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Class Meets: Weekdays 1:30-4:00pm @ 9B114

# SKKU ISS3147

## Myths and Mysteries of Human Learning and Memory

### Recognition Memory & Autobiographical Memory

4 Jul 2016

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## Essential difference between recall and recognition tests

“Recall is that aspect of memory process in which a *setting*... is present in clear consciousness, but a desired *focal element* is missing...

Recognition is... just the reverse of this process... the focal element is present... and the question is whether or not this element will recall a more or less definite general setting.” (Hollingworth, 1913)

In other words:

Recall test—experimenter provides the context and the subject has to retrieve the target

Recognition test—experimenter provides the target and the subject has to retrieve the context

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## RECOGNITION

### Forced choice

(e.g., 4-alternative forced choice or 4AFC = “multiple choice” test with 4 options)

### Free choice

Yes/No (or Old/New)

Easier than recall test?

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“... the difference between recall and recognition is a matter of degree, so that material which was relatively poorly learned may be recognized; if it was learned somewhat better it may be both recognized and recalled; *but recall without recognition is impossible.*”

(Raffel, 1934)

*Really?*

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## Recognition failure of recallable words

| Step | Procedure                          | Example                               |
|------|------------------------------------|---------------------------------------|
| 1a   | List 1 presented                   | badge-BUTTON                          |
| 1b   | Cued recall of List 1              | badge- <u>button</u>                  |
| 2a   | List presented                     | preach-RANT                           |
| 2b   | Cued recall of List 2              | preach- <u>rant</u>                   |
| 3    | List 3 presented                   | glue-CHAIR                            |
| 4a   | Free-association stimuli presented | Strong associate of → table           |
| 4b   | Free-association responses made    | TARGETS table chair cloth desk dinner |
| 5a   | Recognition test sheets presented  | DESK TOP CHAIR                        |
| 5b   | Recognized items circled           | DESK (TOP) CHAIR                      |
| 6    | Cued recall of List 3              | glue- ?                               |

Across 6 experiments, subjects failed to recognise (in Step 5) between 24 – 62% of the targets they recalled in Step 6. i.e., it is possible to obtain a situation where an item can be recalled but not recognised!

(Watkins & Tulving, 1975)

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## FREE CHOICE RECOGNITION TEST

Study: Items presented one at a time

e.g., cattle, form, tribute, style, hint, etc...

Test: For each word, indicate whether it was in the earlier list you saw (Y/N or Old/New)

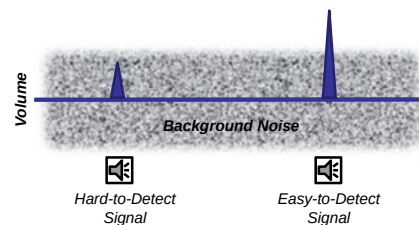
e.g., tribute, cotton, attic, style, madness, form, hint, star, elbow, etc...

Old (studied) words are intermixed with new (nonstudied) words – referred to as *targets* and *lures/foils*, respectively.

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## SIGNAL DETECTION THEORY

- A model for explaining recognition memory
- Based on auditory perception experiments:
  - Typical Task:
    - Ask participants to detect a faint tone (signal) presented against a background of noise
    - The tone's loudness against the background noise is manipulated



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## + SIGNAL DETECTION THEORY

- Accuracy depends on being able to discriminate the presence of signal (signal + noise) from its absence (just noise)
- 4 possible outcomes:

- |           |                           |                                                                    |
|-----------|---------------------------|--------------------------------------------------------------------|
| CORRECT   | <b>Hits</b>               | Correctly reporting the presence of the signal                     |
|           | <b>Correct Rejections</b> | Correctly reporting the absence of the signal                      |
| INCORRECT | <b>False Alarms</b>       | Incorrectly reporting presence of the signal when it did not occur |
|           | <b>Misses</b>             | Failing to report the presence of the signal when it occurred      |

|          |       | Actual Signal Status |                   |
|----------|-------|----------------------|-------------------|
|          |       | Target               | Lure              |
| Response | "Old" | HIT                  | FALSE ALARM       |
|          | "New" | MISS                 | CORRECT REJECTION |

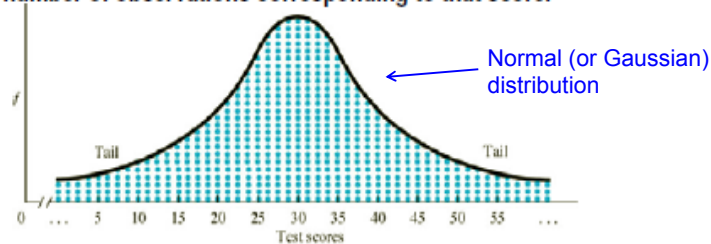
$$p(\text{Hits}) + p(\text{Misses}) = 1$$

$$p(\text{FA}) + p(\text{CR}) = 1$$

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## + A quick statistics review...

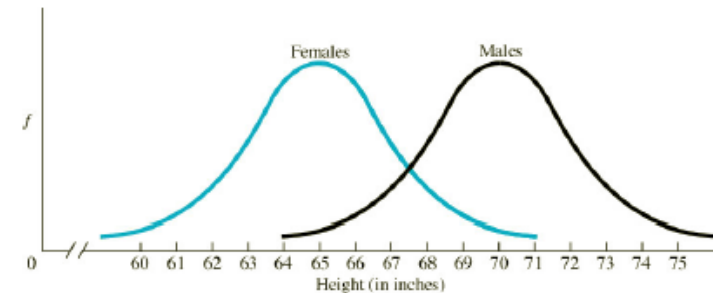
Histograms (frequency distributions) are often depicted with lines, where the height of the curve above any score reflects the number of observations corresponding to that score.



