



HUMAN PERFORMANCE

M6X00915

Ageing and performance

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ESSENTIAL READING

- Chapter 16 - Matthews G., Davies, D .B., Westerman, S J., & Stammers, R. B. (2000). *Human Performance: Cognition, stress and individual differences*. Hove: Psychology Press.
- Craik, F. I., & Salthouse, T. A. (Eds.). (2011). *The handbook of aging and cognition*. Psychology Press (Available as PDF through Google Scholar)

LECTURE COVERAGE...

- Impact of ageing in relation to:
 - Sensory Performance
 - Response Speed
 - Attention
 - Memory
 - Intelligence
- Theories of Age Differences in Performance



INTRODUCTION

- Many people now surviving to age of 65+
- Growth expected in no. of individuals living longer
- Growing older typically associated with decline in abilities:
 - Physical
 - Mental
- Vision, hearing, & other sensory capacities show signs of impairments.
 - Also tend to perform worse than younger individuals on psychometric tests of intelligence: N.B individual differences
- However, there are some exceptions..



AGE & SENSORY PERFORMANCE

- Efficiency of all main sensory systems tends to deteriorate.
 - Most predominant decline in **vision** and **hearing**.
- This is problematic for everyday activities.
- In groups.....
 - Come up with examples of daily activities that would be problematic to perform if vision &/or hearing declines?
 - What are the practical implications?
 - How might they impact the individual psychologically?



AGE & VISUAL PERFORMANCE

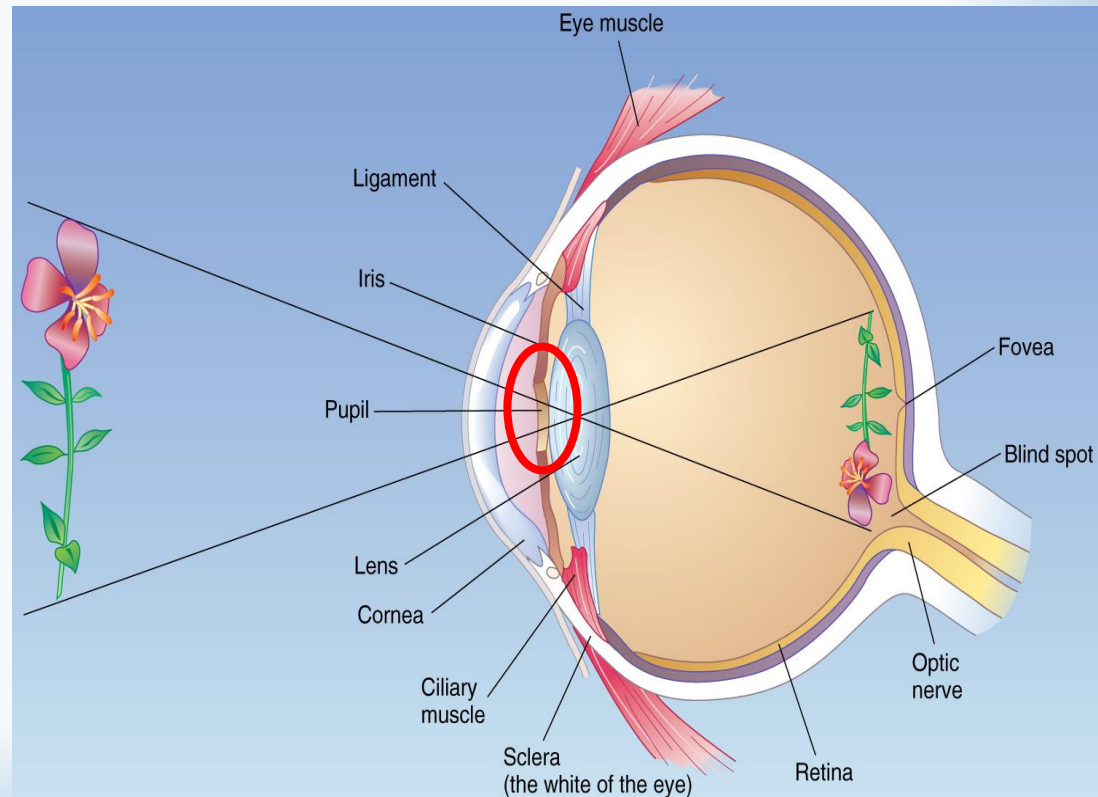
- Attributable to structural changes taking place in the visual system – particularly the eye.

