Lecture 14:
(Atypical) Language Processing

COGS 153

1. Language processing in schizophrenia

Clinical characterizations of language *production* in schizophrenia

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  - Not all patients with schizophrenia show these impairments
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    - *Derailment* / *tangentiality* are considered a 'loosening of associations'
      - A pattern of spontaneous speech that tends to "slip off track"

        Interviewer: "How have you been feeling today?"

        Patient: "Well, in myself I have been okay what with the prices in the shops being what they are and my flat is just round the corner. I keep a watch for the arbiters most of the time since it is just round the corner. There is not all that much to do otherwise."

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  - 'Word salad' or schizophasia
    - Unintelligible speech where words / sentences do not correspond to overall meaning
    - e.g. "Oh, it [life in a hospital] was superb, you know, the trains broke, and the pond fell in the front doorway"

Language comprehension abnormalities in schizophrenia

- Difficulties with figurative language
  - Demonstrate ‘concrete thinking’: Patients often choose concrete interpretations when asked to interpret figurative language (Brune & Bodenstein 2005; Chapman 1960; Kiang et al. 2007)
  - Proverb interpretation is often used clinically to assess schizophrenia (included in the psychiatric rating scale ‘PANSS’ Kay et al. 1987).

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  - Proverb interpretation is often used clinically to assess schizophrenia (included in the psychiatric rating scale ‘PANSS’ Kay et al. 1987).
- Patients show deficits in interpreting long and grammatically complex sentences
  - Show relatively poor performance in interpreting syntactically complex sentences
  - Correlated with their poor performance on verbal working memory span tasks

Atypical language comprehension in schizophrenia

- Differences in sensitivity to semantic context during online processing of language (Kuperberg et al., 1998)
  - Spoken sentences contained a target word that violated semantic constraints
    - e.g., “The crowd was waiting eagerly. The man drank the guitar…”
    - Patients were less sensitive to the violations

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- Differences in the resolution of lexical ambiguity
  - Patients more likely to misinterpret homonym as its dominant meaning (more frequency meaning) (Chapman et al., 1964)
    - e.g., “When the farmer bought a herd of cattle, he needed a new pen” → interpret “pen” as the writing instrument

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  - Patients were asked to listen to sentences containing homonyms and make lexical decisions to visually-presented target words presented after each sentence
    - Target words were either semantically-related or unrelated to either the dominant or the subordinate meaning of the homonym
    - Context of the sentence was moderately biasing towards subordinate homonym
    - Patients showed priming of the homonym’s *dominant* meaning, suggesting that it was not suppressed by the context

Atypical language comprehension in schizophrenia

- ERP evidence of lack of suppression of contextually inappropriate meanings of homonyms (Sitnikova et al., 2002)
  - **Procedure**:
  - Participants read sentences that biased towards either the dominant meaning or the subordinate meaning of a homonym
    - Dominant: “Diving was forbidden from the bridge…”
    - Subordinate: “The guests played bridge…”
      - The following clause of the sentence would be semantically related with the *dominant* meaning of the homonym (e.g., “…because the river had rocks in it.”)