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## OVERLAPPING DISTRIBUTIONS

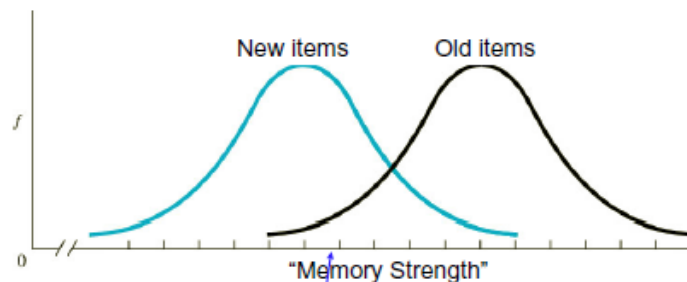


Are there more males or females with a height of 69"?  
If someone has a height of 65" are they male or female?

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## A SIMILAR THING HAPPENS IN RECOGNITION



Are there more NEW or OLD items with this memory strength?

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## SIGNAL DETECTION THEORY IN RECOGNITION MEMORY

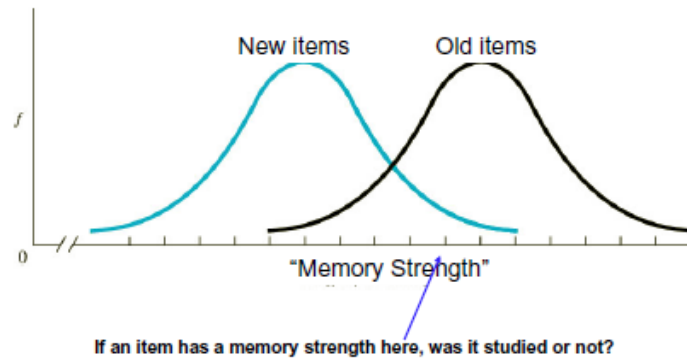
Assumptions:

- Memories vary in terms of “strength” (strength of evidence)
  - E.g., depends on attention paid to stimulus at encoding, # of times the stimulus is presented
- Strength values for “old” and “new” items are normally distributed
- On average, “new” items have less memory strength than “old” items
- But the distribution of “old” and “new” items often overlap
  - E.g., some lures have a high strength value because they are very familiar based on prior exposure; some targets have a low strength value because little attention was paid to them during study
- An item that exceeds a certain threshold of memory strength (i.e., response criterion) will be judged “old”

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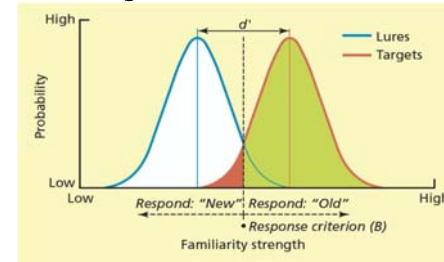
## A SIMILAR THING HAPPENS IN RECOGNITION



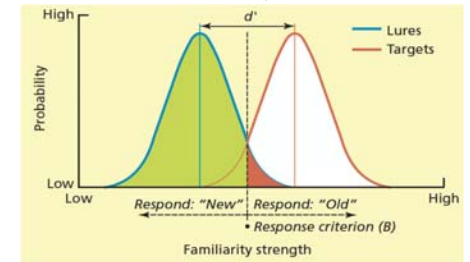
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# SIGNAL DETECTION THEORY IN RECOGNITION MEMORY

Target Distribution: Hits & Misses



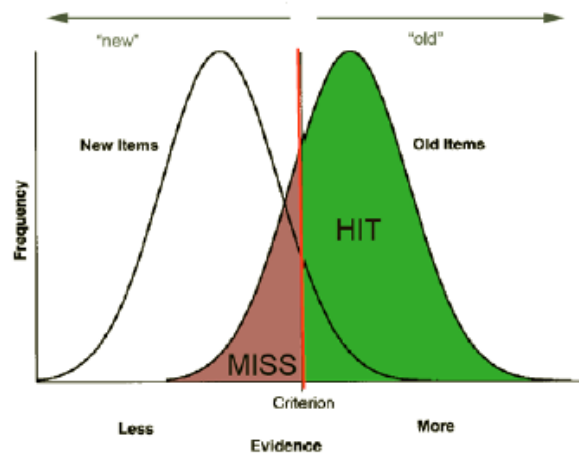
Lure Distribution: Correct Rejections & False Alarms



- Items that yield a strength value greater than the response criterion ( $\beta$ ) will be judged "old"
  - A centrally placed  $\beta$  is unbiased
- Items that yield a strength value lower than the response criterion will be judged "new."
  - Hits (in green)
  - Misses (in red)
- Focus now on the lure distribution:
  - Correct rejections (in green)
  - False alarms (in red)
- D prime ( $d'$ )** represents:
  - The distance between the means of the 2 distributions
  - The subject's ability to discriminate between the two distributions (measure of recognition accuracy)

