How quickly we forget…

Recognition

Forgetting curve;
measures of retention;
context-dependent and
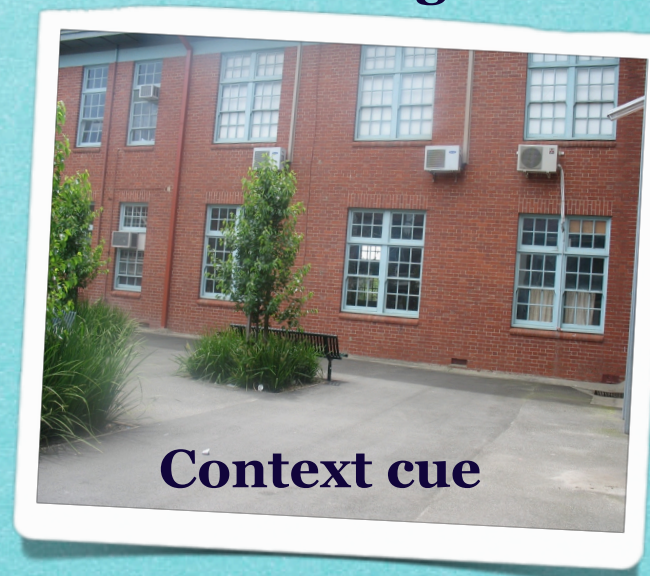state-dependent cues

Context cue

Study Design Dot Point:
Manipulation and improvement of memory

*forgetting curve as informed by the work of Hermann Ebbinghaus

*measures of retention including the relative sensitivity of recall, recognition and relearning

*use of context-dependent cues and state-dependent cues

The **Forgetting** Curve
by Hermann Ebbinghaus

The aim of Ebbinghaus's research twas to measure the amount of information retained after learning and to determine the rate at which information is forgotten.

He learned a series of lists of 13 nonsense syllables until he could recite them.

He tested his recall for each list after different periods of time had elapsed from his initial learning. The time periods ranged from 20 mins to 31 days.

Nonsense Syllables

Nonsense syllables were used because they are **meaningless** and therefore unaffected by associations with words already stored in memory.

This ensured that the rate of forgetting would not be influenced by past experience of the learned material.
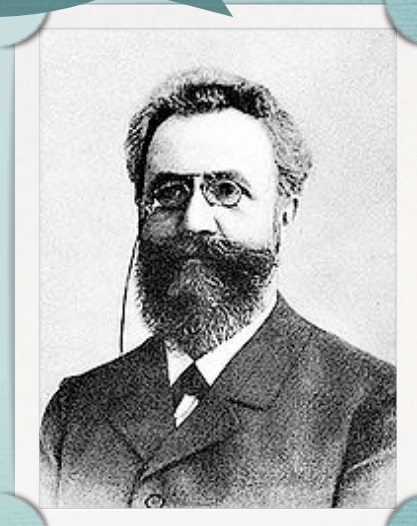
Imagine the sheer dedication of Ebbinghaus.

Could you spend days and weeks learning nonsense syllables, in order to figure out how quickly we forget?