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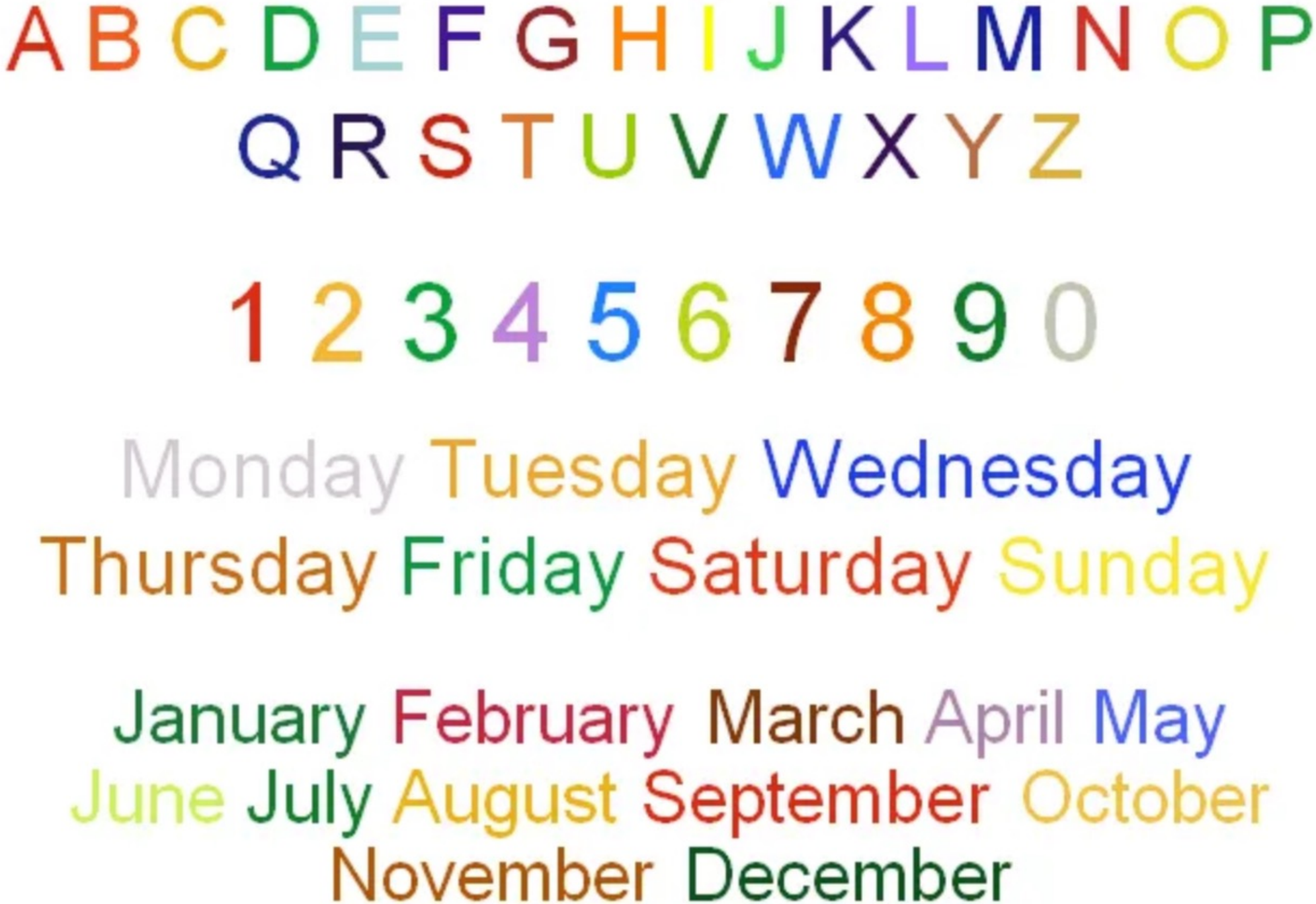
  - **Results**:
  - As expected, control participants produced a smaller N400 to contextually appropriate versus inappropriate words in the second clause
    - e.g. to “river” when the initial context was “Diving was forbidden from the bridge…” versus “The guests played bridge…”
  - Schizophrenia patients showed no significant difference in N400 amplitude to “river” in the different contexts
    - So, the dominant meaning of the homonym is still priming “river”, even in the incongruous context
    - Processing dependent on semantic associations between *individual words,* rather than building up whole sentence context?

Language comprehension abnormalities in schizophrenia

- Two main explanations have been proposed to account for language dysfunction in schizophrenia:
  - abnormalities in semantic memory
  - abnormalities in the build-up and use of ‘context’