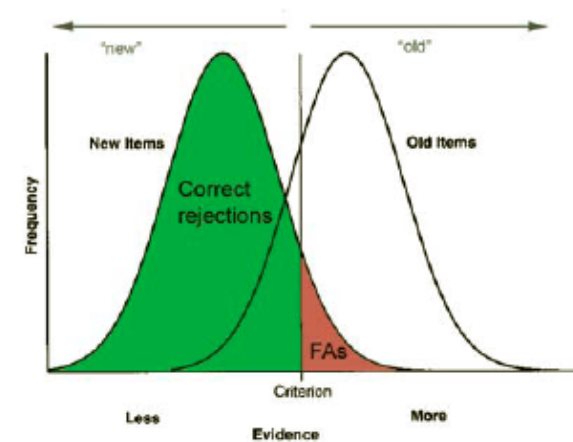
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## OLD WORDS: hits and misses



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## NEW WORDS: Correct rejections or false alarms

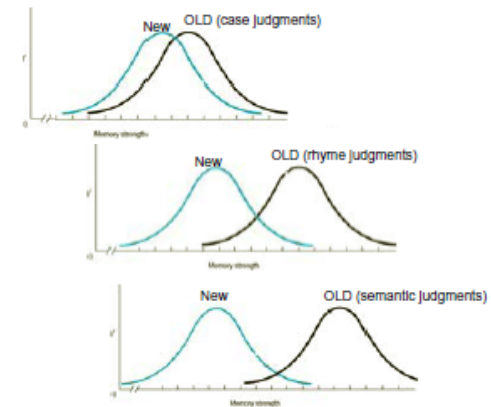


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Discriminability (or sensitivity) is the ability to discriminate between the old and new distributions

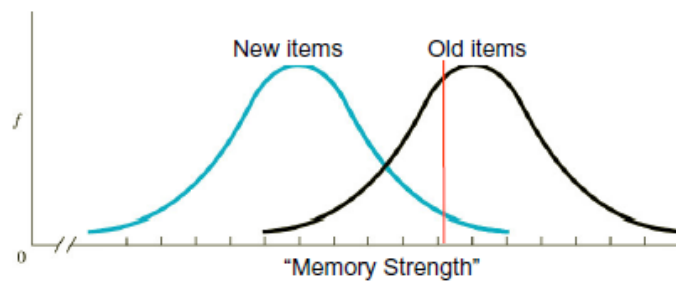


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### OVERLAPPING DISTRIBUTIONS

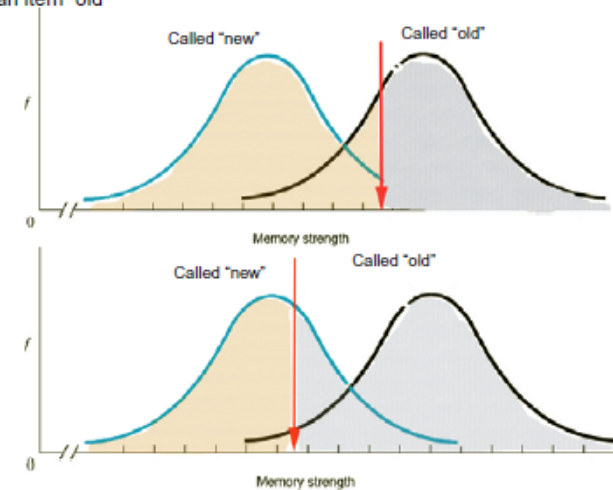


Where would you place the cutoff point for calling an item old/new?

--depends

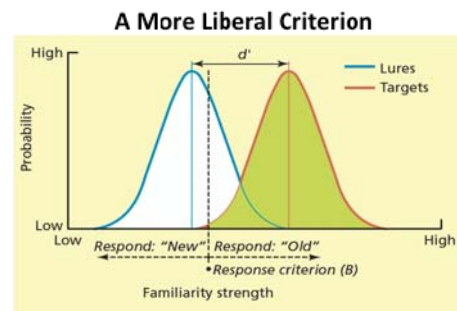
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Subjects set a **criteria** indicating how much evidence is required to call an item "old"



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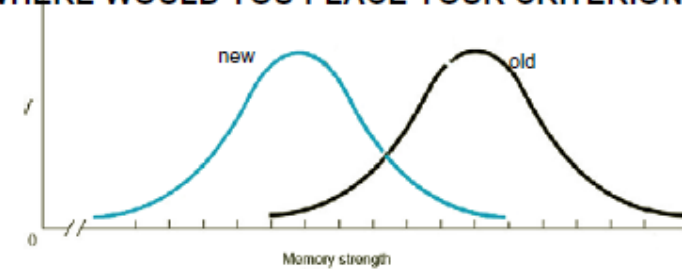
# SIGNAL DETECTION THEORY IN RECOGNITION MEMORY



- Liberal bias
  - Response criterion shifted to the left
  - Accept more targets as “old” (i.e. more hits)
  - Accept more lures as “old” (i.e. more false alarms)
- Conservative bias
  - Response criterion shifted to the right
  - Fewer hits
  - Fewer false alarms

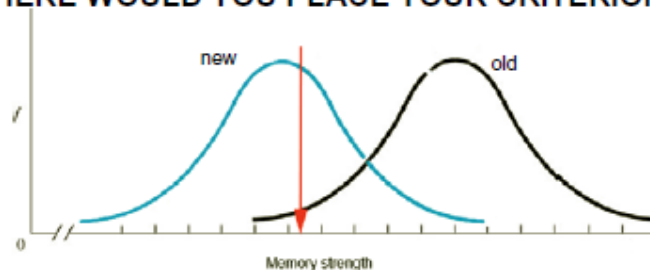
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IF YOU WANT TO MAXIMIZE THE HIT RATE, WHERE WOULD YOU PLACE YOUR CRITERION?



