Thursday … ten o'clock ah doctors

Broca's aphasia – The speaker hesitates. This is a response to the question 'Who brought you to hospital?' The speech lacks any grammatical words and inflections

8. Me? Yes sir. I'm a male demaploze on my own. I still know my tubaboys what for I have that's gone hell and some of the go. (Reply when asked if he was a doctor)

Wernicke's aphasia – The speaker has fluent speech. He is using novel/nonsense words that make no sense. The speaker's grammar is intact. He uses the copula *be* (I **am**), plural -s (even on novel words), contracted auxiliary *be* (that'**s** gone) and prepositions ***of, on.***

Ideas for projects

- Phineas Gage
- Genie (already mentioned in Topic 6 – Language Acquisition)
- Careers in Speech and Language Therapy

Additional resources DLD / SLI

Information on DLD/SLI:

- https://radld.org/

- Oliver Sacks Mind Traveller – 'Don't be shy, Mr Sacks':

https://www.youtube.com/watch?v=2J8YNyHIT64

(This is a 50-minute movie about Williams Syndrome by Oliver Sacks)

- Probing the evolution of human language in a model organism:

https://www.youtube.com/watch?v=k27DfgKGVp8

(A short video about the FoxP2 gene and the evolution of human language)

Additional resources Aphasia

- This site has some very interesting videos with samples of people with different types of aphasia:
- https://www.aphasia.org/stories/different-types-aphasia/

- Another video on Aphasia:
- https://ed.ted.com/lessons/aphasia-the-disorder-that-makes-you-lose-your-words-susan-wortman-jutt
- (this can also be found on Youtube: https://www.youtube.com/watch?v=-GsVhbmecJA)

Reference

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Thank you

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Supported by An Roinn Oideachais Department of Education