2. Synesthesia and language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Monday Tuesday Wednesday
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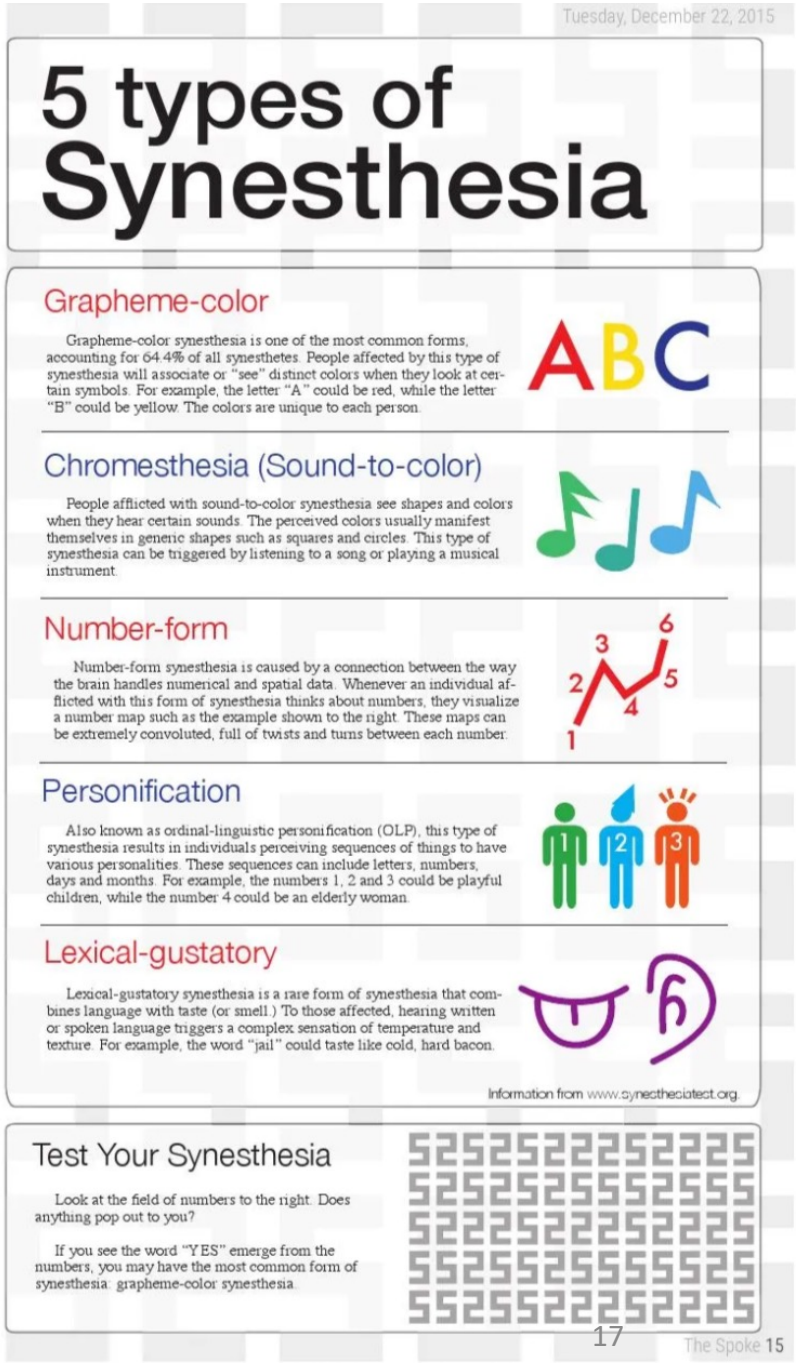
Synesthesia

- **Synesthesia:** a perceptual phenomenon where stimulation of one sensory/cognitive pathway leads to involuntary experiences in a second sensory pathway



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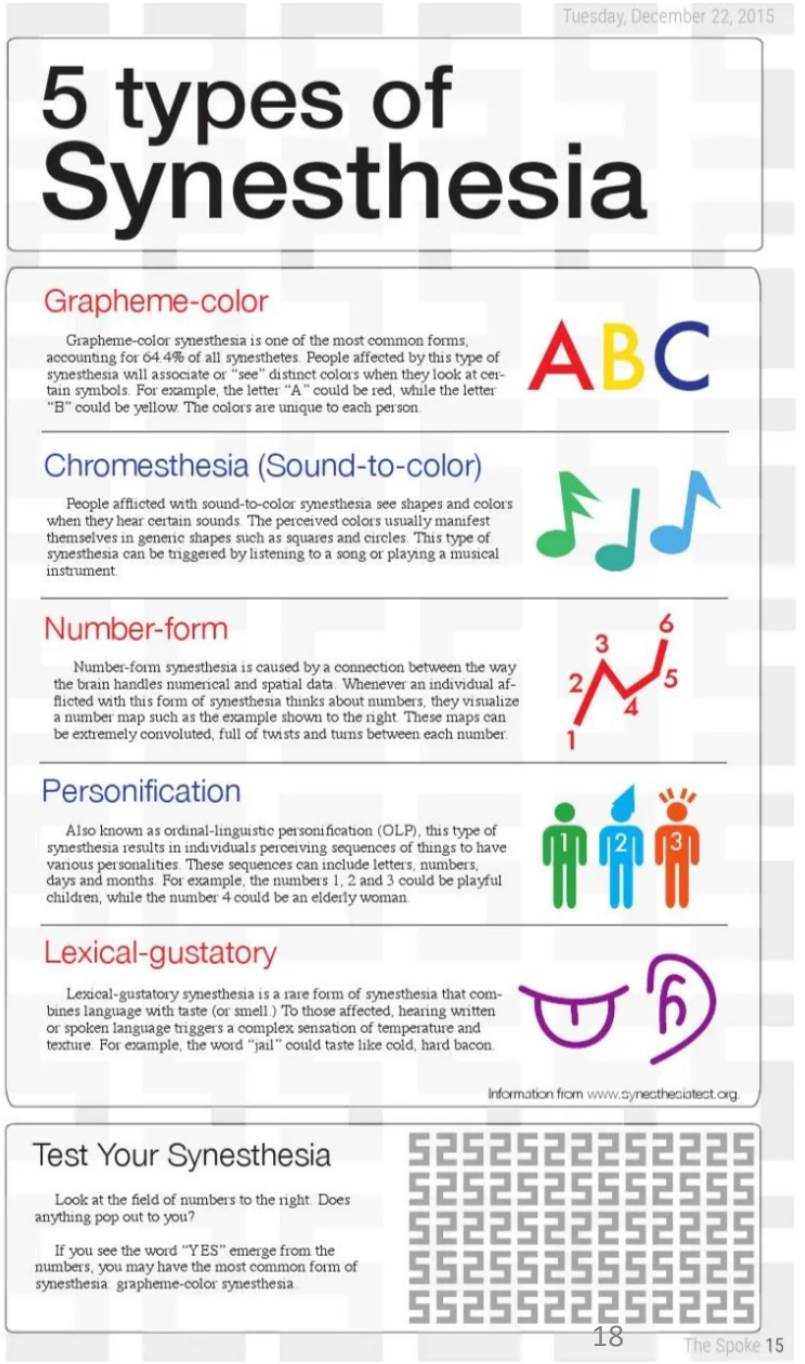