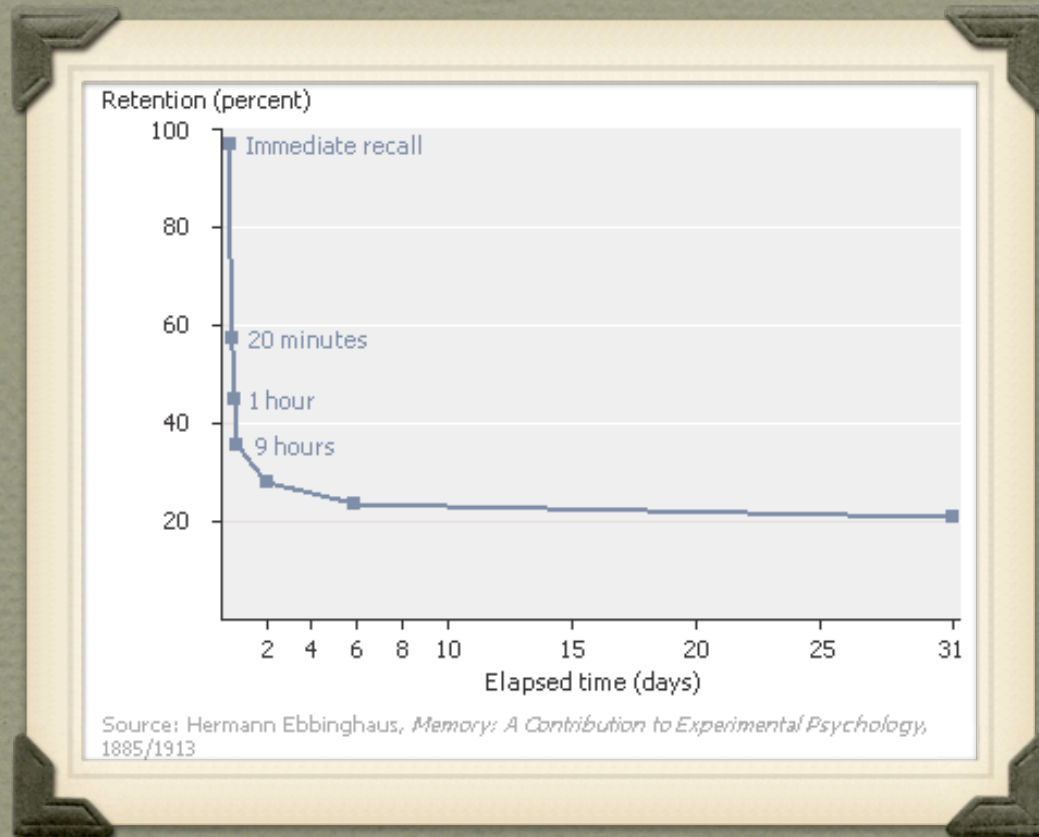*If I see another nonsense syllable, I'm going to scream!*

We would rather go to a staff meeting!

A **nonsense syllable**, by the way, is a meaningless three-letter word with two consonants wrapped around a vowel, such as **bep** or **vuj**.

Hardly riveting material.

The Shape of the Forgetting Curve

Retention (percent)
- Immediate recall — 100
- 20 minutes
- 1 hour
- 9 hours
- 20, 40, 60, 80, 100

Elapsed time (days): 2, 4, 6, 8, 10, 15, 20, 25, 31

Source: Hermann Ebbinghaus, *Memory: A Contribution to Experimental Psychology,* 1885/1913

This graph shows the pattern of forgetting that occurs over time. "Pattern" here means the **amount** that is lost from memory and the **rate** at which it is lost.

Write a description of this curve, referring to the **amount forgotten over time** and the **rate at which that loss occurs**. (See handout.)

Suggest how the **rate of forgetting** might change if you were learning something easier to encode than nonsense syllables.

Ebbinghaus's Conclusions

Ebbinghaus concluded from his research that when a participant memorises nonsense syllables, forgetting is rapid at first and then slows down gradually over time.

He made a remarkable contribution to the early study of memory and cognitive processes.

But he probably drove his wife mad…

Psychology

The Ebbinghaus household…

Research Conclusions

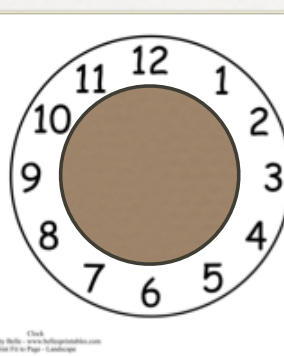**More than half of the memory loss of nonsense syllables occurred within the first hour after learning.**

*20 minutes - able to recall 58%
*After one hour - able to recall 44%
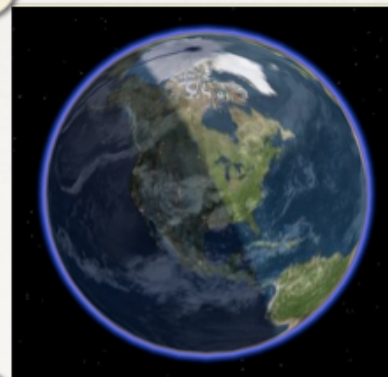*After one day - able to recall 34%
*After one week - able to recall 21%

After 20 mins - 58% retained

After 1 hour - 44% retained

After 1 day - 34% retained

After 1 week - 21% retained

Fill these details in on your handout!

