

ECPS6005: COGNITION IN ACTION

LECTURE TEN: COGNITION AND AGEING

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The Aging Brain

As individuals age, their brain shrinks.

Gradually lose nerve cells and process information more slowly.

Consequently, learning new concepts and patterns becomes more difficult.

Memory also begins to fail.

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Memory Decline

Memories established and retrieved through conscious, or effortful means (episodic, explicit, declarative)

Memories established and retrieved with little consciousness or effort (semantic, implicit, procedural).

Effortful memories are more likely to decline than those requiring less effort

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Effortful vs. Effortless Processing

Craik (1983) – environmental support hypothesis

- Tasks requiring less effortful processing are well preserved with age because performance is supported by elements in the test environment
- e.g., recognition tests provide memory items themselves – no need to generate the item from memory – only assess its familiarity = less work

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Effortful vs. Effortless Processing



- Myerson and Hale (1990)
 - Decline due to speed of cognitive operations slows with age

Laborious tasks
have many
processing steps



The more steps the more information is lost

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Memory

Sensory memory

- More fleeting in older adults
- However, because this store holds information so briefly it is hard to compare younger with older adults (Botwinick, 1984).

STM

- *Working memory* is reduced in older adulthood.
- The more complex the mental manipulations, the more difficulty older adults will experience.

LTM

- *Procedural memory*: older adults may be slower than younger adults in recovering these memories
- However, given a little more time, they are just as capable as younger adults.

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Memory

LTM

- *Semantic memory* – older adults do not differ from younger adults in the content or organisation of linguistic knowledge in their semantic store (Wingfield, 1995).
- Although word-finding differs = tip of the tongue experiences (Kemper, 1995).
- *Episodic memory* – actions and activities - where we put the keys etc. differs between older and younger adults.
- Better for motor activities than cognitive activities (Kausler, 1994).

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More recently...

- With cognitive tasks heavily dependent on frontal cortex (matching faces/recalling words) neuroimaging shows distinct age differences in which area of brain is accessed.
- Older adults sometimes used additional areas in same region of brain.
 - E.g., young adults perform cognitive task by activating left hemisphere of prefrontal cortex, older adults activated both right and left hemispheres.
- Older adults sometimes used an entirely different part of the brain than younger adults use for the same task.

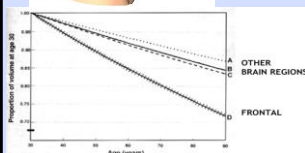
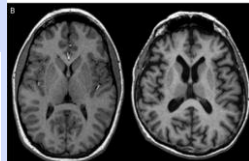
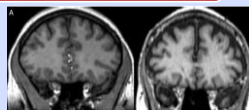
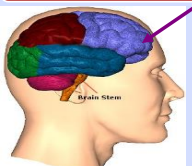


When older adults asked to perform same cognitive tasks as young adults, brain scans show different or more parts became active (Cabeza 2002; Park et al. 2001)

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Working Memory

Reliant on prefrontal cortex...a region that undergoes cell shrinkage & cell loss with age



Young adult Older adult

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Working Memory & Processing Speed

Working memory declines with aging due to reductions in processing speed

Aging results in slowing of reaction time (the time it takes to respond to an event)

Somewhat slower on "simple associative" tasks (e.g., hitting brakes in response to red light)

Even more pronounced slowing on "complex choice" tasks (e.g., deciding whether to accelerate or brake at a yellow light)



T. Salthouse

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Working Memory & Processing Speed

Processing speed can affect the ability to hold information in mind, because by the time one part of a problem has been completed, other aspects of the problem may have been forgotten.

- Fred walks up to a store counter with 3 packs of sweets, each costing 50p.
- He gives the sales clerk £5.
- Because the clerk is out of pound coins, she gives Fred his change in 50p coins.
- How many 50p coins does Fred receive from the sales clerk?

If it takes you longer to process "Fred walks up to a store counter with 3 packs of sweets", you may miss that they each cost 50p.