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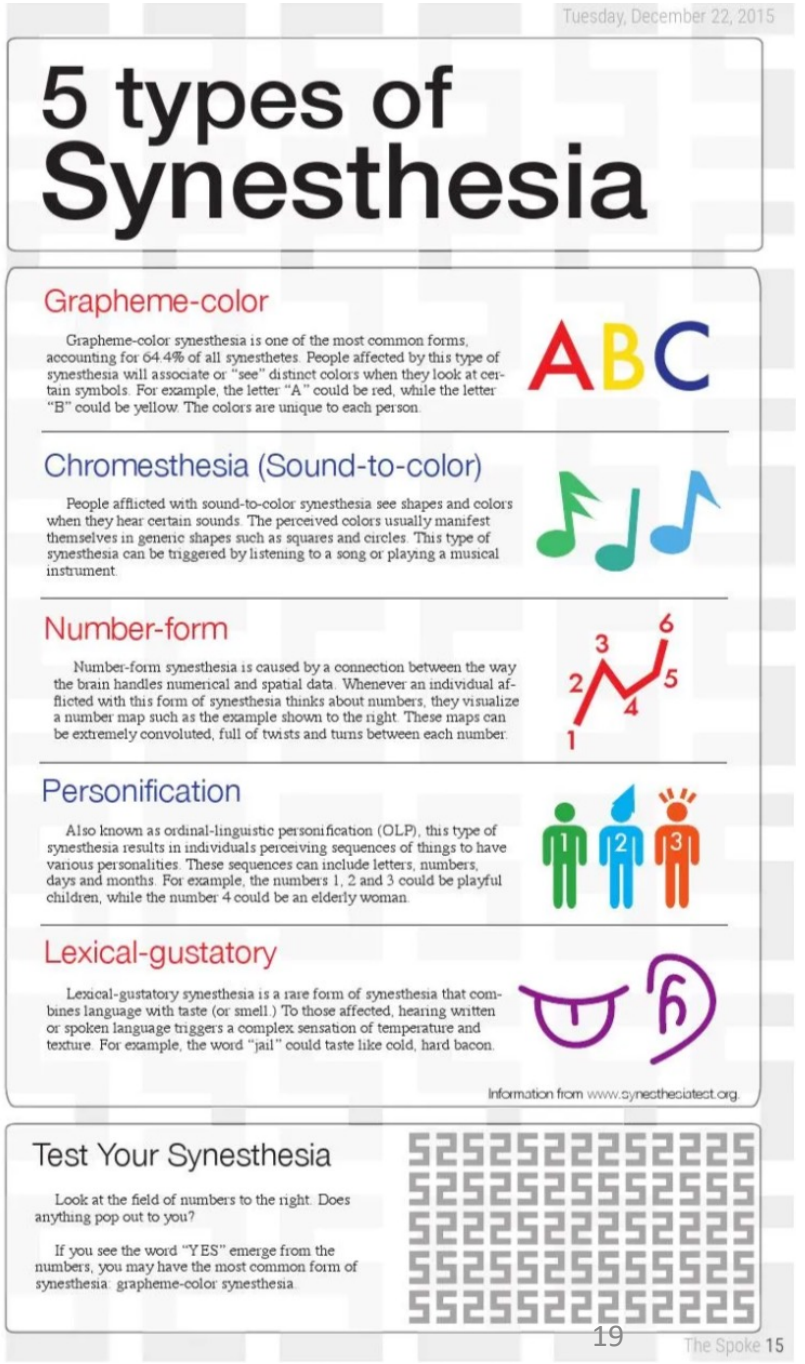
      - Phonetic similarity (sound similar)
      - Color terms (“Y is yellow”)
      - Semantic associations (“D is for dog and dogs are brown”)