Some factors that may influence the rate of forgetting are:

★ How meaningful one makes the information to be remembered. The more meaningful information is, the less rapidly it is forgotten.

★ How well the information was learnt initially. If it was learnt well originally then the information is less likely to be forgotten, regardless of the difficulty of the material.

★ When information is learnt over an extnded period of time, more information is retained. Nevertheless, the pattern of initially rapid loss of information, followed by a gradually slowing rate of forgetting, is still evident.
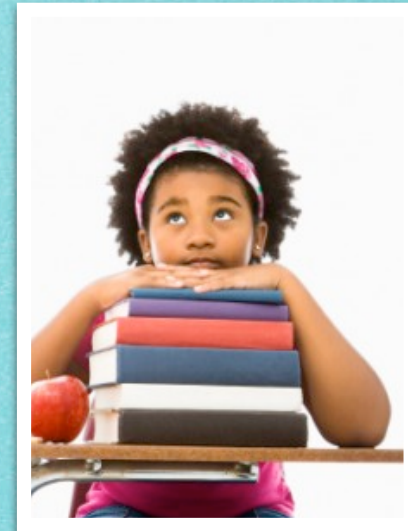
Factors affecting the amount and rate of forgetting

*Which factors affect the amount and rate of forgetting (even though the pattern of forgetting appears to be retained in a wide variety of conditions)?

*Which factors do not appear to affect the rate of forgetting, if the material is well learned?

Questions and Answers

*Which factors affect the amount and rate of forgetting
(even though the pattern of forgetting appears to be retained
in a wide variety of conditions)?

∞ whether the material is meaningful (increases retention)

∞ whether the material is learned over a longer time span (increases retention)

∞ quality of initial encoding (increases retention)

*Which factors do not appear to affect the rate of forgetting,
if the material is well learned?

∞ difficulty of the material

∞ learning ability of the individual

Expert advice…

How you can foil that steep forgetting curve and make your memory work for you...

*Learn material over a **period of time**, rather than cramming it all the night before.

***Overlearn.** If you only learn until you can recite the material once (e.g. after one class), you will rapidly forget it. You must learn and revise well beyond that first perfect recital.

***Spaced practice** is more effective for retention than **massed practice**. If you have three hours to give, 6 half-hour stints will be more effective than one 3-hour stint.

*Add meaning to the information by **self-referencing** and by **using your own words and examples** rather than just copying notes.

***Relearn** the material two or three times after the original learning. Read back over your notes actively. Make up tricky questions to ask yourself.

Learning Activities on Forgetting Curve

Learning Activity 7.1 p. 363

and/or

class handout

Read the account of the forgetting curve in GDC, pp.376-7) and answer these questions:
1. Draw a picture of the forgetting curve, labelling your axes carefully, and write down the percentages in the text from Ebbinghaus's first ground-breaking study, i.e. (a) after 20 minutes, (b) 1 hour, (c) 1 day (d)1 week.

2. Now use the images below to seal these times and percentages in your memory. Add information to each picture.

After 20 minutes...   After one hour...   After one day...

After one week...

2. Write a description of the **pattern** of this curve. e.g.
Straight after initial learning, forgetting is...etc.

3. Even though the pattern of how we forget seems to be retained in a variety of conditions, certain factors affect the amount and rate of forgetting. Which factors affect the amount and rate of forgetting?

4. Which factors do **not** appear to affect the rate of forgetting, if the material is well learned?

5. What does all this suggest about revision for exams? Suggest four or five pieces of advice.

6. What are nonsense syllables and why did Ebbinghaus choose them for his studies? How might different material affect the forgetting curve?

