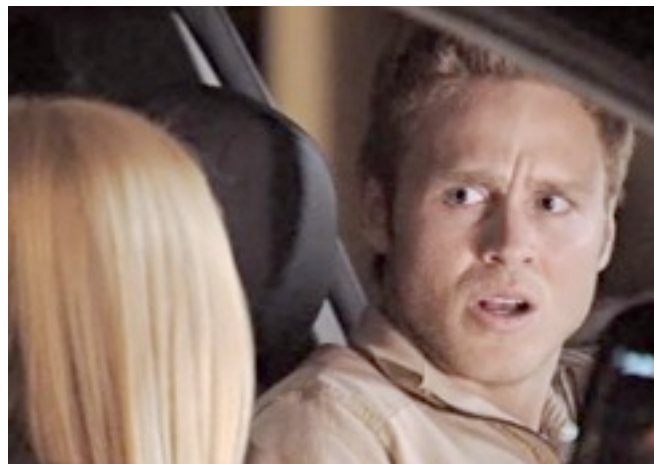# Lecture 3: Lab in Human Cognition

**Todd M. Gureckis**
Department of Psychology
New York University

# How do people remember?

- Remembering is so commonplace to almost be obvious... it is our ability to use past experience to inform our current experience.

- It has long been recognized that there a really multiple forms of remembering

*Which people have you seen before*

*What is my grandma's phonenumber?*

# How do people remember?

- Remembering is so commonplace to almost be obvious... it is our ability to use past experience to inform our current experience.

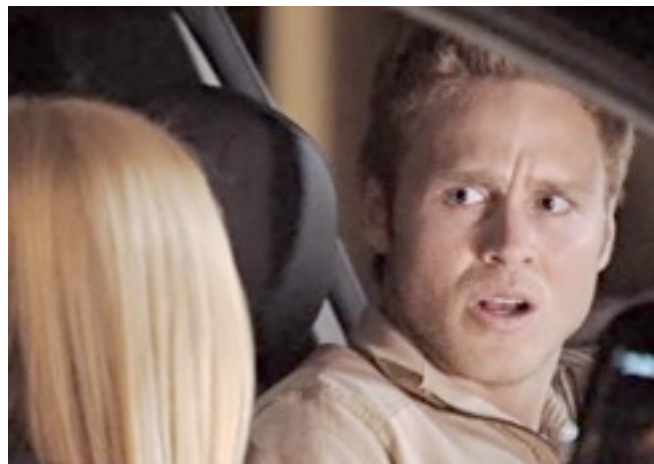- It has long been recognized that there a really multiple forms of remembering



*RECOGNITION*



*RECALL*

# Recognition and Recall as Two Forms of Remembering

- Even if we have some *intuition* of how they might be different, the scientific question is how do these forms of memory retrieval or remembering differ from one another?

- What are the INFORMATION PROCESSING STEPS involved in either type of retrieval?

# One Hypothesis: The Generation-Recognition Theory

- According to this theory there is really only one process of remembering and it is RECOGNITION

- RECOGNITION is a simple process... presentation of a stimulus either externally (in the world) or internally (and idea that comes to mind) causes activation of other concepts in your head.

- Successful RECOGNITION happens when the presented cues activate a concept.