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IF YOU WANT TO MAXIMIZE THE HIT RATE, WHERE WOULD YOU PLACE YOUR CRITERION?



**You'd use a liberal criterion (left-leaning)**

This would come at some expense:

Increases the likelihood of false alarms

Decreases the likelihood of correct rejections

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Hits alone are uninformative.

The hit and false alarm rates are used to compute estimates of discriminability and bias.

Sample  $d'$  values for different hit and false alarm rates:

| $p(H)$ | $p(FA)$ | $z_{sn}$ | $z_n$  | $d'$ | $C$    |
|--------|---------|----------|--------|------|--------|
| .90    | .90     | -1.282   | -1.282 | 0.00 | -1.282 |
| .90    | .70     | -1.282   | -.524  | .76  | -.904  |
| .90    | .02     | -1.282   | 2.054  | 3.34 | .384   |
| .50    | .02     | .000     | 2.054  | 2.05 | 1.029  |

Measure of bias:  $<0$  = liberal;  $>0$  = conservative

A  $d'$  of 1 or 2 is generally taken to represent good memory performance

$$d' = z_n - z_{sn}$$

$$C = \text{mean}(z_n, z_{sn})$$

$z_n$  = z score for noise

$z_{sn}$  = z score for signal + noise

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# CORRECTING FOR GUESSING

Signal detection approach

$d'$  (discriminability) independent from C (bias)

Hit rate – False alarm rate

(also referred to as *corrected recognition score*)

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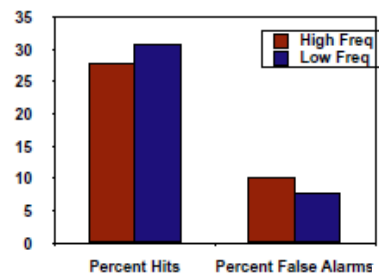
# THE MIRROR EFFECT

"The type of stimulus that is accurately recognized as old when old is also accurately recognized as new when new. The type that is poorly recognized as old when old is also poorly recognized as new when new." (Glanzer & Adams, 1985)

↑ Hit rate      ↓ False alarm rate

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## THE MIRROR EFFECT: an example



Low-frequency words are better recognised than high-frequency words (frequency refers to its use in the language, NOT the # of times the item is presented in the experiment)

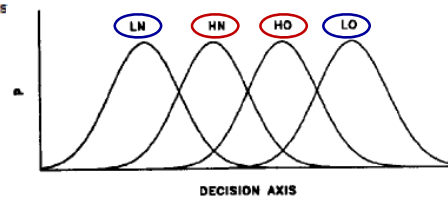


Figure 1. Arrangement of underlying old and new distributions showing the mirror effect. The figure is schematic, showing distributions with equal variance. Variance is generally not equal, according to either data or theory. p = probability; L = low frequency; H = high frequency; N = new; O = old.

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## Dual-process models of recognition

Recollection: conscious recollection of the event, including retrieval of contextual information; slow, attention-demanding

Familiarity: acontextual sense of familiarity of the stimulus; fast, automatic

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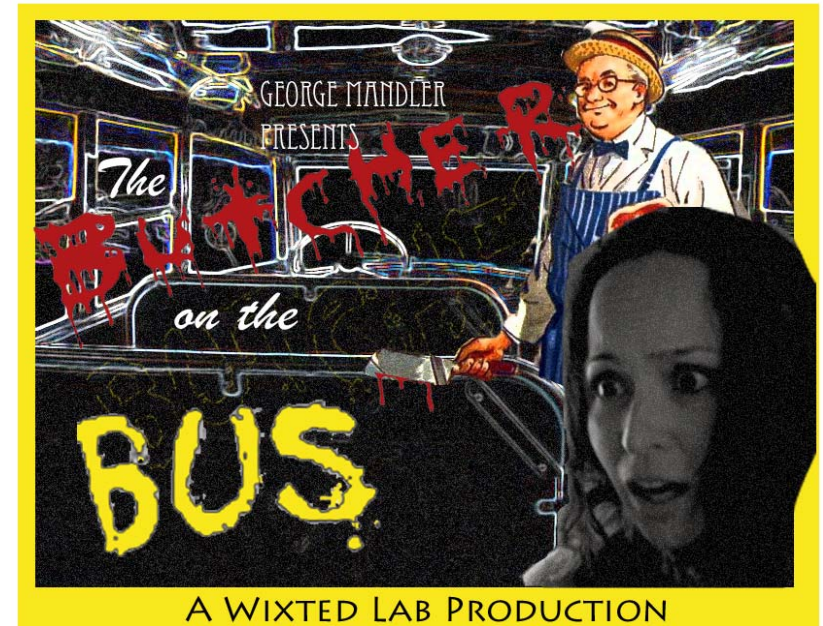
## Classic Dual-Process Anecdote

"Consider seeing a man on a bus whom you are sure that you have seen before; you "know" him in that sense. Such a recognition is usually followed by a search process asking, in effect, Where could I know him from? Who is he?...Eventually the search process may end with the insight, That's the butcher from the supermarket!"



