

Ch. 15: New directions

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New directions

- New Theory
 - Cognitive-behavioral
- New Computerized & Tools
 - Psychophysiology
 - Traditional Test administration
 - Computer-Aided Interview
 - Computer-Administered test
 - Test scoring
 - Internet/web-based tools

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Clinical Example

- 7 year old boy presents with weight loss secondary to reluctance to eat other than a few foods (cereal, PB&J, plain spaghetti)
- At age 4 he had illness for 25 days during which he could not swallow solid food
- Parents are desperate “Isn’t there some test you can give him to determine what’s wrong?”
- IQ test - high average
- Interview & projective tests suggest eating disorder is related to trauma re: illness

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Clinical Example 2

- Medical model:
 - reluctance to eat is a symptom of deeper problem
 - find the cause and treat it, and the symptom(s) will get better
- Cognitive-behavioral model:
 - the original causes (if any) are in the past and can’t be changed.
 - the eating behavior itself is the problem, and the focus of treatment.
 - the symptom IS the disorder

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Clinical Example 3

- CBT set up a treatment regimen:
 - mother would monitor eating behavior
 - point system
 - rewards (toys, etc.) given for points
- Results:
 - problems greatly reduced in a few weeks.
 - treatment stopped but new (proper) eating behavior persisted

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Traditional vs. CBT

- Traditional assessment & testing are focused on finding patterns of psychopathology with a goal of diagnosis -- finding the cause of the illness.
- Diagnosis may lead to treatment, which may lead to cure, but this is indirect.
- In CBT, the test is a measure of the problem and also is a measure of the treatment.

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Psychophysiology

- Under CBT, physical measures are considered to be more “objective” or “observable”
- Examples:
 - GSR (galvanic skin response) -- sweating
 - heart rate (pulse)
 - blood pressure
 - sexual response / arousal
 - pupil dilation
- These measures can be correlated with various cognitive & emotional processes

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State of the art?

- Clinical Psychology has lagged in embracing computerized tests and assessment
- In 2020, many major tests are still widely given using paper & pencil versions with hand-calculated scoring
- Few standards exist for sharing clinical / research data.
- Most psychological tests are based on theories that pre-date the cognitive revolution (1960s)
- Why the slow adoption?

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Slow adoption of technology...

- Clinical Psychology is not a medical discipline -- pressure to standardize and cut costs has been limited
- Computer phobia? (Perhaps in researchers, but probably not in patients)
- Generational?
- Intellectual Property / profit concerns?
- Field is still young -- hasn't had breakthroughs similar to other fields (genetics, physics etc.)

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Aided- or Administered-

- Computer-aided tests are traditional tests given by a clinician with the computer helping sequence items and phrase questions.
- Computer-administered tests are traditional tests given entirely by computer.
- Both generally show reliability & validity equal to that of the paper & pencil tests they are based on.
- Computer-administered tests often show reduced defensiveness -- people are more willing to admit embarrassing symptoms.

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New computer tests

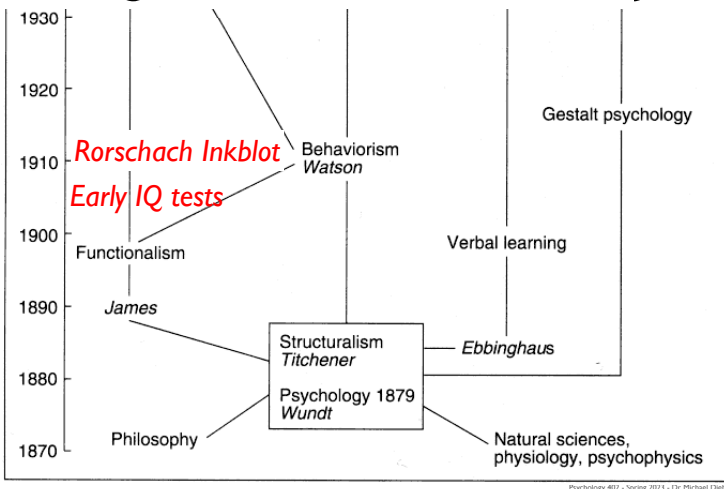
- New theories being applied:
 - cognitive / neuroscience
 - non-human animal research
 - computer science / cognitive science / AI
- New methods being used:
 - fast presentation of stimuli
 - accurate measurement of responses
 - scoring
 - adaptive tests

