

# 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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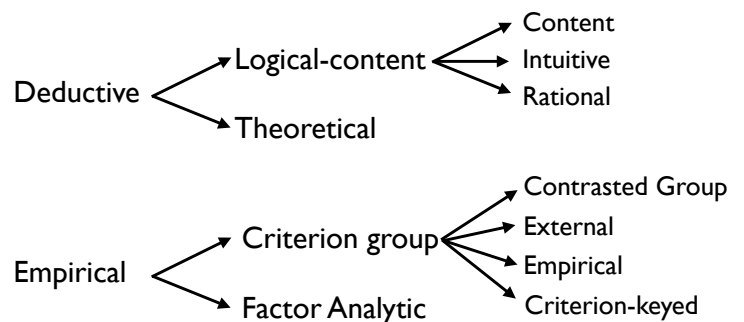
## Clinical Example 2

- 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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## Design Theories



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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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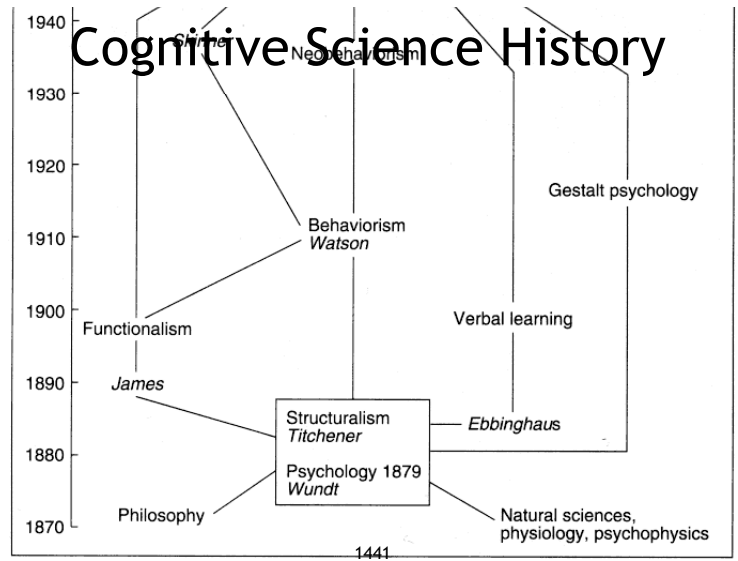
## New computer tests

- 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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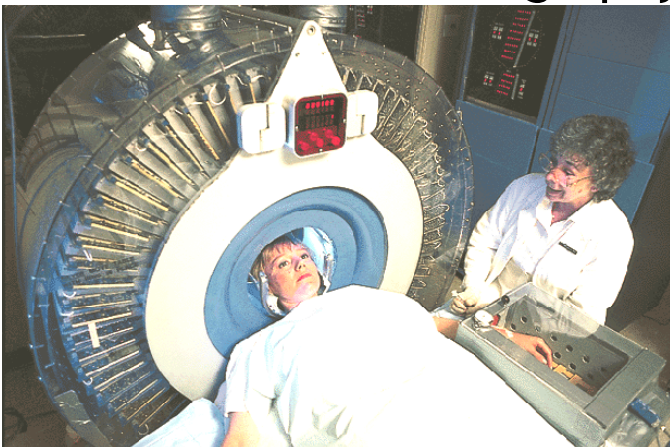
## Tools & Techniques

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

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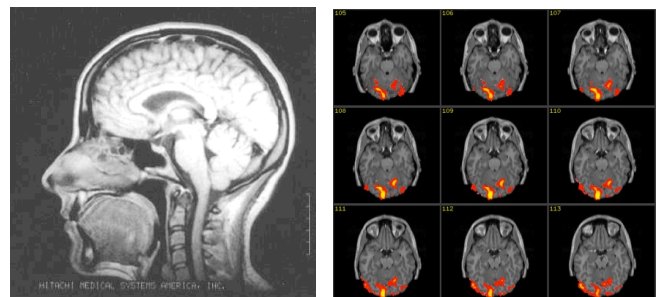
## Positron Emission Tomography