Measures of retention including the relative sensitivity of recall, recognition and relearning

**Retention:** The process or state of storage is termed retention.

The three basic ways to measure retention are:
*recall
*recognition
*relearning

Each of these measures is likely to uncover different levels of knowledge of the material.
***Recall** is the most demanding measure, because it provides the least cues.
***Recognition** gives you options to choose between.
***Relearning** reveals that you do in fact have some retention of something you were sure you had forgotten. That's why it is often referred to as the most sensitive measure of retention: it uncovers the information you didn't know you still knew!
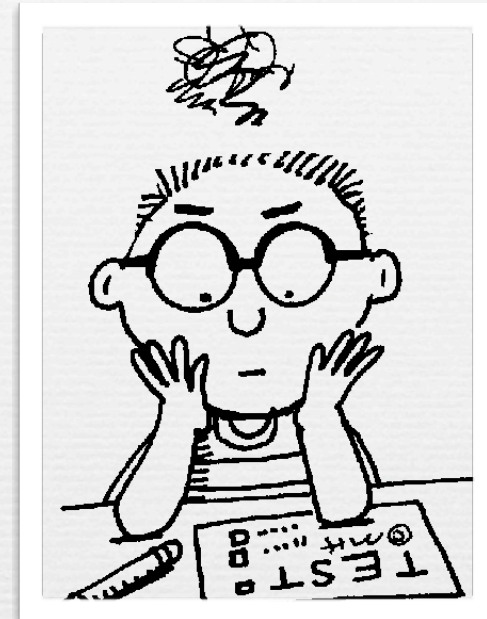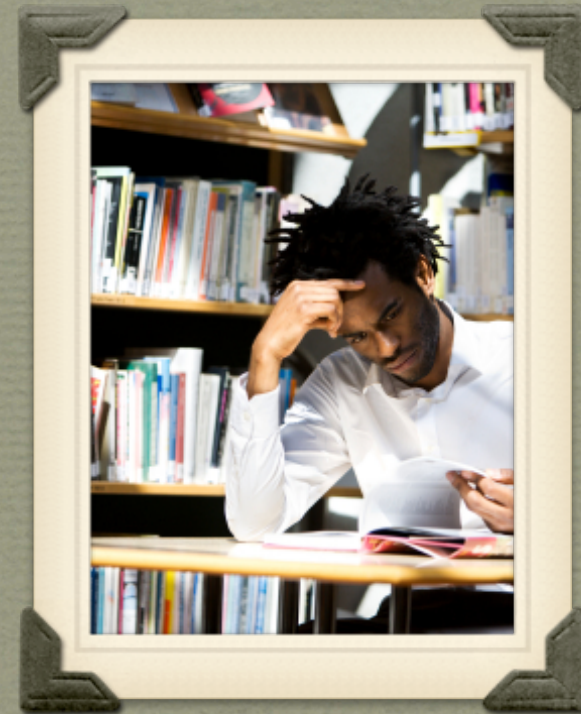
SENSITIVITY OF MEASURES OF RETENTION

Sensitivity: The sensitivity of a measure of retention refers to its ability to assess the amount of information that has been stored in memory.

The more sensitive a measure is, the more likely it is to detect information that has been learned and stored in memory.

If this man had to write an essay on what he had read, what kind of measure would be testing his retention?

(Sort of like a sensitive man being more likely to know that his girlfriend is annoyed with him than an insensitive man, who might not even notice...)

(Of course women can be insensitve too.)

RELATIVE SENSITIVITY OF MEASURES OF RETENTION

More demanding task

More sensitive measure
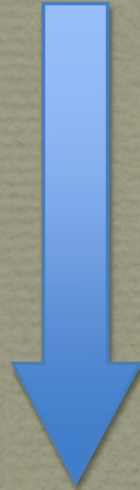
Of these three **measures of retention**:

***Recall** is the least sensitive, that is, it requires the best retention, because it provides the fewest cues to help you to access memory.