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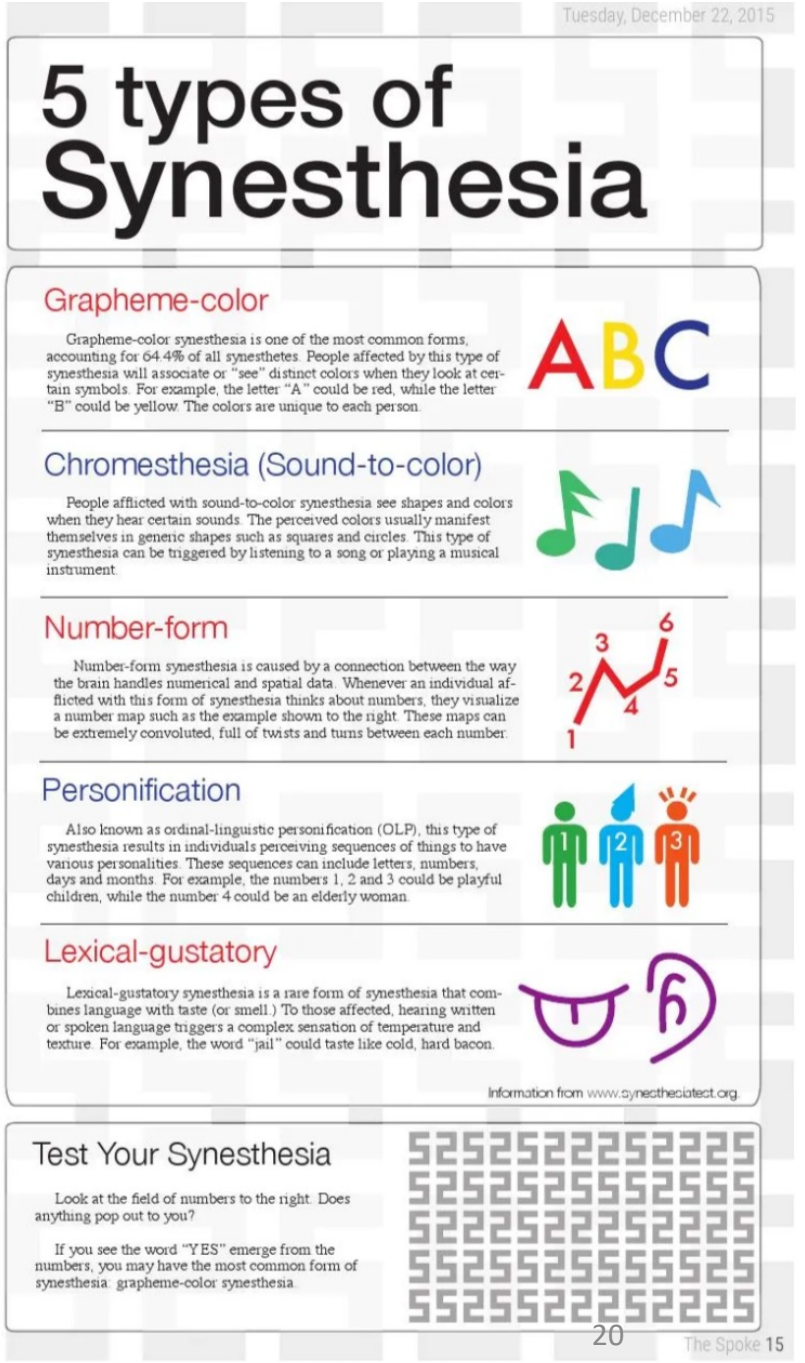

