

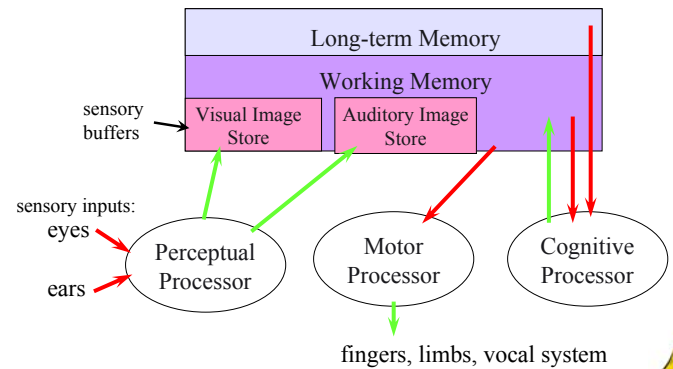
CMPE 80A: Universal Access: Disability, Technology, and Society



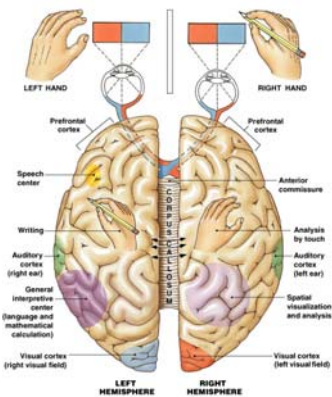
Learning and Cognitive Disabilities



Memory and the world



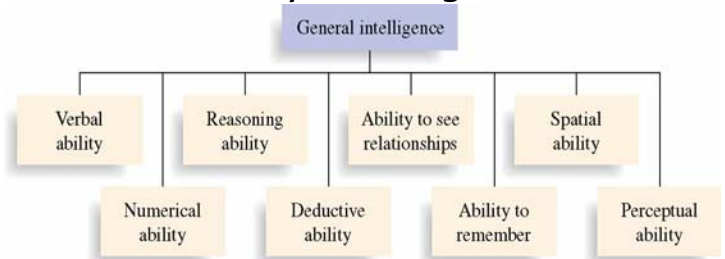
The Mind



- ▶ In most people, left brain controls:
 - reading, writing, and math
 - decision-making
 - speech and language
- ▶ Right cerebral hemisphere relates to:
 - senses (touch, smell, sight, taste, feel)
 - recognition ([faces](#), voice inflections)
- ▶ Prefrontal cortex:
 - integrates sensory info
 - performs abstract intellectual activities (e.g., predicting consequences of actions)



Memory and Cognition



- ▶ Different types of memory:
 - Episodic – things you have done (personal experiences)
 - Semantic – facts and concepts
 - Prospective – things you intend to do (go shopping, visit friends, make and keep appointments)



Cognitive Disorders

- ▶ Four major types listed in the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders)

1. Delirium

- ▶ Impaired consciousness & cognition for hours or days
- ▶ Appear confused and disoriented
- ▶ Cannot focus
- ▶ Impaired memory and language
- ▶ 10-15% → acute care facilities
- ▶ Quick recovery after treatment
- ▶ Most prevalent in older adults, patients undergoing medical procedures, cancer and AIDS patients
- ▶ Associated medical conditions
 - Intoxication by drugs
 - Withdrawal from drugs
 - Infections
 - Brain traumas



Cognitive Disorders

2. Dementia

- ▶ Progressive deterioration of brain functions including memory, language, judgment, attention, and other cognitive domains
- Incidence is higher among older adults (but can occur at any age)
 - ▶ 1% among 65-74 yrs of age
 - ▶ 4% among 75-84 yrs of age
 - ▶ 10% among 85 yrs and older
 - ▶ Women > men (women live longer)
- Causes: Abuse of drugs, infection, Alzheimer's, Cerebrovascular events, Parkinson's, Huntington's



Cognitive Disorders

2. Dementia of Alzheimer's type

- Most common type of dementia
- Multiple cognitive deficits that develop gradually
- Inability to incorporate new information
- Main symptom: Memory loss
- Forget important events/lose objects
- Aphasia → Difficulty with language
- Apraxia → Impaired motor functioning
- Agnosia → Failure to recognize objects
- Impaired Executive Functioning → Coordination of behavior to achieve a goal
- Neurofibrillary tangles → Abnormal bundles of filaments in nerve cells in the brain