(Mandler, 1980)

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## Remember/Know Procedure

On a (free choice) recognition test, subjects are asked to indicate for items judged as "old", whether they:

**REMEMBER** (i.e., have a conscious recollection of the item's occurrence on the study list)

**KNOW** (i.e., know the item was on the study list, but have no conscious recollection of its actual occurrence)

Assumed to be an index of familiarity

(Tulving, 1985, was the first to ask subjects to make the distinction between R and K)

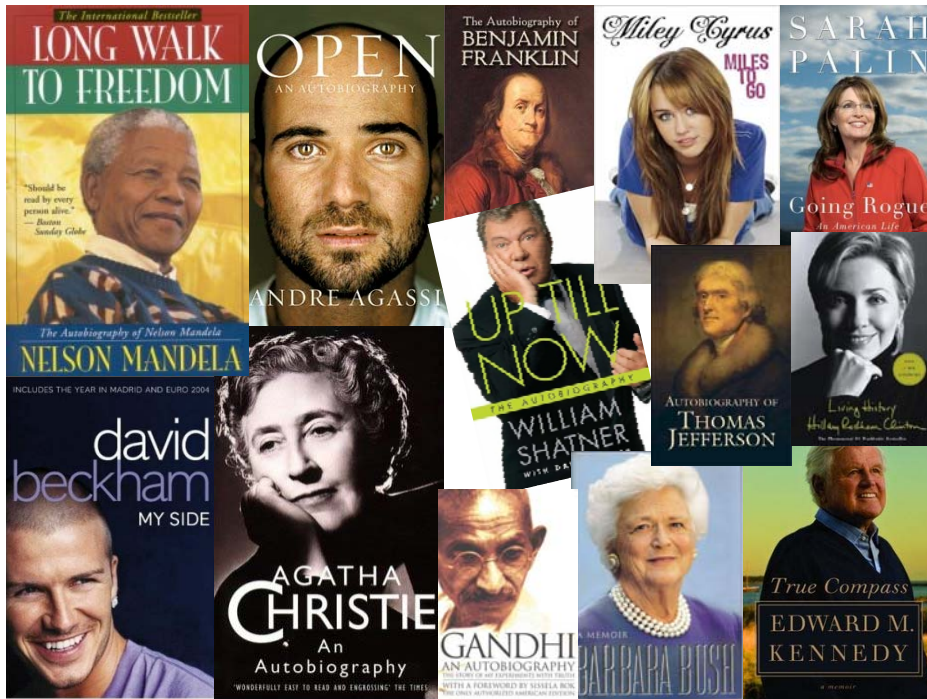
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## Summary

1. Recognition tests are not necessarily easier than recall tests.
2. Signal detection theory offers a useful approach to understanding recognition memory.
3. Recognition performance is affected by both discriminability and bias.
4. Dual process models posit that 2 separate processes—recollection and familiarity—underlie recognition memory.

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## Autobiographical Memory (ABM)

“memories a person has of his or her life experiences” (Robinson, 1998)

“memory for information about the self” (Brewer, 1998)

“specific, personal, long-lasting and (usually) of significance to the self-system. Phenomenally, it forms one’s personal life history” (Neisser, 1993)

“Autobiographical memory is of fundamental significance for the self, for emotions, and for the experience of personhood, that is, for the experience of enduring as an individual, in a culture, over time.”

(Conway & Pleydell-Pearce, 2000) 34

### Methods for studying ABM

Diary studies

Galton Word-Cuing Technique

Event cuing techniques

### What can we say about:

Types of events likely to be remembered

Effects of passage of time

Forgetting of personal memories

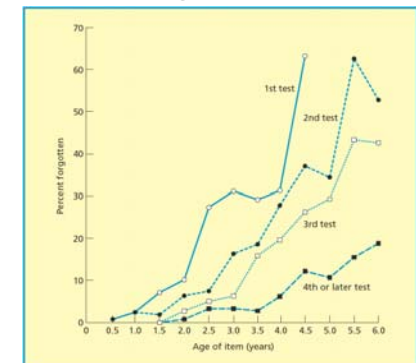
### DIARY STUDIES: daily recording of events

Marigold Linton recorded 5,500 events during a 6-yr period (1972–1978).

Then what?

She tested herself monthly on her memory for *when* (some of) the events occurred.

Conclusion: remembered events were salient, emotional, distinctive



Probability of forgetting a diary item as a function of elapsed time and number of prior tests. From Linton (1975).



## DIARY STUDIES: daily recording of events

Willem Wagenaar (1986):  
2,400 events over 6 yrs

He recorded ~1 event each  
day, along with

Who

What

When

Where

And its salience  
(distinctiveness), emotion,  
pleasantness

nr 3329

|       |                                 |
|-------|---------------------------------|
| WHO   | Leonardo da Vinci               |
| WHAT  | I went to see his 'Last Supper' |
| WHERE | In a church in Milano           |
| WHEN  | Saturday, September 10, 1988    |