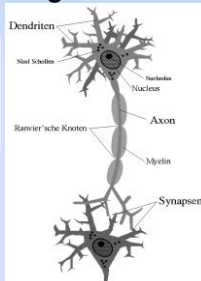
If it takes you longer to multiply 3 by 50, you may have already forgotten that he gave the clerk £5.

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The Aging Brain: Slowing Down

Changes in speed of neurotransmission likely underlie age-related changes in processing speed

Particularly pronounced in prefrontal cortex



Although aging can lead to a slower reasoning through decisions, it can facilitate making a "gut decision". These "gut decisions" are often the optimal ones.

(T. Hess, F. Blanchard-Fields, A. Damasio)

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Working Memory & Attention



With age, it becomes harder to ignore irrelevant information ("cocktail party phenomenon")



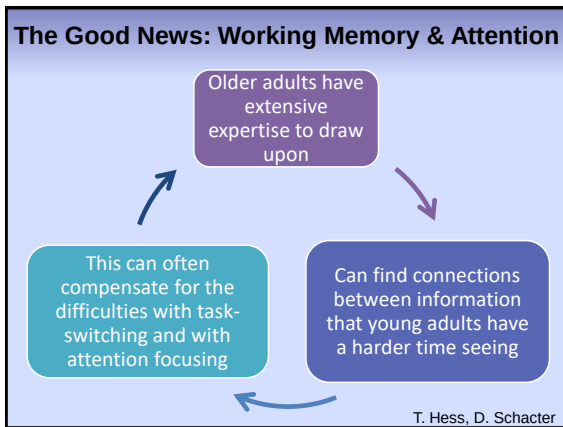
It also becomes harder to switch between tasks with different requirements



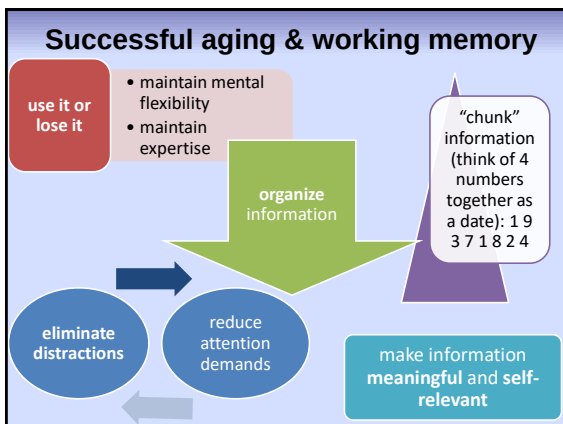
These difficulties can make it more difficult to hold relevant information in mind and to switch between different task requirements (e.g., the multiplication task - multiplication, addition, storage of information, etc)

L. Hasher, R. Zacks

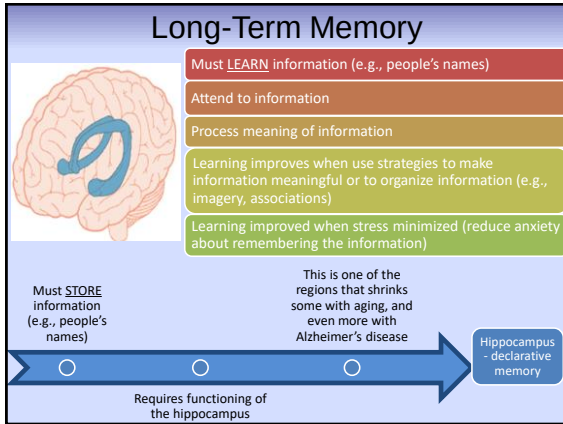
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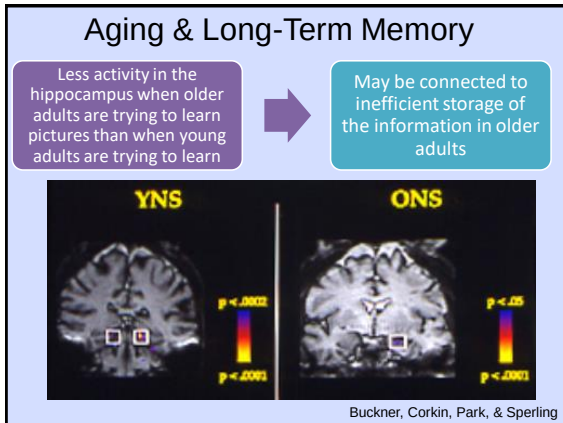
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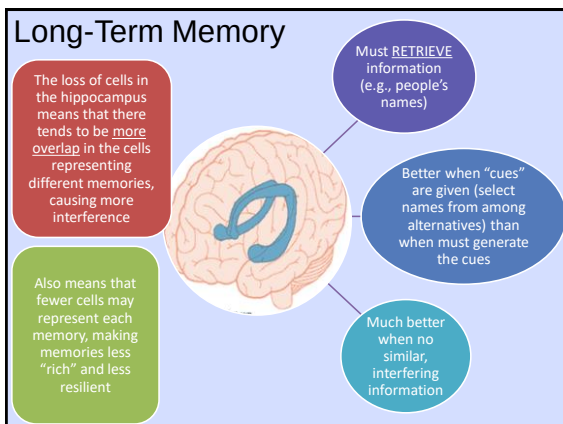
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Aging & Long-Term Memory