Dementia Test: Mini Mental State Exam

1. What date is today? (5)
2. Where are we? (5)
3. Repeat 3 common objects (3)
4. Spell WORLD backward (5)
5. Repeat the objects in 3 (3)
6. Name these 2 objects (2)
7. Repeat "no ifs, ands, or buts." (1)
8. Do: "Take a paper in your right hand, fold it in half, and put it on the floor." (3)
9. Read and obey "Close your eyes" (1)
10. Write a sentence (1)
11. Copy this drawing (1)



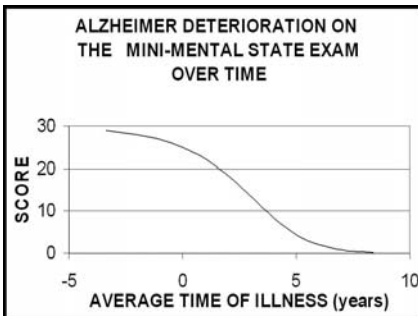
▶ Scores

- 24 – 30: "normal" range
- 20 – 23: mild cognitive impairment or possible early-stage/mild Alzheimer's disease
- 10 – 19: middle-stage/moderate Alz
- 0 – 9: late-stage/severe Alz



Alzheimer Signs (Alz Assoc)

1. Recent memory loss affecting job
2. Difficulty performing familiar tasks
3. Problems with language
4. Disorientation to time or place
5. Poor or decreased judgment
6. Problems with abstract thinking
7. Misplacing things
8. Changes in mood or behavior
9. Changes in personality
10. Loss of initiative



Cognitive Disorders

2. Vascular Dementia (Stroke)

- Progressive brain disorder
- Blockage or damage to blood vessels
- Onset is often sudden
- Variable impairments
- Motor problems and weakness in limbs
- Prevalence
 - ▶ 1.5% in age 70 to 75
 - ▶ 15% in age 80 or older
 - ▶ Men > Women → Higher rates of cardiovascular disease
- Death from infection: pneumonia or weak immune system



Cognitive Disorders

3. Amnestic disorder

- Inability to learn new information
- Inability to recall previously learned information
- Intact global cognitive functioning
- Multiple causes
 - ▶ Industrial solvent, mercury, lead, insecticides
 - ▶ Head trauma
 - ▶ Long-term drug use
- Wernicke-Korsakoff Syndrome
 - ▶ Chronic heavy alcohol use
 - ▶ Thiamine deficiency → thiamine treatment will prevent further damage but does not restore memory
 - ▶ Thalamic damage



Cognitive Disorder: 4. Schizophrenia

- ▶ DSM subtypes; paranoid, undifferentiated, disorganized, catatonic
- ▶ Impaired ability to perceive, understand and interpret the environment.
- ▶ Impaired function - social and motivational
- ▶ Behavioral syndrome - positive and negative symptoms
- ▶ Onset in late teens to early 20s
- ▶ Males and females equally affected but females have later onset and better functional outcome
- ▶ Genetic: 10% for first degree relative or fraternal twin, 50% for monozygotic twin
- ▶ Environmental factors certain but poorly characterized (intrauterine malnutrition, viral illnesses, perinatal insults, drug exposure)
- ▶ Early intervention important: medication & psychosocial

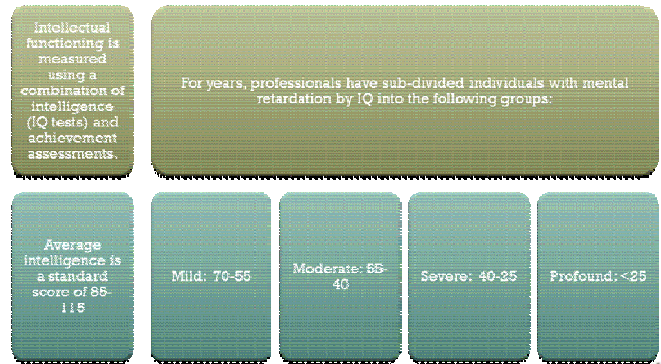


Intelligence and Learning

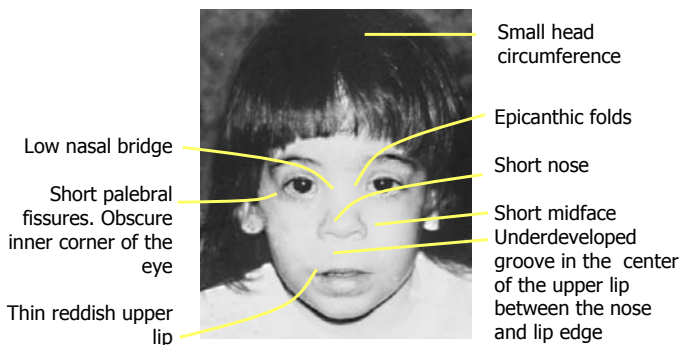
- ▶ Gardner (1983): Frames of Mind: The Theory of Multiple Intelligences
 - The brain has evolved over millions of years to be responsive to different kinds of content in the world
 - All of us have computers that respond to those contents
 - The strength or weakness of one computer doesn't particularly correlate with the other computer
- ▶ Learning styles
 - Visual/Spatial: Learning through seeing
 - Verbal/Linguistic: Learning through hearing
 - Body/Kinesthetic: Learning through doing/moving/touching
 - Logical/Mathematical: Learning through numbers
 - Musical/Rhythmic: Learning through music
 - Inter/intrapersonal: Learning through others'/inner emotions