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Cognitive Science History

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Cognitive Psychology Theory

- Mental processes exist!
- Mental processes can be studied scientifically (by using speed or accuracy as DV's).
- Human beings are active information processors.
- Humans are not necessarily special :
 - it should be possible to deconstruct and reconstruct mental processes in other substrates (e.g. a computer)
 - non-human primates and lower animals are on a continuum with humans

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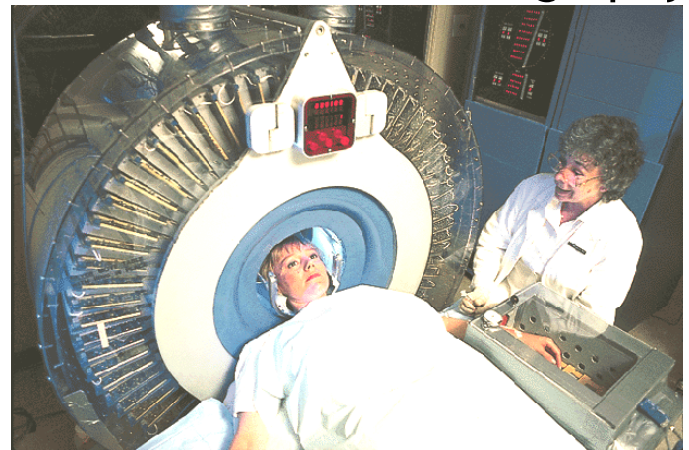
Tools & Techniques

- Brain Imaging
 - Structural
 - CAT, MRI
 - Functional
 - PET, fMRI, MEG
- Electrophysiology
 - EEG
 - ERP

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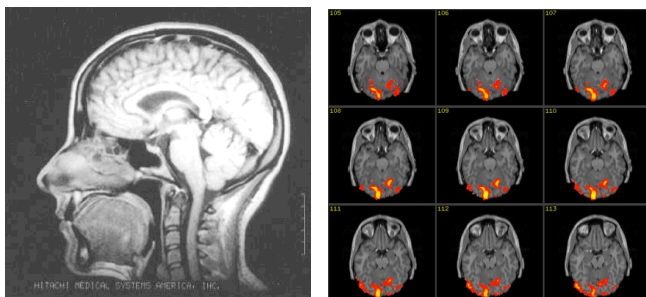
Positron Emission Tomography



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MRI and fMRI



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EEG and ERP



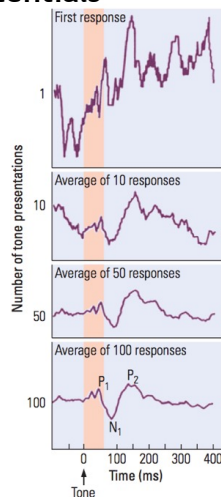
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ERP - Event-Related-Potentials

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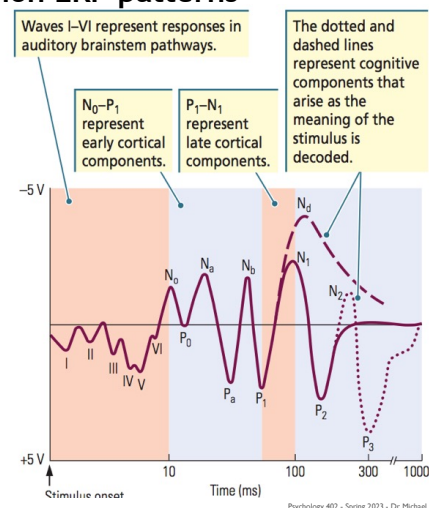
- Can you see “thinking” by watching EEG?
- In a single recording: No, it's too noisy
- By statistically averaging multiple events, a pattern emerges