***Recognition** is less sensitive than relearning, but more sensitive than recall.

***Relearning** is the most sensitive of all three measures of retention, showing savings in the time needed to remaster the material, **even if none of the original material can actually be recalled.**

RECALL

Recall refers to remembering the information requested with few cues (if any) to aid retrieval.

This is the **least sensitive** of the three measures.

For example, in responding to a short answer question, one must search one's available recollections for the necessary information. Likewise, when encountering a new acquaintance, one must search one's past associations with the person to produce his or her name.

When you have to respond to a fairly abstract prompt in an English essay, you are being asked to supply information with the minimum of hints or cues. That's why recall is a tough measure.

Recognition: The ability to identify the information to be remembered among given alternatives.

Meaty Davis-Keith Barby-George McNeil-Paul King-Nick Gould-Head Master Jack Gould ?
Maureen Briers-Barbara Church-Jill Henson-Lynne Ayris-Pat Alderman-Doris Ridgeway-Viv Stacey
Pat O'Brien-Mick Read-Keith Chapman-Peter Roberts-Christopher Ward-KB-Mick Bartlett
Veronica Salas?-Erica Darby-Mervin Emerton-Joan Patemen-Sue Francis (sadly not with us now)
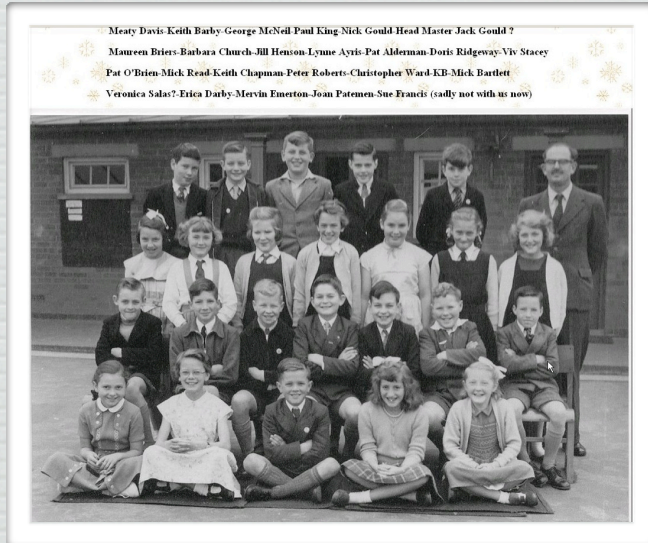
Being asked to identify which name goes with which face in an old class photo is a task requiring recognition.

This refers to the ability to recognize or identify the correct information, as on a **multiple-choice test**. In choosing the correct answer on a multiple-choice test, one must scan the choices and identify the one that matches one's past information about this item.

In **recognition**, two processes are undertaken and compared: a **review of what is being perceived**, and a **review of what is remembered**. When a match is found, we say recognition has occurred.
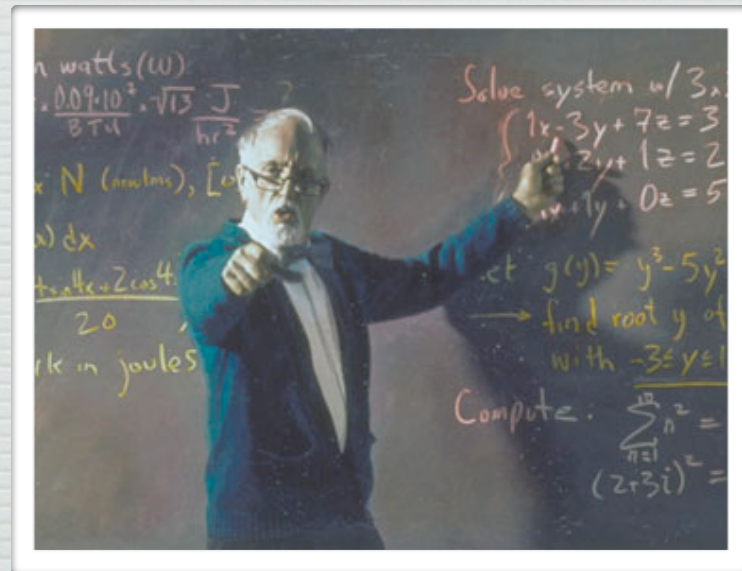
Recognition is a more **sensitive measure** of retention than recall because...