Intelligence Functioning



Mental Retardation



Learning Disabilities

- ▶ Neurologically-based processing problems
- ▶ Interfere with learning basic skills such as reading, writing, or math
- ▶ Can also interfere with higher level skills such as organization, time planning, and abstract reasoning
- ▶ The types of LD are identified by the specific processing problem:
 - Input: getting information into the brain
 - Organization: making sense of this information
 - Memory: storing and later retrieving this information
 - Output: getting this information back out when needed



Learning Disabilities: Dyslexia

- ▶ Impaired brain's ability to translate written images received from the eyes into meaningful language.
- ▶ Occurs in individuals with normal vision, speech and intelligence → 1 in 5, carried into adulthood
- ▶ Individuals with dyslexia commonly have the following problems
 - ▶ Reversals of letters (b for d), (p for q)
 - ▶ Reversal of words (saw for was)
 - ▶ May try to read from right to left
 - ▶ May fail to see similarities and differences in letters/words
 - ▶ May not recognize the spacing that organizes letters into separate words,
 - ▶ Unable to sound out the pronunciation of an unfamiliar word



What those with Dyslexia see

of design, font, type size, contrast and layout, are the focus. The colour of a font, such as light, regular, medium and bold create a certain contrast with the background. The challenge is to find the right contrast (character colour and paper colour) that complements the characters. This can be accomplished with the right weight of a typeface in combination with the right colour paper, avoiding the washout-effect.

references regarding all readers, dyslexics in particular, centred can be used for readings articles. Aligned right and justified causes problems, aligned left causes confusion with flowing to the next line. Justified text creates non-consistency of word spacing, and this can lead to the river-effect distortion. Very important is the strong advice against hyphenation, hyphenated words split and there fore causes difficulty in comprehension. As an overall remark I'd like to emphasise not to provide a 'learn-how-to-read' visual, but to focus on clarity, consistency and space, used initials

Read Regular is created without copying or mirroring shapes. Therefore the frequency of repeated shapes in a text is decreased. This results in a minimum chance of visual distortions (swirl-effect). The aim is to create interesting typography that will maintain the readers' interest and will prevent them from getting bored or frustrated. Diversity in text knows many variations. We must understand the fact that typography for a novel is different from a magazine or a publication for education. Even so a novel has the potential to be clear and interesting. This can be achieved in any level of creativity, thinking on type size, reading, the amount of words on a sentence and the character/paper combination.

Washout effect

River effect

Swirl effect



Chinese Characters

- ▶ Pictographs (≈4%) → drawing of real-life objects
 - Man 人 sun 日 mountain 山
- ▶ Ideographs (≈1%) → positional and numeral concepts by indication
 - One 一 up, above 上
 - Two 二 lower, below 下
 - Three 三
- ▶ Logical Aggregates (≈13%) → Form a new meaning by combining the meanings of two or more characters
 - Wood 木 Small Forest 林 Big Forest 森
 - Person 人 Small Group 从 Large Group 众
- ▶ Phonetic Complexes (≈82%) → combining the meaning of one character and the pronunciation of another character
 - (water) + 其 = 淇 (the river)



Dyslexia in Chinese

- ▶ Different parts of the brains are activated
 - Learning Chinese = areas for remembering visual patterns.
 - Learning English = areas for phoneme processing.
- ▶ It's possible to have dyslexia in English but not in Japanese/Chinese

Semantic error (with visual error)		Orthographic/visual error		Auditory/phonological - homophones	
Target	Result	Target	Result	Target	Result
病	痛	聰	聽	鄰	輪
S: "Illness" P: beng [6]	S: "Pain" P: tung [3]	P: chung[1] S: clever	P: ting[3] S: listen	P: lun[4] S: neighbour	P: lun[4] S: wheel



Arabic Language

- ▶ Alphabetic - 28 letters
 - ▶ Consonants - letters
 - ▶ Vowels - diacritics
 - ▶ Cursive script
 - ▶ Bi-Directional
 - Letters: RTL
 - Numbers: LTR
 - ▶ Orthography
 - Deep – no vowels
 - Shallow – diacritics/vowelized
- e.g.: In English **hrd** : hard, hired, heard, herd