This reduces amount of light reaching the retina by ~65%

Pupil size diminishes

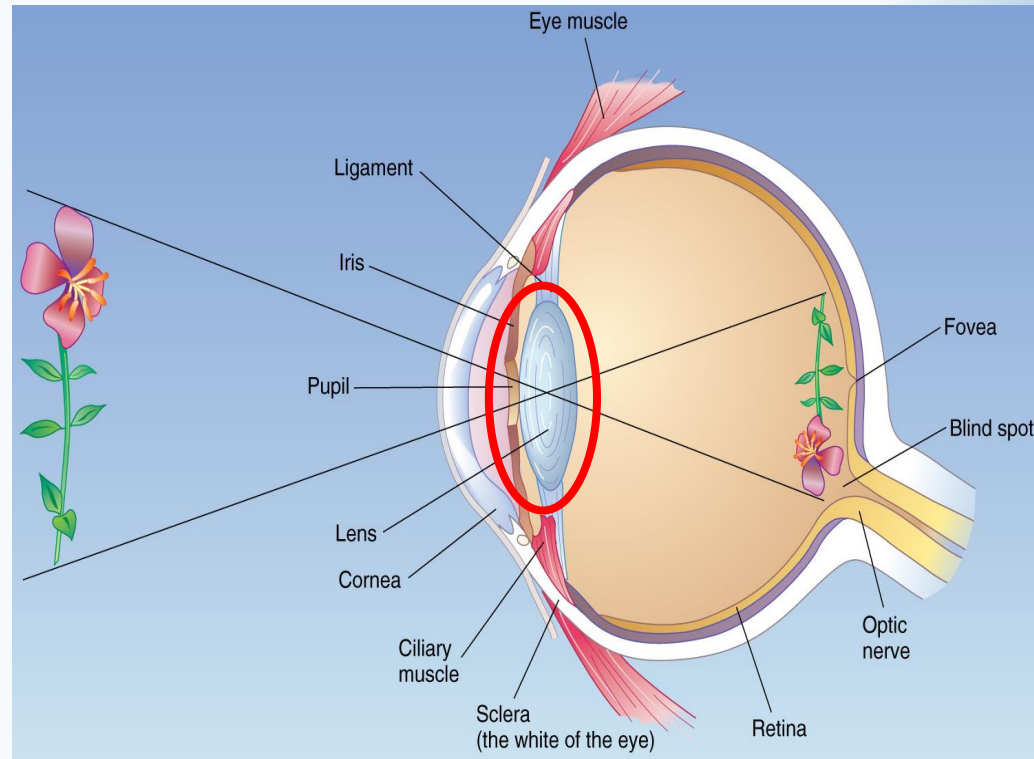
Aqueous humour becomes less transparent

- Pupil takes longer to respond to sudden changes in illumination:
 - Driving at night difficult as pupil cannot adapt to oncoming headlights.
- In the dark, pupil size is smaller than in young individual
 - Impairs nocturnal vision.



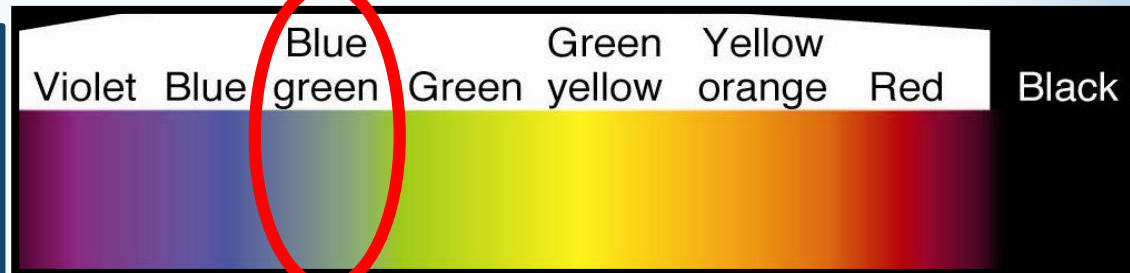
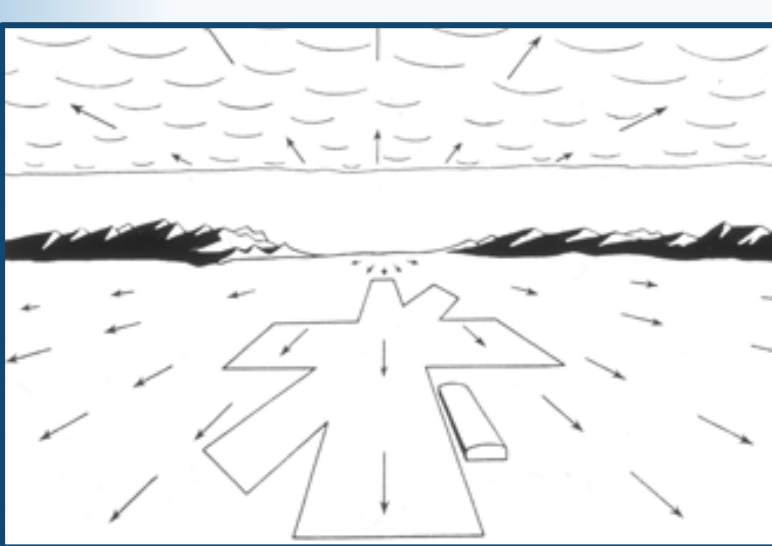
AGE & VISUAL PERFORMANCE