Common ERP patterns

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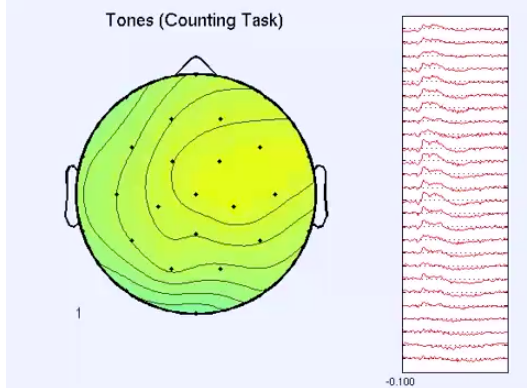
- (P)ositive and (N)egative waves
- Early waves in brainstem (I, II, III, IV, V, VI)
- Later waves in cortex (N0, P0...N3, P3)
- Image: ERP in Parietal Cortex in response to spoken word



Multi-electrode ERP

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An individual's event-related potentials (ERPs) to tones in a simple tone counting task. Right column plots ERPs at 26 scalp electrodes (negative is up). Voltage is represented in color on the cartoon head (cool=negative, warm=positive). Time (in seconds) is printed at the bottom of the column of ERPs. Most prominent ERP deflection is the auditory N1 that peaks around 100 ms post-stimulus.



MEG : magnetoencephalography

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- Maxwell-Faraday equation - relates change in Electrical potential (voltage) “E-field” to change in magnetic field “B-field”
- Electrical voltages : can be measured with cheap equipment
- Magnetic fields : measured with fancy equipment
 - SQUIDs : Superconducting quantum interference device
 - Requires liquid helium
 - \$\$\$
- Pro: higher resolution

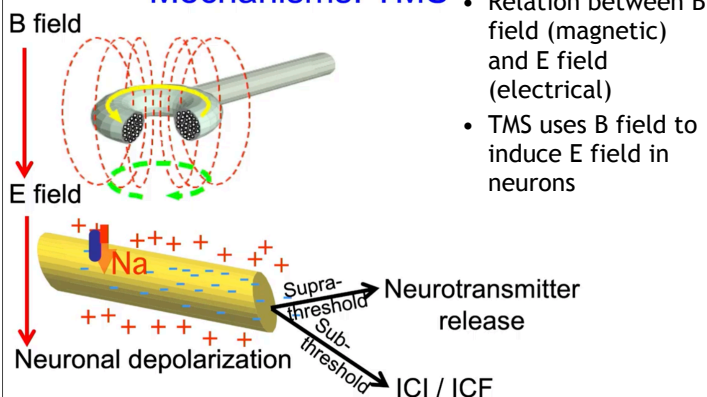
$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$



Transcranial Magnetic Stimulation

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Mechanisms: TMS

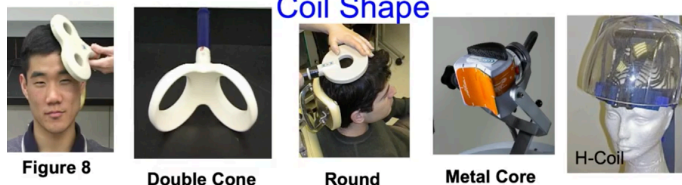


- Relation between B field (magnetic) and E field (electrical)
- TMS uses B field to induce E field in neurons

Transcranial Magnetic Stimulation

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Magnetic Field Characteristics: Coil Shape



Modern Trends

- Computerized Standards for Assessment
 - NIH Toolbox
- 'mHealth' products
 - personal / mobile hardware & software
- Machine Learning (ML), Large Language Models (LLM) and Artificial Intelligence (AI)
 - ChatGPT 4

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NIH Toolbox

- Attempt to make worldwide standard for neuropsychological assessment

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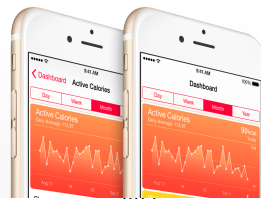
mHealth (mobile health)

- Handheld technology
- on-site rather than in hospital
- personal vs. professional



Health.
An entirely new way to use you
health and fitness information.

The new Health app gives you an easy-to-read dashboard of your health & fitness data. And we've created a new tool for developers called HealthKit which allows all the incredible health and fitness apps to work together, a work harder for you. It just might be the beginning of a health revolution.



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Apple Heart Study

- Using digital watch to look for heart rhythm irregularities



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Chat GPT

- Large Language Model (LLM) trained on much of the writing on the internet
- Issues of "hallucinations", harmful recommendations, and bias

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