|                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SALIENCE</b><br><input type="checkbox"/> 1=1/day<br><input type="checkbox"/> 2=1/week<br><input checked="" type="checkbox"/> 3=1/month<br><input type="checkbox"/> 4=2/year<br><input type="checkbox"/> 5=1/three years<br><input type="checkbox"/> 6=1/fifteen years<br><input type="checkbox"/> 7=1/lifetime | <b>EMOTIONAL INVOLVEMENT</b><br><input checked="" type="checkbox"/> 1=nothing<br><input type="checkbox"/> 2=little<br><input type="checkbox"/> 3=moderate<br><input type="checkbox"/> 4=considerable<br><input type="checkbox"/> 5=extreme | <b>PLEASANTNESS</b><br><input type="checkbox"/> 1=extr. unpleasant<br><input type="checkbox"/> 2=very unpleasant<br><input type="checkbox"/> 3=unpleasant<br><input type="checkbox"/> 4=neutral<br><input checked="" type="checkbox"/> 5=pleasant<br><input type="checkbox"/> 6=very pleasant<br><input type="checkbox"/> 7=extr. pleasant |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**CRITICAL DETAIL**  
 QUESTION: Who were with me?  
 ANSWER: Beth Loftus and Jim Reason

FIG. 1. Example of a recorded event.

## Wagenaar later attempted to recall the events using various cues

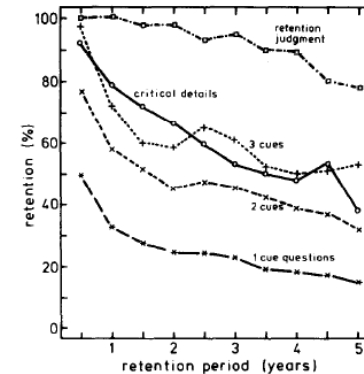


FIG. 3. Retention curves as a function of the number of retrieval cues. The curve marked "critical details" represents the recall of critical details after the presentation of all four retrieval cues. The curve marked "retention judgment" represents the number of events not judged to be completely forgotten.

The event was easier to recall with a *who*, *what*, or *where* cue than with a *when* cue.

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## General conclusions from diary studies

- Unique events are recalled well
- Emotional events are recalled well
- Temporal cues aren't very effective
- Some evidence that positive events are better remembered

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## PROBLEMS WITH DIARY STUDIES

Tend to have a single subject (often a psychologist)

Generalisability

Open to biases of the subject, especially in the selection of events

Difficult to conduct—takes a long time

Act of recording may change memory of the event

Knowledge of upcoming memory test

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## A diary study with *random* selection of events

Subjects wore pagers and were paged at random times.

When paged, they recorded event details, its significance, goal, emotional state, etc.

(Brewer, 1988)



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## What were subjects doing/thinking about when paged?

| Rank | Action category    | Freq. | Thought category      | Freq. |
|------|--------------------|-------|-----------------------|-------|
| 1    | Writing – academic | 60    | Romantic friend       | 54    |
| 2    | Reading – academic | 54    | Writing – acad. cont. | 51    |
| 3    | At lecture         | 49    | Friend                | 47    |
| 4    | Walking            | 43    | Reading – acad. cont. | 43    |
| 5    | Dressing/grooming  | 38    | Class content         | 30    |
| 6    | Talking            | 38    | Beeper                | 28    |
| 7    | Studying           | 31    | Organizing – acad.    | 27    |
| 8    | Eating in          | 28    | Plans – acad.         | 22    |
| 9    | TV                 | 28    | Eating in             | 20    |
| 10   | Beeper             | 27    | Physical appear.      | 18    |
| 11   | Phone              | 20    | Blank mind            | 18    |
| 12   | Reading – nonacad. | 20    | Plans – short range   | 15    |
| 13   | Resting            | 17    | Weight/health         | 13    |
| 14   | Cooking            | 17    | Misc.                 | 12    |
| 15   | Organizing – home  | 17    | TV                    | 12    |
| 16   | Writing – nonacad. | 17    | Roommate              | 12    |
| 17   | Waiting            | 15    | Faculty/TA            | 12    |
| 18   | Organizing – acad. | 14    | Cooking               | 11    |
| 19   | At work            | 14    | Physical discomf.     | 11    |
| 20   | Eating out         | 11    | Current issues        | 11    |

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## Recall test

At varying retention intervals, subjects tried to recall events in response to particular retrieval cues:

- Time
- Location
- Both time & location
- Thoughts
- Action

Characteristics of recalled events:

Rich in sensory detail, emotions and thoughts; unique, exciting events

(Brewer, 1988)

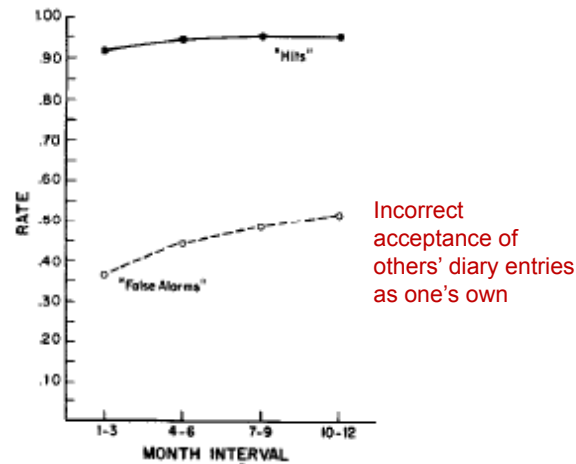
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## What's missing from this analysis?

**LURES**

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## FALSE ALARMS DO OCCUR



(Barclay & Wellman, 1986)

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## Galton Word-Cuing Technique



Retrieve a personal memory in response to cue word.

### MEDAL

Write down a phrase to remind you of the personal memory that you retrieve.