- Lens becomes thicker, less flexible, and more opaque:
 - Leads to difficulties focusing on objects in near vision.
 - Also leads to less light being able to reach photoreceptors in the retina.
- Greatest loss of visual acuity (ability to discriminate fine detail) takes place after the age of 60 (Verillo & Verillo, 1985).
- Contrast sensitivity (ability to detect differences in luminance) deteriorates sharply with age (Kline & Scheiber, 1985).



AGE & VISUAL PERFORMANCE

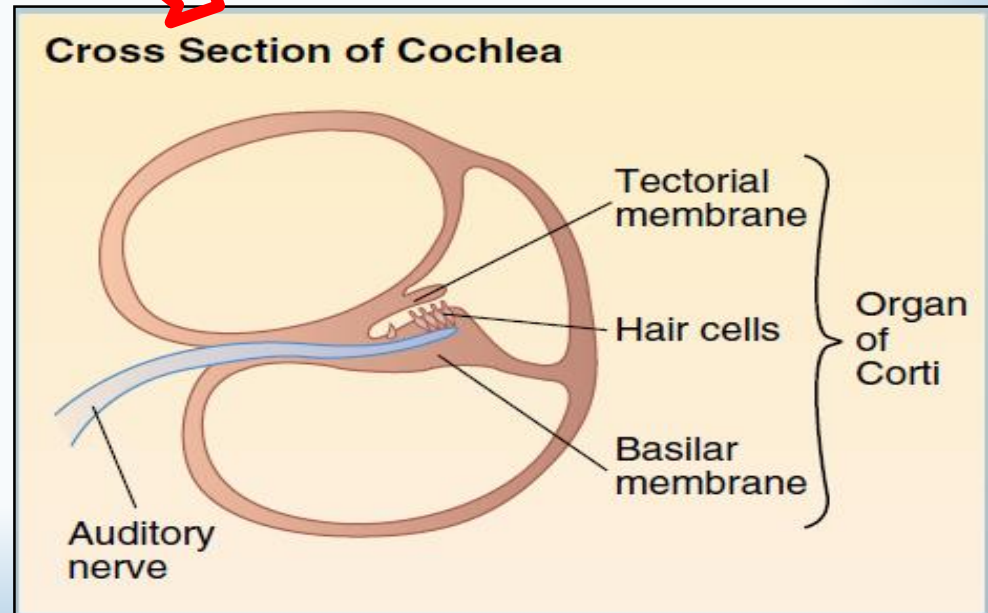
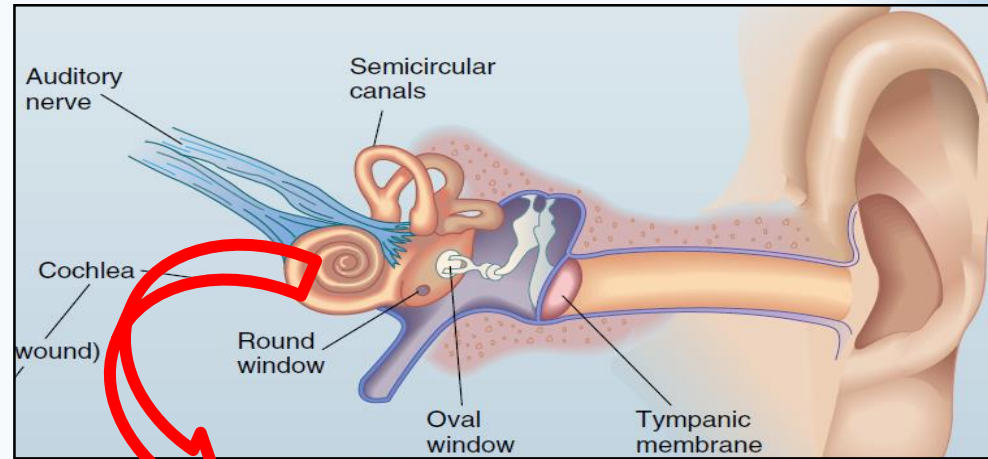
- Performance of tasks involving perception of motion adversely affected by ageing.
- Consequence = impaired mobility & increase in likelihood of falls (Simoneau & Leibowitz, 1996).
- However: depth perception and colour vision exhibit relatively modest age-related decline.