# One Hypothesis: The Generation-Recognition Theory
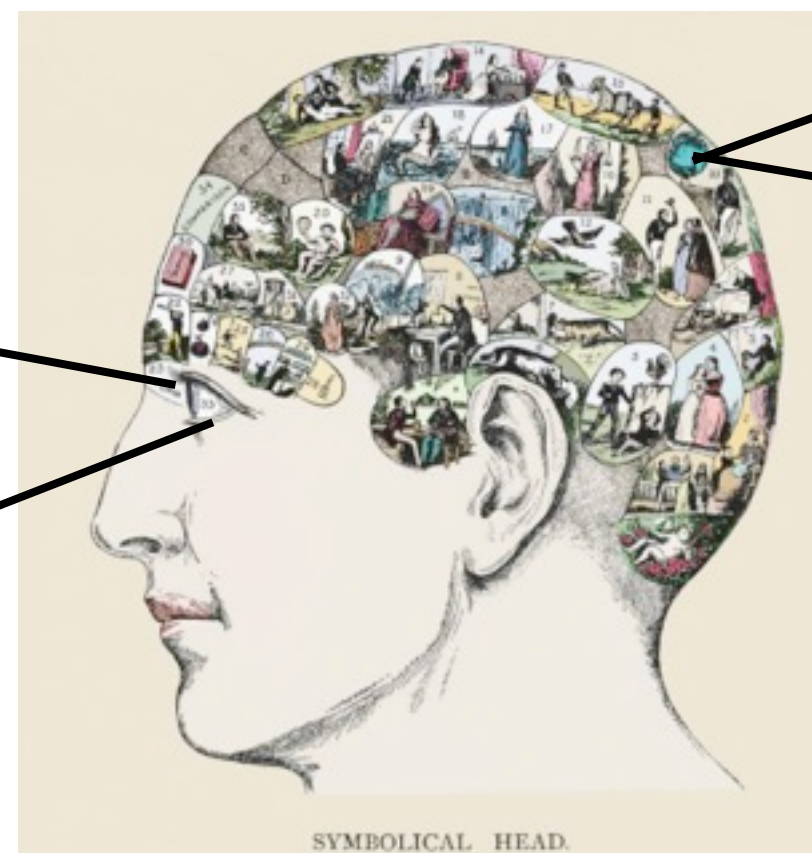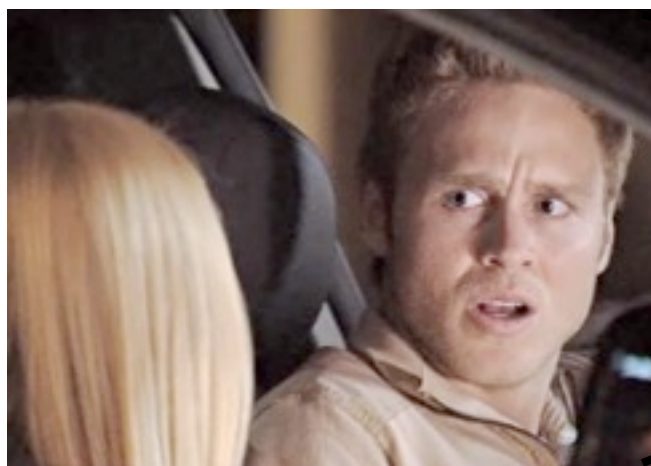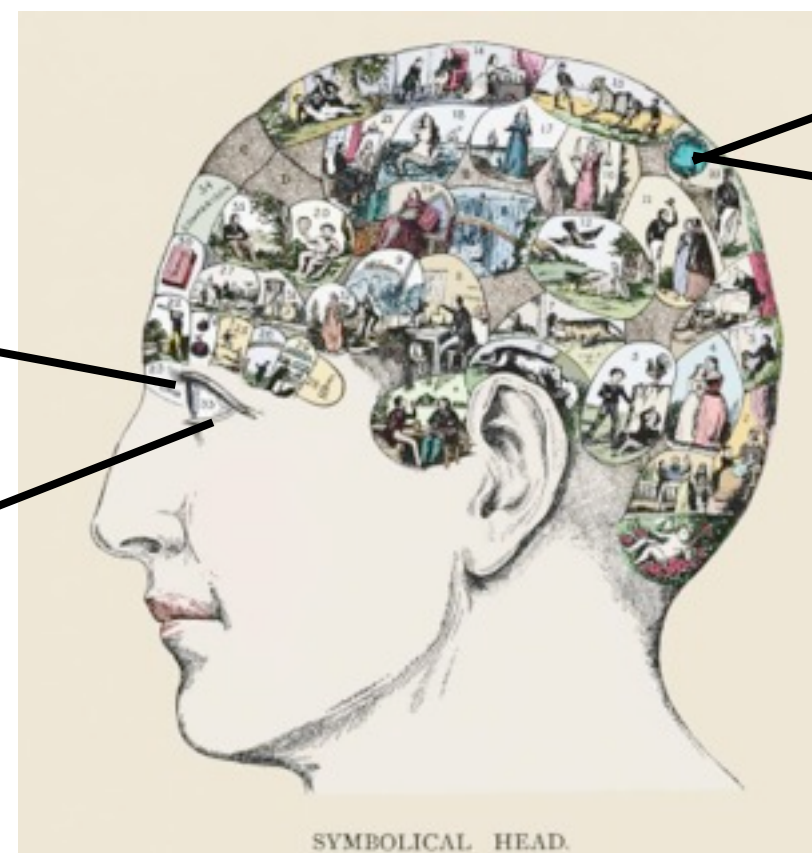
- The process of recognition



Spencer

(aka dimwit)

SYMBOLICAL HEAD.