Next, try to date each memory.

This method aims to obtain a random sample of all memories via the use of cue words.

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## Memories retrieved as a function of age

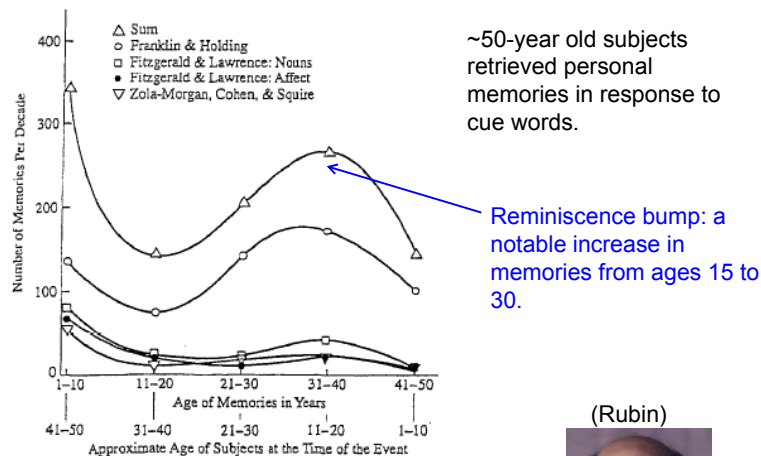


Figure 17.6 Distribution of autobiographical memories across the life span. In four studies, represented by the lower four curves in the figure, 50-year-old subjects remembered and dated life events in response to cue words. The top curve collapses over studies and sums over the lower four curves. Subjects recalled a disproportionate number of events from adolescence and early adulthood (reminiscence bump). Source: From Rubin et al. (1986) and reprinted with permission of Cambridge University Press.

(Rubin)



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## Event-cuing technique: Recall personal memories in response to specific event cues

E.g.,

Your 1<sup>st</sup> week of college

Hearing the news of 9/11

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## Methods for studying ABM

- Diary studies
- Galton Word-Cuing Technique
- Event cuing techniques

## What can we say about:

- Types of events likely to be remembered
- Effects of passage of time
- Forgetting of personal memories

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## Among college students, commonly recalled events are

- Injuries & accidents
- Sports
- Romantic episodes
- “Firsts”

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## Forgetting

### Occurs

But different from word lists (think of Ebbinghaus’s forgetting curve)

- Exposure to additional (post-event) information
- Rehearsal of life events

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## MISINFORMATION AND ABM

“Did you see the video footage on television of the moment the plane hit the apartment building?”



On 4 Oct 1992, an El Al jet crashed into an apt building shortly after taking off from Amsterdam. There was *no* video footage of the actual moment of impact.

55% said they had.

Of the 55%, most of them were willing to describe what they “saw”, including how long it took a fire to break out (82%), and the angle of the plane when it hit the building (70%).

(Crombag, Wagenaar, & van Koppen, 1996)

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# VISUAL PERSPECTIVE

## Field perspective (1<sup>st</sup>-person)

Perspective originally experienced  
Through one's own eyes  
Through original field of view



## Observer perspective (3<sup>rd</sup>-person)

Standpoint outside initial experience  
As an observer might see it  
Often "see" one's self in the memory

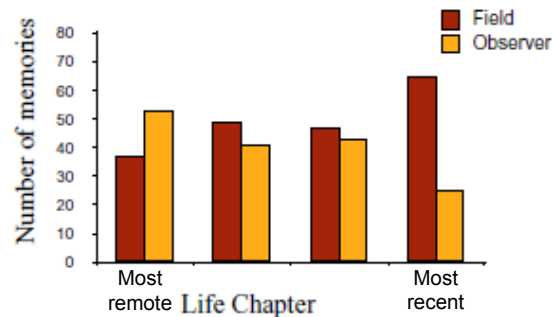


Remember the last time you had breakfast...

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## Age of memory affects perspective



Older memories more often observer perspective  
Recent memories more often field perspective

(Robinson & Swanson, 1993)

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"The past is remembered as if it were a drama in which the self was the leading player."

(Greenwald, 1980, *The Totalitarian Ego: Fabrication and Revision of Personal History*)

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## Rewriting history as it “should’ve been”

### Selective retrieval (biased search)

In realistic social settings, when one recounts an event from memory, the goal of such storytelling is often to entertain (or to project a certain image). Accuracy is not of foremost importance; we take liberties with the actual event, embellish details, etc.

### Implicit theories (of change vs. stability)

Using current status as reference point, reconstruct the past based on whether changes should have occurred over time.

Subjects who took a bogus study skills course misremembered their prior skills as having been worse than they actually were (Conway & Ross, 1984).

### Wishful thinking

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## John Dean’s Memory: Motivated Remembering

June 1973: John Dean (White House Counsel) testified before the Senate Watergate Investigating Committee as to whether President Nixon was aware of and involved in a politically-motivated cover-up of a burglary in the Watergate building.



His testimony began with a 245-page statement in which he described dozens of meetings in detail.

Dubbed the “human tape recorder” by some reporters. Unbelievable memory. Ironically, actual tape recordings of some of the meetings were later discovered.

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## John Dean’s Memory: Motivated Remembering

Sen. Inouye: Your 245-page statement is remarkable for the detail with which it recounts events and conversations occurring over a period of many months. It is particularly remarkable in view of the fact that you indicated that it was prepared without benefit of note or daily diary....