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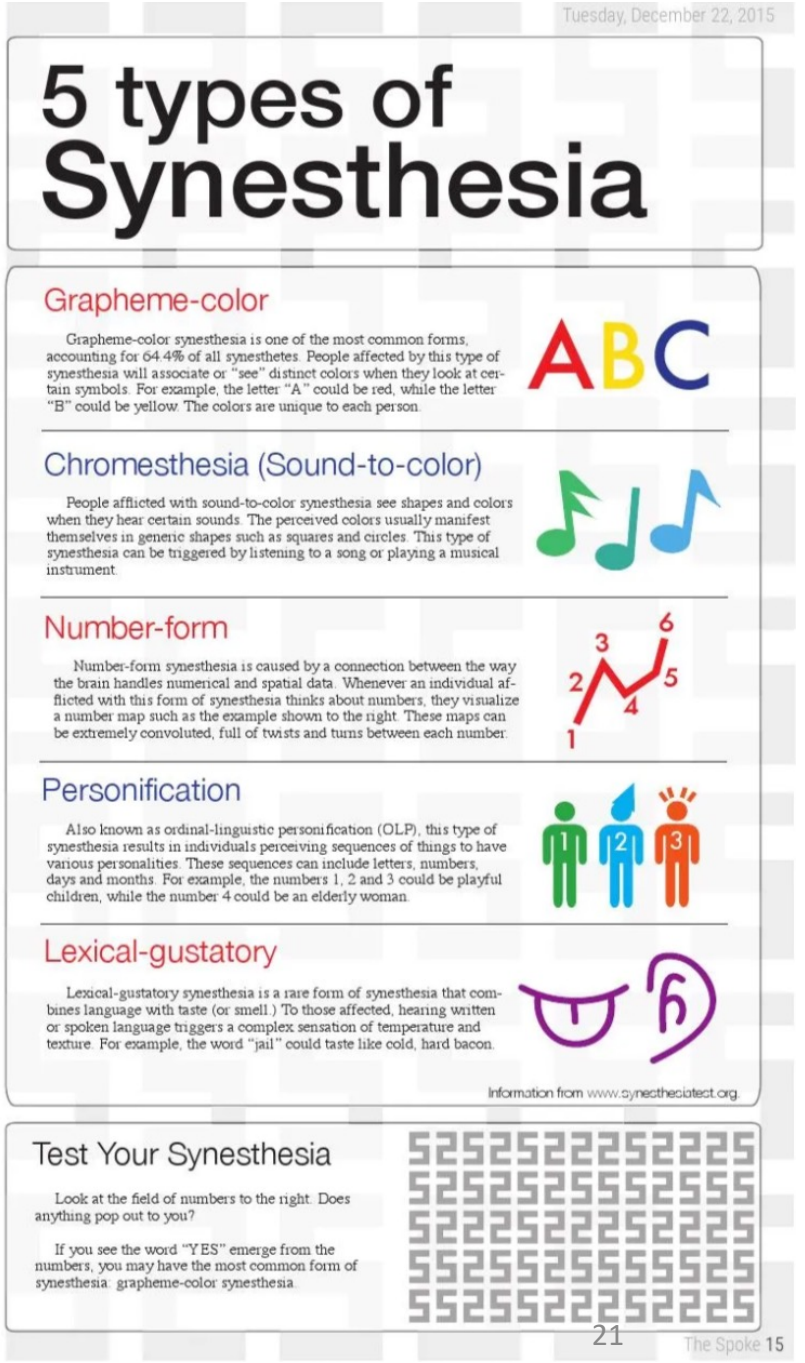
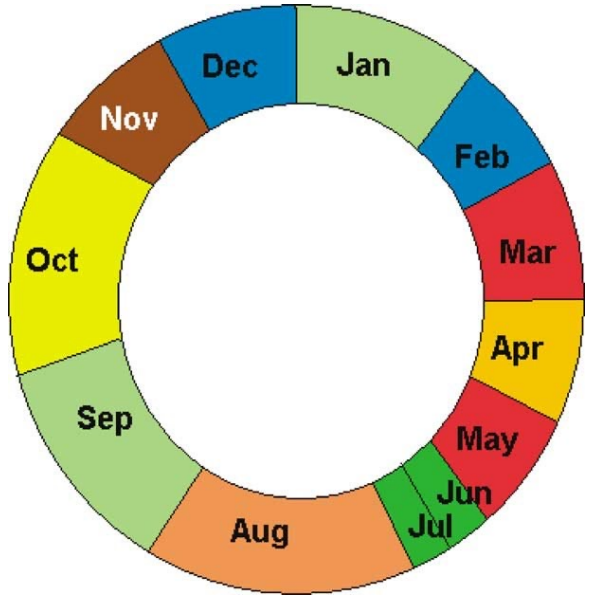
    - Associations are stable across the individual’s lifetime
    - Associations found to vary across languages and cultures (Root et al., 2021)