- ▶ Similar difficulties in
 - Phonological processing
 - Memory
- ▶ Differences
 - Orthography demands higher phonological processing and/or visual-spatial processing



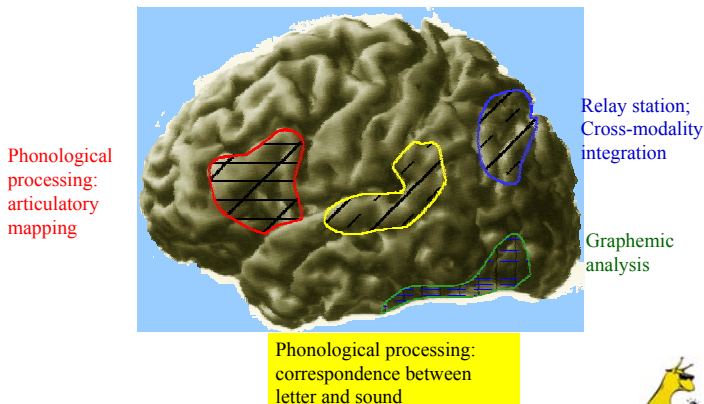
Deep vs. Shallow Orthography

Shallow orthography

Deep orthography



A Theoretical Model for the Brain Circuit for Reading



Dyscalculia

- ▶ Having huge problems in math, in spite of being of normal intelligence
- ▶ Problems with:
 - "Linguistic" skills: understanding or naming mathematical terms, operations, or concepts, and decoding written problems into mathematical symbols
 - "Perceptual" skills: recognizing or reading numerical symbols or arithmetic signs and clustering objects into groups
 - "Attention" skills: copying numbers or figures correctly, remembering to add in "carried" numbers, and observing operational signs
 - "Mathematical" skills: following sequences of mathematical steps, counting objects, and learning multiplication tables
- ▶ Caused by:
 - Visual-spatial difficulties
 - Weakness in visual processing of numbers and mathematical notations



Dysgraphia

- ▶ Neurologically caused writing disability
- ▶ Pain while writing:
 - The pain usually starts in the center of the forearm and then spreads along the nervous system to the entire body.
- ▶ Symptoms:
 - May have illegible printing and cursive writing despite appropriate time and attention given the task
 - Shows inconsistencies: mixtures of print and cursive; upper and lower case; or irregular sizes, shapes, or slant of letters
 - Has unfinished words or letters, omitted words
 - Inconsistent spacing between words and letters
 - Exhibits strange wrist, body, or paper position
 - Has difficulty pre-visualizing letter formation
 - Can copy a section of text but not knowing what it says
 - Shows poor spatial planning on paper



Dyspraxia

- ▶ An impairment in the ability to plan skilled, non-habitual movements
- ▶ An impairment in the ability to relate the sequence of motions to each other
- ▶ Occurs since birth or at very young age
- ▶ Different from apraxia:
 - Adult condition: Disorder of learned movement or loss of ability due to brain damage
- ▶ Types:
 - Oral: difficulty in movements of tongue, cheeks, lips and jaw
 - Postural: inability to assume unusual or unaccustomed positions or postures involving motor planning
 - Constructional: inability to create, assemble, join or articulate parts to get a single structure



Attention Deficit Hyperactivity Disorder

- ▶ Used to be called "*minimal brain damage*", then "*minimal brain dysfunction*", it is neurological.
- ▶ Runs in families, 75% carries into adulthood
- ▶ 5-10% also have learning disabilities
- ▶ Symptoms
 - Lack of social skills, unpopular, need to be first
 - Needs are imperative, now, can not wait
 - Lower threshold for stimuli (ADHD a misnomer)
 - Distractability, inability to pay attention
 - Hyperactivity (more in boys than girls)
 - Impulsivity (doing things without thinking of the consequences)
 - Irritability (short fuses)



ADHD Tests

- ▶ Problems with ADHD
 - Attention
 - Disinhibition of behavioral responses
 - Working memory
 - Planning
 - Verbal fluency
 - Perseveration
 - Motor frequency
- ▶ Disinhibition of behavioral responses
 - Stroop, CPT, Go No-Go
- ▶ Working memory
 - Arithmetic, Digit Span, Trails
- ▶ Verbal fluency
 - FAS (generate words)
- ▶ Perseveration
 - WCST (Wisconsin Card Sorting Test), Trails
- ▶ Motor frequency
 - CPT (Continuous Performance Test)