(Dean explains that all he relied on were press clippings on the Watergate break-in; the senator is still incredulous...)

Mr. Dean: Well, senator, I think I have a good memory. I think that anyone who recalls my student years knew that I was very fast at recalling information, retaining information. I was the type of student who didn’t have to work very hard in school because I do have a memory that I think is good.



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“When I arrived at the Oval Office I found Haldeman and the President. The President asked me to sit down... Both men appeared to be in very good spirits and my reception was very warm and cordial... The President told me I had done a good job and he appreciated how difficult a task it had been and the President was pleased that the case had stopped with Liddy. I responded that I could not take credit because others had done much more difficult things than I had done... I also told him there was a long way to go before this matter would end and that I certainly could make no assurances that the day would not come when this matter would start to unravel.”

-excerpt from John Dean’s testimony concerning a September 15 meeting w/ the President

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~~“When I arrived at the Oval Office I found Haldeman and the President. The President asked me to sit down... Both men appeared to be in very good spirits and my reception was very warm and cordial... The President told me I had done a good job and he appreciated how difficult a task it had been and the President was pleased that the case had stopped with Liddy. I responded that I could not take credit because others had done much more difficult things than I had done... I also told him there was a long way to go before this matter would end and that I certainly could make no assurances that the day would not come when this matter would start to unravel.”~~

-excerpt from John Dean's testimony concerning a September 15 meeting w/ the President

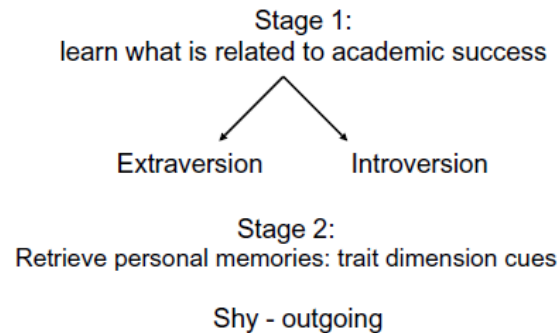
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“What his testimony really describes is not the September 15 meeting itself but his fantasy of it: the meeting as it should have been, so to speak. In his mind, Nixon **should** have been glad that the indictments stopped with Liddy, Haldeman **should** have been telling Nixon what a great job Dean was doing; most of all, praising him **should** have been the first order of business. In addition, Dean **should** have told Nixon that the cover-up might unravel, as it eventually did, instead of telling him it was a great success. By June, this fantasy had become the way Dean remembered the meeting.”

- Neisser (1981)

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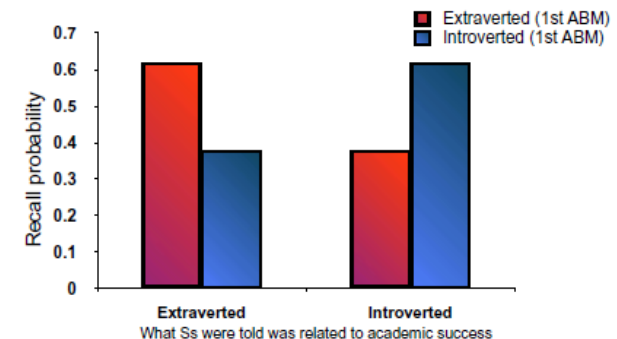
## Motivated Remembering



(Sanitioso, Kunda, & Fong, 1990)

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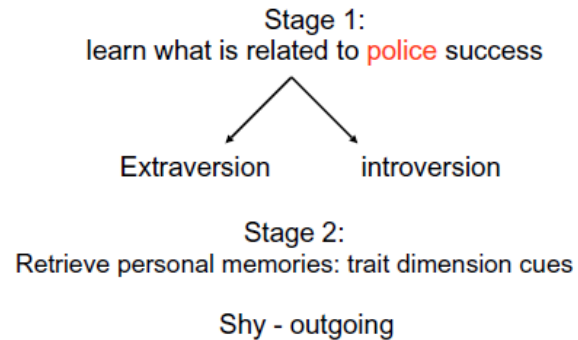
## Motivated Remembering



(Sanitioso, Kunda, & Fong, 1990)

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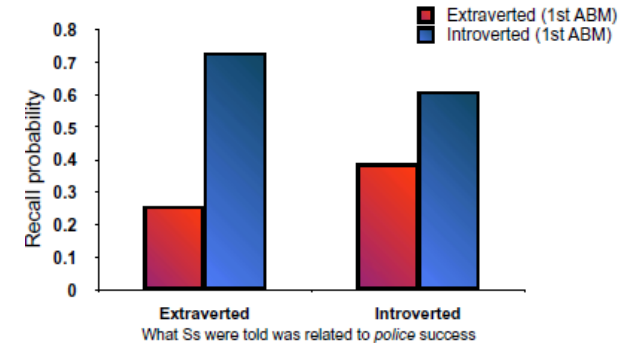
## What happens if you remove motivation?



(Sanitioso, Kunda, & Fong, 1990)

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## What happens if you remove motivation?



(Sanitioso, Kunda, & Fong, 1990)

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## Summary

1. ABM consists of memories of events and knowledge about the self
2. ABM for events is characterised by vivid memories, but much of the mundane is lost.
3. The way we remember personal events is driven in part by how we are motivated to see ourselves, our need for a cohesive life narrative, and our ideas about what should have happened.

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