...even if you cannot recall something, you can often identify a correct alternative when options are supplied.

Recognition is a more sensitive measure because it can uncover knowledge you were unable to access via recall.

In this sense, the greater ease of recognition provides support for retrieval failure theory. When the cues are available, one can often retrieve more.

You may not be able to recall the name of your Year 7 Maths teacher, for instance, but if given a list of 20 maths teachers, you might recognise the name.

Relearning

Relearning is the **most sensitive measure of retention**, because it is able to detect and measure some memory of information, even when an individual is unable to remember through recall and recognition.
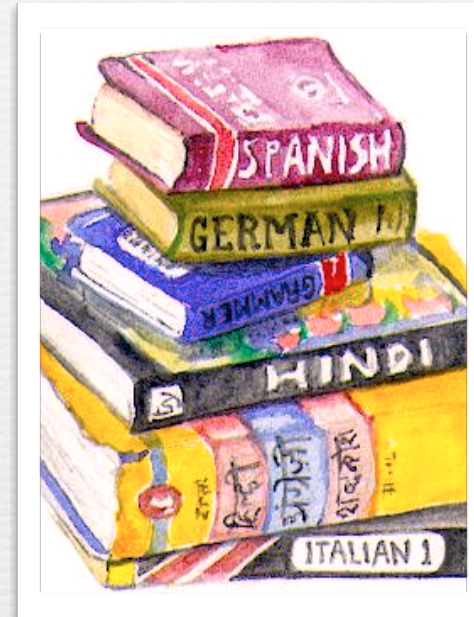
I learned French at school but would struggle to recall more than 20 words. I'd recognise many more. If I were to relearn French, however, I would reach the level I had attained as a teenager much faster the second time. The time saved would be a measure of my retention.

RELEARNING

Relearning is measured by relearning information previously memorised and measuring the **amount of time** or the **number of learning trials** saved in this process.

If one learns more rapidly the second time around, it is inferred that one remembers information from previous learning even if one cannot consciously recall these memories.

SAVINGS SCORE IN RELEARNING

Savings score = estimate of retention, reckoned as a percentage

E.g. If you learned a list of German words in one hour, then returned to this task later, it might take you only you 40 minutes the second time. Your saving would be 20 minutes, therefore one third or 33.33%.

Formula:

Savings score = number of trials for original learning - trials for relearning

$$\text{Savings score} = \frac{\text{number of trials for original learning - trials for relearning}}{\text{trials for original learning}} \times \frac{100}{1}$$

For example, if you require 10 trials of 2 minutes each to learn a list of 40 nonsense syllables, but find that 2 weeks later you need only 8 trials, the formula would look like this:

$$\frac{10-8}{10} \times \frac{100}{1} = \frac{200}{10} = 20\% = \text{percentage of trials (or could be minutes/units of time) saved}$$

APPLY THE FORMULA
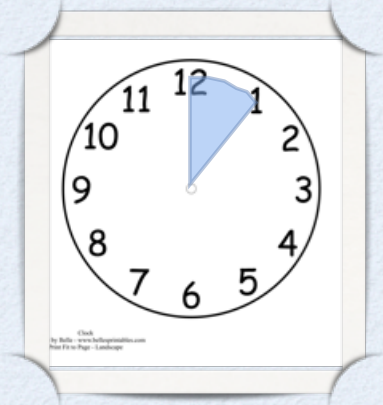
- You take 20 minutes to learn a list of psychology definitions to the point where you can recite them exactly.

- A month later, it takes you only 6 minutes to learn the list. What is your savings score?