Although ability to discriminate between colours in this range is adversely affected (Kline & Scialfa, 1996)

AGE & AUDITORY PERFORMANCE

- Cross sectional + longitudinal studies have suggested that older adults are less able to hear high frequency sounds (See Fozard, 1990).
- Age related hearing loss mainly due to structural changes in auditory system.
- E.g., degeneration of hair cells in the cochlea.
- Also, loss of nerve cells in auditory pathway
 - Stiffening of vibrating bone structures



AGE & SENSORY PERFORMANCE

- Much less is known about the effects of age on the
 - Cutaneous system (touch)
 - Vestibular system (balance)
 - Gustatory system (taste)
 - Olfactory system (smell)
- However, there is growing evidence to suggest these systems experience age related performance impairments.
- The range of sensory deficits experienced by ageing individuals can have an impact in real world scenarios and in a variety of settings.....

AGE & SENSORY PERFORMANCE

- Kosnick, Seklur, & Kline (1990):
 - Older drivers who had given up driving reported more visual problems than those who continued to drive.
 - However, when answering questions on visual problems whilst driving, older drivers often mentioned:
 - Difficulty with speed judgement
 - Cars just “appearing” in the visual periphery
 - Difficulty reading road signs
 - Difficulty seeing the instrument panel
 - Difficulty perceiving other cars through windscreen
- Older drivers tend to put measures in to place to attempt to alleviate these issues:
 - E.g., driving less, avoiding rush hour, not driving at night.