Synesthesia

- Associators vs Projectors
  - Associators: synesthetes who see the color “in their mind’s eye”
  - Projectors: synesthetes who see the color on top of the letter



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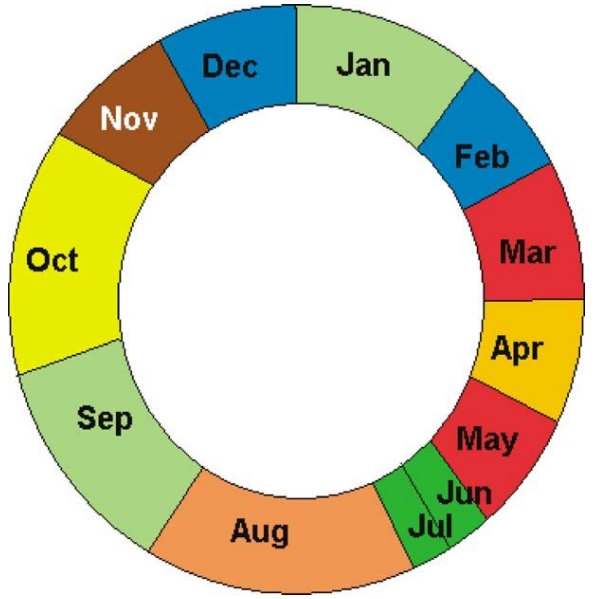
  - An example of how language can shape perception (linguistic relativity)



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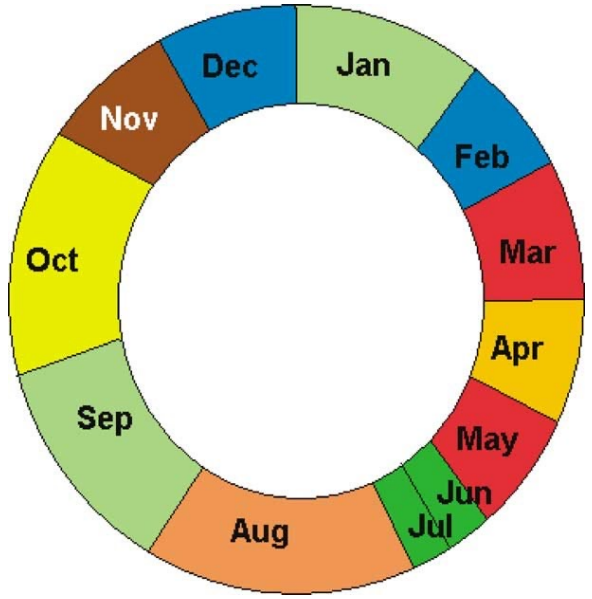
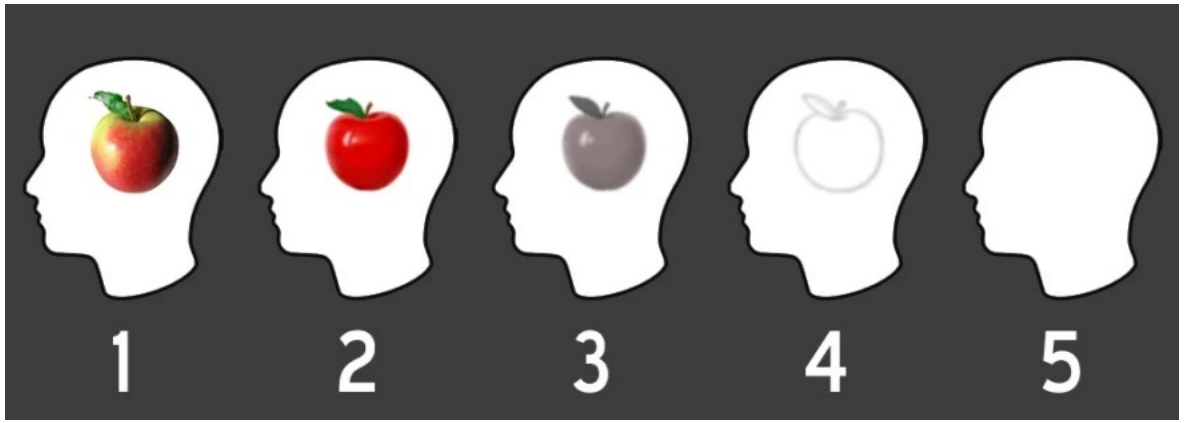
- Strong vs Weak synesthesia
  - Strong: what we’ve been discussing, activating one sensory modality in response to stimulation in another one
  - Weak: cross-modal associations expressed through language, experienced even if you’re not synesthetic
    - e.g., cross-modal metaphors in language: a *warm* color or a *sweet* smell