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## MRI and fMRI



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# EEG and ERP



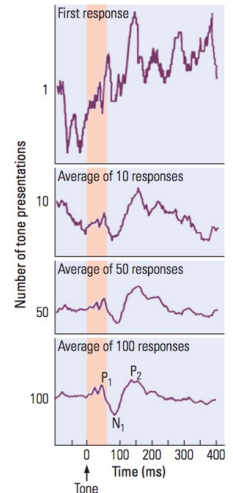
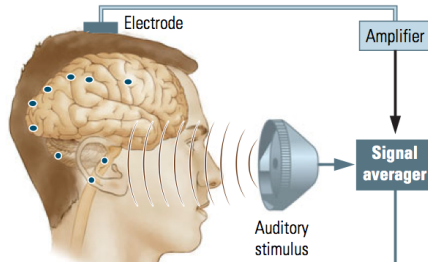
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## ERP - Event-Related-Potentials

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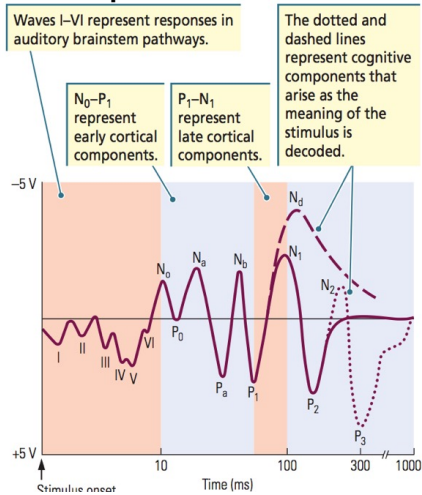
- Can you see “thinking” by watching EEG?
- In a single recording: No, it's too noisy
- By statistically averaging multiple events, a pattern emerges



## 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

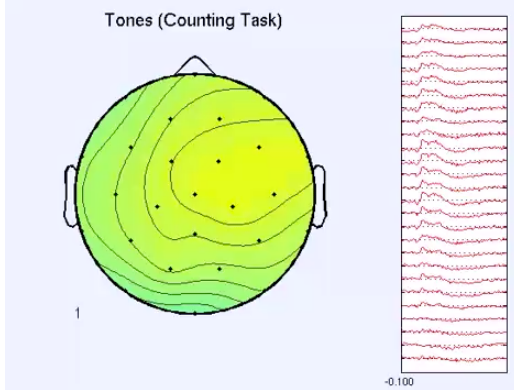


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## Multi-electrode ERP

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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.



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## MEG : magnetoencephalography

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- Maxwell-Faraday equation - relates change in Electrical potential (voltage) “E-field” to change in magnetic field “B-field”

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

- 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

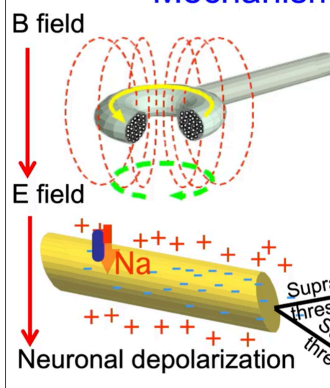


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## Transcranial Magnetic Stimulation

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### Mechanisms: TMS



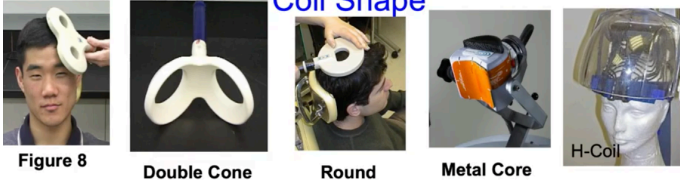
- Relation between B field (magnetic) and E field (electrical)
- TMS uses B field to induce E field in neurons

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## Transcranial Magnetic Stimulation

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### Magnetic Field Characteristics: Coil Shape



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## Modern Trends

- NIH Toolbox
- 'mHealth' products

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## NIH Toolbox

- Attempt to make worldwide standard for neuropsychological assessment

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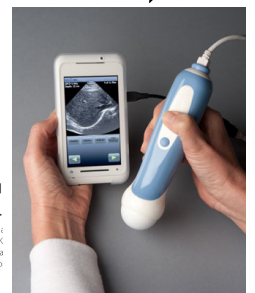
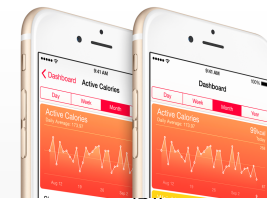
## mHealth (mobile health)

- 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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