On the plus side, this may make it easier for older adults to extract commonalities among experiences, to see the “whole picture” rather than just the details

Aging enhances the ability to remember information that is **emotionally positive** and **personally relevant**



Aging helps people use their memories for directive purposes: to reflect on their sense of self and on their relationships with close others, or to regulate their emotions.

Carstensen, Mather, Gutchess, & Hess

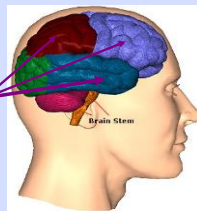
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Remote Memory & Semantic Memory

Over time, memory is no longer dependent on the hippocampus

These memories tend to be more resilient, and are less affected by brain damage, aging, or the initial stages of Alzheimer's disease

Instead, the surrounding cortical regions become able to support the memory



Lots and lots of repetition spread out over many years causes this transition

Remote memory - ability to remember things that happened years ago

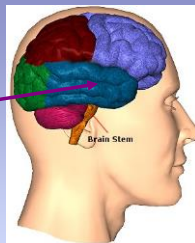
Nadel & Moscovitch

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Semantic Memory

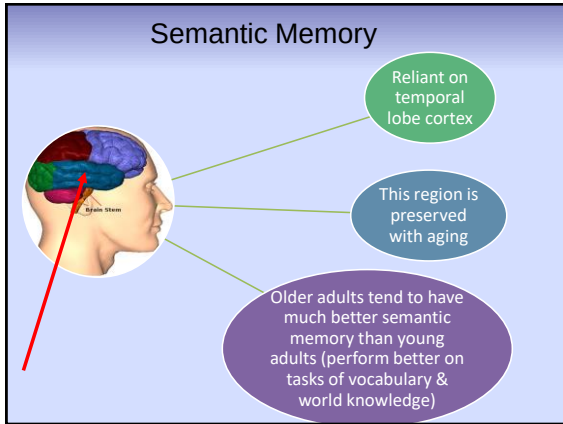
No longer contains details about the time and place in which the learning occurred

- There was a specific time when you learned that the Eiffel Tower was in France
- ... but most of you probably cannot tell me when that was

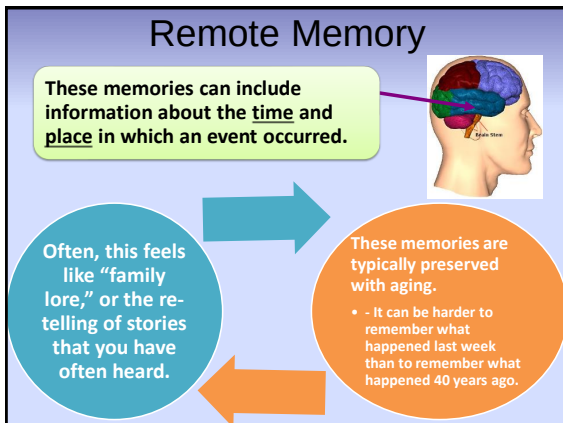


World knowledge & factual information (vocabulary, etc)