3. Mental Imagery and language

Mental Imagery and aphantasia

- Mental (visual) imagery: seeing absent items ‘in the mind’s eye’
- Aphantasia: absence of visual imagery ability
- Hyperphantasia: abundance of visual imagery ability



Mental Imagery and aphantasia

- Previous studies show that aphantasia is associated with...
  - Scientific and mathematical occupations
  - More difficulty with face recognition and autobiographical memory
  - Often still dream visually
  - Occurring in families more often than expected by chance
- These studies show that hyperphantasia is associated with...
  - ‘Creative professions’
  - Elevated rate of synesthesia

Zeman et al., 2020

Aphantasia and comprehension of action language

- Reading action words engages motor simulations, i.e. activation of motor-related cortical regions – does this differ in aphantasia?
- **Procedure**:
  - People with and without aphantasia read manual action sentences
  - Used TMS to triggered motor-evoked potentials (MEP) in the right index finger
    - Measured MEP amplitude (a marker for excitability)
  - Tested reading comprehension

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- **Results**:
  - 'Normal' controls: MEP increased during action reading compared to rest
  - Aphantasic individuals: No change in MEP compared to rest
    - Neurophysiological evidence for differences in motor system engagement during action sentence reading
  - Aphantasic individuals also had difficulty selecting words that best fit the context of sentences
    - Deep-level reading comprehension ability was impaired in individuals with aphantasia
  - Dupont et al. (pre-print)

Thought and internal representation

- People differ in how they experience their own thoughts
  - Visualizers: think they see thoughts ‘in their mind’s eye’
  - Verbalizers: think they hear sentences ‘in their mind's ear’
- Others report a mix of both, or have difficulty describing their inner experience

3. Inner speech and language

Inner Speech and Sign

- **Inner speech**: verbal-based inner experience
  - Also referred to as verbal thinking, inner speaking, covert self-talk, internal monologue, and internal dialogue
- **Inner sign**: some deaf individuals report internal experiences of fingerspelling, signing, and lipreading

Alderson-Day & Fernyhough (2015)

Inner Speech and Sign

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- **Inner sign**: some deaf individuals report internal experiences of fingerspelling, signing, and lipreading
- Why do we experience inner speech/sign?
  - It's proposed to have an important role in the self-regulation and executive function
  - Also proposed to be important to cognitive development in childhood
  - Shares resources with other cognitive processes, like working memory
- *Atypical processing of inner speech* has been implicated in psychotic disorders, mood disorders, and anxiety disorders

Alderson-Day & Fernyhough (2015)

Inner speech in psychotic disorders

- Inner speech is implicated in auditory verbal hallucinations (AVHs)
  - AVHs: the experience of hearing a voice in the absence of any speaker
  - Typically associated with schizophrenia, but can occur in other populations as well

- AVHs may be due to a misattribution of inner speech as coming from an external source
  - Some studies show self- and source-monitoring deficits in individuals who experience AVHs
  - Neuroimaging studies demonstrate activation of language networks during AVHs

Inner Speech in mood disorders

- Rumination: repetitive concentration on negative thoughts
  - A well-known feature of depression, and often described to be verbal in nature
  - ‘Overly evaluative forms of inner speech’ correlate to low self-esteem in university students (Alderson-Day et al., 2014)

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- Mortiz et al (2014) asked people with mild and moderate depression to complete the Sensory Properties of Depressive Thoughts Questionnaire
  - Questionnaire asks about bodily/tactile experiences, visual sensations, and auditory properties, such as experiencing an “inner critic” about depressive thoughts/ruminations
  - **Results**:
    - Auditory properties were reported by 31% of the sample
    - Visual experiences (27%)
    - Bodily experiences (40%)

Inner Speech in anxiety disorders

- Worry: repetitive thinking that is negative, uncontrollable, and often aimed at problems with no clear solution

- Studies have found that worrying is linked to verbal processes
  - Stokes and Hirsch (2010) asked a group of self-reported high worriers to engage in either visual imagery or verbal thinking about a worrying topic
    - Found that verbal worrying was correlated with an increase in negative intrusive thoughts, while visual imagery was associated with a decrease in intrusive thoughts

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  - Behar et al. (2005) asked people with GAD and posttraumatic stress disorder traits to report on their verbal thoughts and mental imagery during recall inductions for worry and trauma
    - Worry experiences were mostly verbal in form, while trauma recall was mostly imagery-based