# One Hypothesis: The Generation-Recognition Theory

- The process of recognition



SYMBOLICAL HEAD.

?

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# One Hypothesis: The Generation-Recognition Theory

- How does recall work then?

GENERATE

Grandma's

phone number

512-563-2345

512-832-2856

614-452-5782

419-034-2944

SYMBOLICAL HEAD.

# One Hypothesis: The Generation-Recognition Theory

- How does recall work then?

GENERATED LIST

RECOGNIZE

**512-563-2345**

**512-832-2856**

**614-452-5782**

**419-034-2944**



SYMBOLICAL HEAD.

**512-832-2856!!!!**

# One Hypothesis: The Generation-Recognition Theory

- Critically, according to the GENERATION-RECOGNITION hypothesis, RECALL is a **TWO STAGE PROCESS**

  - **STEP 1:** Generate a list of possible alternatives in your head

  - **STEP 2:** Apply a recognition procedure to the internal list and output the item which is recognized

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# AN INFORMATION PROCESSING THEORY

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# AN INFORMATION PROCESSING THEORY

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Abstract enough to apply to many situations.  Doesn't depend on the actual CONTENT of memory, right?  Just the stages of how ABSTRACT INFORMATION can be processed by the brain/mind.

HOORAY, WE HAVE A COGNITIVE THEORY!!

# One Hypothesis: The Generation-Recognition Theory

- Remember, a theory is only useful if it is in principal **FALSIFIABLE**!!!

- What makes something falsifiable?  It has to make a prediction about some observation we could the test with an experiment.

- No prediction, not a good theory.

- What prediction might  the GENERATION-RECOGNITION theory make?

# One Hypothesis: The Generation-Recognition Theory

- One prediction concerns the relationship between RECALL and RECOGNITION tasks.

- Remember, according to the GENERATION-RECOGNITION theory RECALL is a 2 stage processes that ultimately relies on a single memory processes - RECOGNITION

- In RECOGNITION the GENERATE step is skipped... just recognize the cues in the external world.

- In RECALL, you first GENERATE the list, the scan it with your "mind's eye" to see which of the generated set you RECOGNIZE.

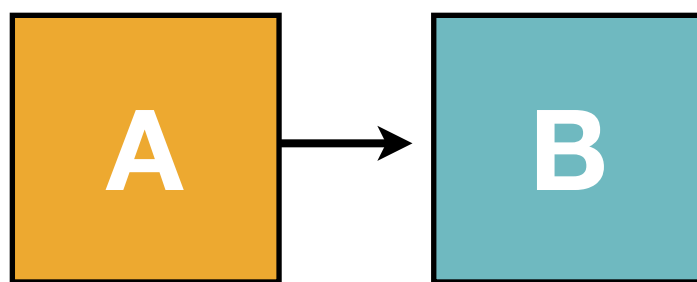# One Hypothesis: The Generation-Recognition Theory

- What can go wrong in RECOGNITION?

    - Cue not similar enough to studied cue (spencer and himself a couple years ago before he became a REAL freak)

    - Cue is present but activation of internal memory not sufficient to cause the feeling of "remembrance"

    - Cue activates some other trace more strongly (the wrong one). Maybe we confuse Spencer for a shaggy dog.

# One Hypothesis: The Generation-Recognition Theory

- What can go wrong in RECALL?

    - The internal list you generate doesn't include the target you are trying to remember

    - Your internal list you generated includes the target but you fail to RECOGNIZE it for all the reasons just listed (a failure of RECOGNITION process)
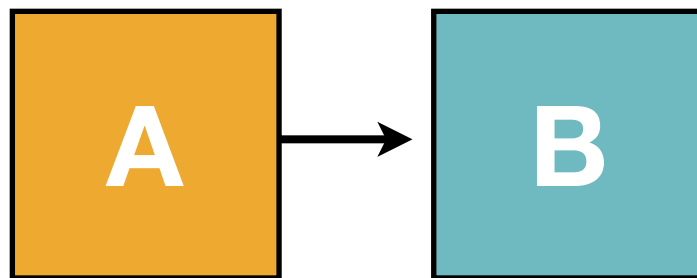
# One Hypothesis: The Generation-Recognition Theory

- If you were an engineer which system would you prefer?  Why?