SOLUTION

- Savings score = $\dfrac{\text{original minutes - relearning minutes}}{\text{original minutes}} \times \dfrac{100}{1}$

$$\text{Savings score} = \frac{20\text{-}6}{20} \times \frac{100}{1} = 70\%$$

Activities

Worksheet on measures of retention

Learning Activity 7.3, p.370

Learning Activity 7.4, p.370

Recall: What is it?
Recognition: Which is it? - A cat, a mouse or a rat?
Relearning: How long will it take the mouse to learn a maze it ran successfully last week, compared to the first time it ran the maze?

Summary of Measures of Retention

Measures of retention

Retention - proportion of material retained or remembered

Recall

"What is the item?"

(Houston, 1986)

- **Defn**: being asked to provide or reproduce information with the minimum of cues to assist retrieval

- **Example**: Who is the current PM of Australia?
- **Example**: Recalling all the names of a class of students without a list (eg. when a duty student comes in without a blackberry)

- **Sensitivity**: least sensitive measure of the three measures of retention - i.e. the least sensitve measure for discovering what might be in memory

Recognition

"Is this the item?" (Houston)

- **Defn**: identifying correct information from supplied alternatives (provides more cues than recall)
- **Example**: Choose the current PM from a list of all PMs
- **Example**: Picking out the names of students in the class from a list of year 12 students; marking the blackberry)
- **Sensitivity**: More sensitive than recall but less sensitive than relearning, because you may recognise something that you cannot recall.

- For testing information in LTM, recognition is a type of measure which discovers more than recall. It may not be possible to recall a single name from your prep class, but if you were given a list, you might find that the information is there, if you only use a sensitive enough measure to retrieve it.

Relearning

(also called the method of savings)

- **Defn**: involves memorising information that has already been memorised in the past; if information is learned more quickly the second time, it is assumed that some must have been retained from the first learning experience. The savings score is an estimate of retention reckoned as a %.

- **Example**: Learn list of PMs. A year later, how much less time does it take to learn them.
- **Example**: How long does it take you to learn a whole class's names after having learned them in the past?
- **Sensitivity**: most sensitve measure or test, because you may retain something that you can neither recall nor recognise and this method allows you to ascertain how much.

Quality of encoding

An orderly filing cabinet is easier to retrieve things from than one with everything in a state of confusion. Your long-term memory works better if material is well-encoded.

The better you encode material, the easier it will be to retrieve.

What are some ways in which you can ensure quality encoding of new material?

Try to write down four or five suggestions.

Quality Encoding

+Link the material with information already in LTM

+Think of examples, analogies and symbols

+Make up diagrams, concept maps and flow-charts

+Reword material

+Connect it with everyday personal examples (self-referencing)

+Use chunks, acrostics and acronyms

+Think up questions and answer them   AND SO ON...

Quality Encoding
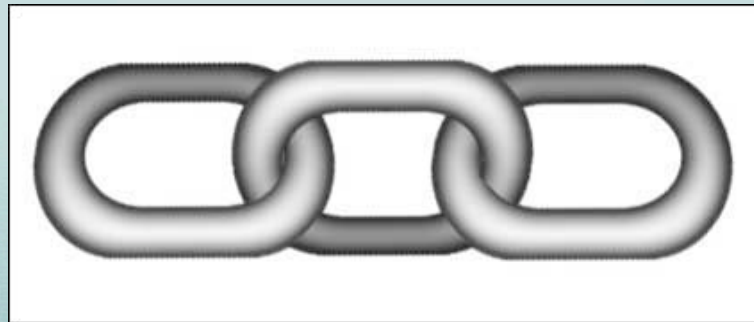
If your locker is set out in categories according to subjects (or in some other meaningful fashion) it will be easier to find what you need. A long-term memory with many links and connections, allowing many mental pathways to information, will likewise make retrieval easier.

In other words, use elaborative rehearsal to create many associations with the material in your long-term memory.

In a sense, this is like a website with lots of hyperlinks to the information you want; there are therefore many paths to accessing what you need to know.