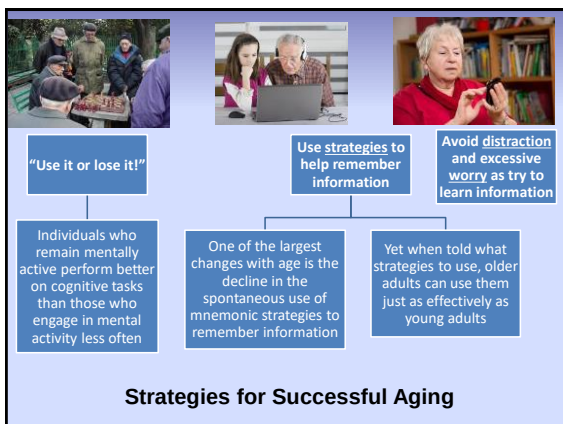
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Prospective Memory

Time-based vs. Event-based

Which is best?




EBPM – prompted by an external cue

TBPM – dependent on self-initiated mental activities

PM requires retrieval of what needs to be done

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Memory in ageing...PM

Empirical studies - older adults not impaired in all aspects of PM, they tend to perform as well/better than younger counterparts in tasks carried out in naturalistic rather than laboratory settings.

Lab - dual tasks (West and Covell, 2001)

Telephone the experimenter at a specific time over 4 weeks (Devolder, Brigham, & Pressley, 1990); 3 weeks (Poon & Schaffer, 1982), 2 weeks (Moscovitch, 1982); 5 days (Maylor, 1990)

periodically log the time on an electronic organizer (Rendell & Thomson, 1993, 1999)

mail postcards to the experimenter (Patton & Meit, 1993)

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Memory in ageing...PM



Age differences in their motivation to successfully complete PM tasks outside of the laboratory (Rendell & Craik, 2000).

In addition, older adults tend to show better TBPM for attending appointments (Martin, 1986).

Age effects determined by presence or absence of external aids to cue the PM event.

Naturalistic tasks - older adults usually able to set up external cues to act as reminders (Cavanaugh, Grady, & Perlmutter, 1983).

When required to make prearranged phone calls, for e.g., older adults use "conjunction cues," such as placing the action to be remembered with another routine event e.g., having a meal (Maylor, 1990).

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The Positivity Effect and Memory/Attention

Older adults think differently - "positivity effect," a shift from a disproportionate preference for negative information in young adulthood to a relatively stronger preference for positive information in old age (Carstensen, Isaacowitz, and Charles 1999).



Fung and Carstensen (2003) - When older adults presented with pairs of advertisements that were identical except for the featured slogan, a majority preferred the ads featuring slogans that promised more emotional rewards over those that promised the expansion of horizons, exploration, and knowledge..



Chronological age is associated with paying more attention to emotional gratification and the emotional aspects of life (Carstensen 2006; Mather and Carstensen 2005).

As a consequence, attention to and memory for positive information is accentuated.

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Shaping Goals Based on Perceived Time Left

The "socio-emotional selectivity theory," goals shift in importance depending on perceived time left.



Perceived limited time - individuals place priority on goals that emphasize feeling good and optimizing psychological well-being.

Open-ended time - priority to goals that focus on gathering information, experiencing something new, or expanding one's breadth of knowledge.



Perceived finite time - attach greater importance to finding emotional meaning and satisfaction from life and invest fewer resources into gathering information and expanding horizons.

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Shaping Goals Based on Perceived Time Left

Goals, preferences, and thought processes such as attention and memory change as time horizons shrink.



The subjective sense of time left can change.

Events such as the 9/11 attacks and the severe acute respiratory syndrome (SARS) epidemic in Hong Kong eliminated age differences on some motivation measures, reminding all people, regardless of age, of the fragility of life.

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Summary

Not all cognitive function decline in old age

Not all memories decline in old age

Use it or lose it

Importance of environmental cues.