# One Hypothesis: The Generation-Recognition Theory

- If you were an engineer which system would you prefer? Why?



Two things can go wrong

Three things can go wrong

# One Hypothesis: The Generation-Recognition Theory

- If you were an engineer which system would you prefer? Why?

The more things that can go wrong, the more errors the system is likely to make!

# One Hypothesis: The Generation-Recognition Theory

- If you were an engineer which system would you prefer?  Why?

Therefore, RECALL performance should always be WORSE than (OR EQUAL TO) RECOGNITION performance.

In other words, the G-R theory predicts that RECALL is HARDER than RECOGNITION.

# One Hypothesis: The Generation-Recognition Theory

- If you were an engineer which system would you prefer?  Why?

Is it?

# Our Experiment: Comparing RECALL and RECOGNITION within individuals

| | | | | |
|---|---|---|---|---|
| hand | COLD | | mail | FLOWER |
| puzzle | LIGHT | | tooth | SWEET |
| integral | NEED | | code | BABY |
| apple | GREEN | | brain | SMOOTH |
| slap | LARGE | | chimney | SMOKE |
| noise | DAY | | book | PAIN |
| sad | BLUE | | count | SHEEP |
| shower | WET | | tree | GO |
| park | BALL | | card | QUEEN |
| diver | WIND | | throat | CUT |
| application | CHAIR | | cup | BUG |
| old | MAN | | car | WASH |

# Our Experiment: Comparing RECALL and RECOGNITION within individuals

| | | | |
|---|---|---|---|
| hand | _____ | mail | _____ |
| puzzle | _____ | tooth | _____ |
| integral | _____ | code | _____ |
| apple | _____ | brain | _____ |
| slap | _____ | chimney | _____ |
| noise | _____ | book | _____ |
| sad | _____ | count | _____ |
| shower | _____ | tree | _____ |
| park | _____ | card | _____ |
| diver | _____ | throat | _____ |
| application | _____ | cup | _____ |
| old | _____ | car | _____ |

# Our Experiment: Comparing RECALL and RECOGNITION within individuals

| | | | | | |
|---|---|---|---|---|---|
| ☐ grass | ☐ baby | ☐ father | ☐ cold | ☐ stop | ☐ winter |
| ☐ flower | ☐ white | ☐ shining | ☐ boy | ☐ round | ☐ smooth |
| ☐ go | ☐ woman | ☐ run | ☐ help | ☐ clothes | ☐ sharp |
| ☐ sea | ☐ small | ☐ skin | ☐ night | ☐ cigarette | ☐ blow |
| ☐ ice | ☐ scissors | ☐ sit | ☐ bounce | ☐ light | ☐ sheep |
| ☐ cough | ☐ sour | ☐ bee | ☐ fat | ☐ yellow | ☐ sky |
| ☐ need | ☐ clean | ☐ throne | ☐ blood | ☐ queen | ☐ knife |
| ☐ big | ☐ hurt | ☐ want | ☐ child | ☐ blue | ☐ silk |
| ☐ cry | ☐ ball | ☐ cut | ☐ insect | ☐ breeze | ☐ smoke |
| ☐ crown | ☐ day | ☐ bug | ☐ rain | ☐ green | ☐ wind |
| ☐ petal | ☐ wet | ☐ money | ☐ laundry | ☐ rough | ☐ sugar |
| ☐ fly | ☐ cow | ☐ candy | ☐ sun | ☐ food | ☐ wool |
| ☐ dark | ☐ pain | ☐ pool | ☐ water | ☐ king | ☐ large |
| ☐ dry | ☐ cute | ☐ went | ☐ desk | ☐ red | ☐ man |
| ☐ wash | ☐ basket | ☐ ouch | ☐ bulb | ☐ fire | ☐ table |
| ☐ lady | ☐ rose | ☐ hot | ☐ sweet | ☐ chair | ☐ bright |

# Our Experiment: Comparing RECALL and RECOGNITION within individuals

- **Other details:**

- 2 minutes study

- 1 minute distraction task (think of phone numbers you know)

- 2 minutes test

- 1 minute distraction task (think of professors you've had)

- 2 minutes test

- 24 study pairs (12 strong, 12 weak)

- 96 test items on recognition (24 old, rest new)

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# Our Experiment: Comparing RECALL and RECOGNITION within individuals

- Two groups, two orders (RECALL first or RECOGNITION first)

- Which has higher performance?

- Can you think of any confounds in this simple design?