Context-dependent and state-dependent cues
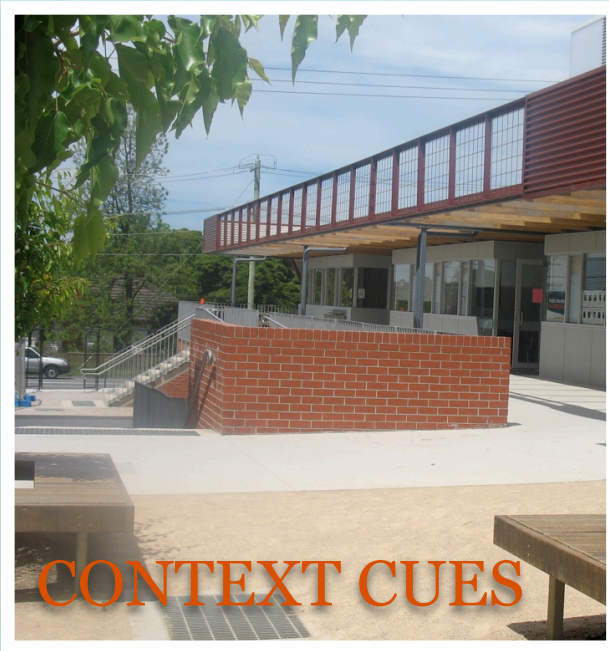
CONTEXT CUES

What you encode here will be more easily retrieved here.

Context-dependent cues and **state-dependent cues** enhance retrieval, because retrieval occurs more easily in the same conditions under which the required information was originally memorised.

CUES

- **Context-dependent cues** are stimuli from the external environment in which information was originally learnt, such as sights, smells and sounds. They enhance retrieval of information encoded when those stimuli were present.

e.g. If you had an argument with a friend in the Resource Centre, you might remember the details better if you returned there.

- **State-dependent cues** refer to the learner's internal environment when the original learning occurred, such as ones's physiological and psychological states/ feelings at the time of learning. They enhance retrieval of information encoded when the person was in that state (physiological or psychological).

If you were happy when something happened, you would be more likely to recall the details if you were similarly happy at some later stage.

Context-dependent cues

Definition: Environmental cues in the actual setting where a memory was formed; these act as stimuli that help us retrieve or recover the memories formed in that environment.

For example:
- sights
- sounds
- smells
- pictures
- songs
- music

A mother whose baby is born in an ambulance, for instance, would be better able to recall the gruesome details of the birth if she stood inside an ambulance.

A context cue is simply a retrieval cue that is specific to a place and time.

CONTEXT-DEPENDENT CUES

Example: When you go from one room to another to get something, then can't remember what you were looking for. You return to the original room and the memory comes back.

Another example: Your memory for a recipe is likely to be greatly enhanced if you are standing in the kitchen looking at the cupboards, oven, bowls and utensils you'd normally use.

State-dependent cues

These are stimuli that are present at the time of learning that are related to the learner's internal psychological and/or physiological state, which act as a retrieval cue to help recover the info learned at that time.

- e.g. feeling happy/sad - the problem can be that we also recall all the other times that we were sad, etc.
- under the influence of marijuana, alcohol or other drugs

(This suggests that if you lose something while inebriated, you might more easily find it by becoming inebriated again. We do not recommend this course of action, however.)
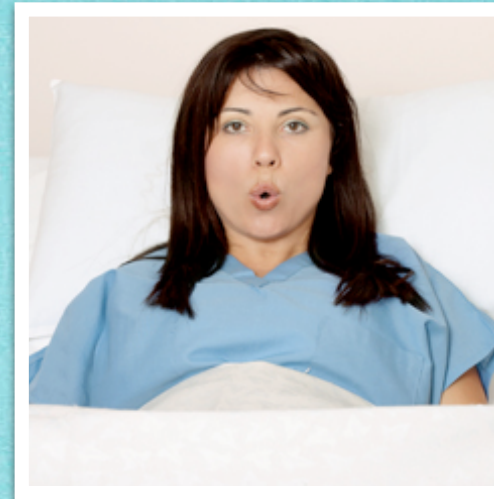
A woman in labour is likely to recall many details of other labours (including the pain), because she is in a state of great pain and stress on both occasions.

Activities

- Learning activity 8.5, p.402
- Learning activity 8.4, p.400