# Our Experiment: Comparing RECALL and RECOGNITION within individuals

| | | | | |
|---|---|---|---|---|
| hand | COLD | | @mail | **FLOWER** |
| @puzzle | **LIGHT** | | tooth | SWEET |
| @integral | **NEED** | | @code | **BABY** |
| apple | GREEN | | @brain | **SMOOTH** |
| @slap | **LARGE** | | chimney | SMOKE |
| @noise | **DAY** | | @book | **PAIN** |
| sad | BLUE | | count | SHEEP |
| shower | WET | | @tree | **GO** |
| park | BALL | | card | QUEEN |
| @diver | **WIND** | | throat | CUT |
| @application | **CHAIR** | | @cup | **BUG** |
| old | MAN | | car | WASH |

Bold @ = weak associates
Regular @ = strong associates

# Our Experiment: Comparing RECALL and RECOGNITION within individuals

- Two groups, two orders (RECALL first or RECOGNITION first)

- Which has higher performance?

- What impact does prior knowledge or prior associations play in supporting recall performance? By comparing STRONG and WEAK associates we can at least quantify how much people were falling back on prior knowledge to solve the task.

# An Alternative Hypothesis: Encoding-Specificity Theory (Tulving & Thompson)

- Critically, according to the ENCODING SPECIFICITY hypothesis retrieval based on a congruence between how information was ENCODED (or studied) and how it is accessed at retrieval.

- An example of TRANSFER-APPROPRIATE PROCESSING.

- Memory is highly context-dependent and EPISODIC in nature (it is not abstracted from the task done at encoding)

- Cues that were present and actively processed at the time of the study will be the most effective retrieval cues

# An Alternative Hypothesis: Encoding-Specificity Theory (Tulving & Thompson)

- A "Mind Hack" (we will read a chapter on this later)

- **Goal:** Easily remember a list of ten things you need to take with you when you leave the house

# An Alternative Hypothesis: Encoding-Specificity Theory (Tulving & Thompson)

| |
|---|
| Medication |
| Keys |
| Cell Phone |
| Notebook |
| Wallet |
| PDA |
| Eyeglasses |
| Handkerchief |
| Knife |
| Pen |

# An Alternative Hypothesis: Encoding-Specificity Theory (Tulving & Thompson)

| |
|---|
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |
| 7 |
| 8 |
| 9 |
| 10 |

# An Alternative Hypothesis: Encoding-Specificity Theory (Tulving & Thompson)

| Gun | Medication |
|-----|------------|
| Shoe | Keys |
| Tree | Cell Phone |
| Door | Notebook |
| Hive | Wallet |
| Sticks | PDA |
| Heaven | Eyeglasses |
| Gate | Handkerchief |
| Wine | Knife |
| Hen | Pen |

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# An Alternative Hypothesis: Encoding-Specificity Theory (Tulving & Thompson)

| 1 | Gun | Medication |
|---|---|---|
| 2 | Shoe | Keys |
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# An Alternative Hypothesis: Encoding-Specificity Theory (Tulving & Thompson)

I, GUN, MEDICATION

# An Alternative Hypothesis: Encoding-Specificity Theory (Tulving & Thompson)

- According to the ENCODING-SPECIFICITY hypothesis, RECALL performance could be greater than recognition because at study participants were encouraged to think about the PAIRS of words **in terms of one another.**

- The episodic trace from this encoding process means that the paired cue can act as a BETTER retrieval cue than the word itself!!

- Basically you didn't even really store the words, but the word pairs, and given part of the word pair you can recover the other part, but it can be hard to recognize the word alone.

# An Alternative Hypothesis: Encoding-Specificity Theory (Tulving & Thompson)

- Note this theory contradicts the GENERATION-RECOGNITION hypothesis which says recall has to be equal to or harder than recognition.

- This theory predict recall may even be EASIER than recognition.

# Third
## So, what happened in our data?

# Scoring our data

- HIT = correctly recalled word

- FA = (false alarm) memory for a word that wasn't actually presented

- CR = (correct rejection) correctly saying a word was new when it actually is new (applies to recognition only)

- MISS = not remembering a word when it was actually studied

**We need HIT/FA/CR/MISS for each person in Recognition**

**We need HIT/FA/MISS for each person in Recall**

**We want HITS separately for STRONG/WEAK terms in Recognition and Recall (using the answer key)**

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# Fourth
# Ok, how do we know what happened in our data?