The Aging Brain

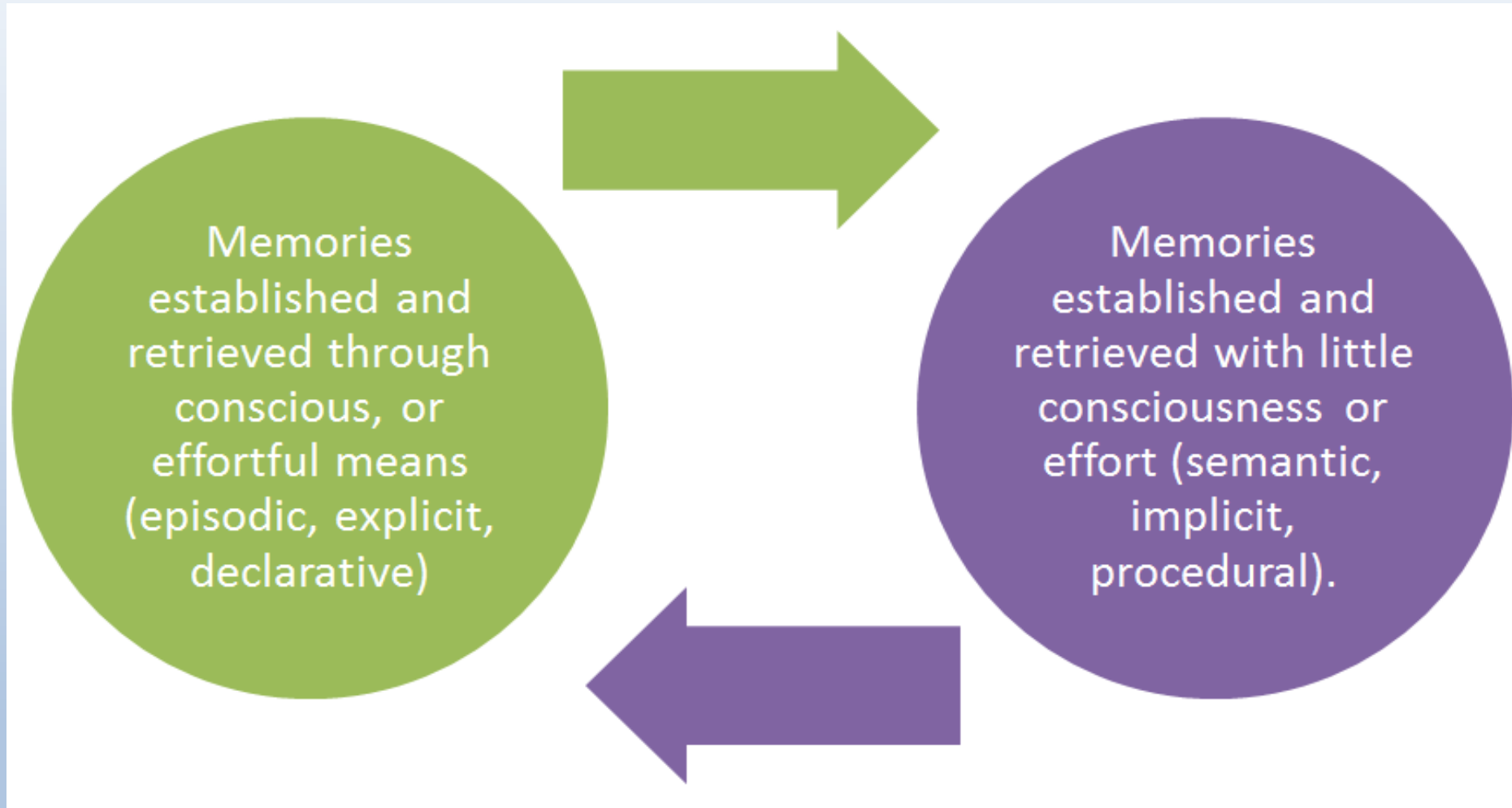
As individuals age, their brain shrinks.

They gradually lose nerve cells that they had from birth and process information more slowly.

As a consequence, learning new concepts and patterns becomes more difficult.

Memory also begins to fail.

Memory Decline



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

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

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

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.

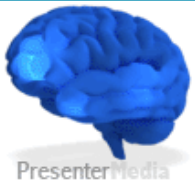
Memory

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).

More recently...

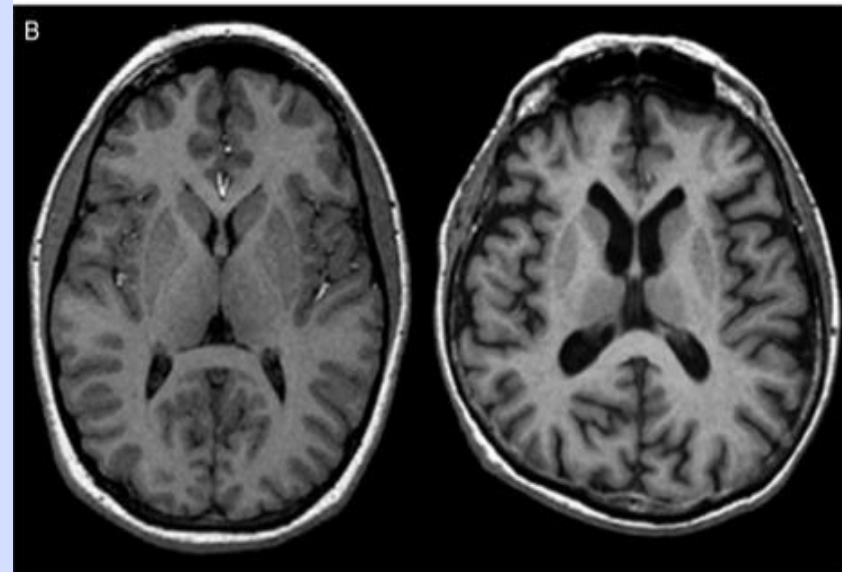
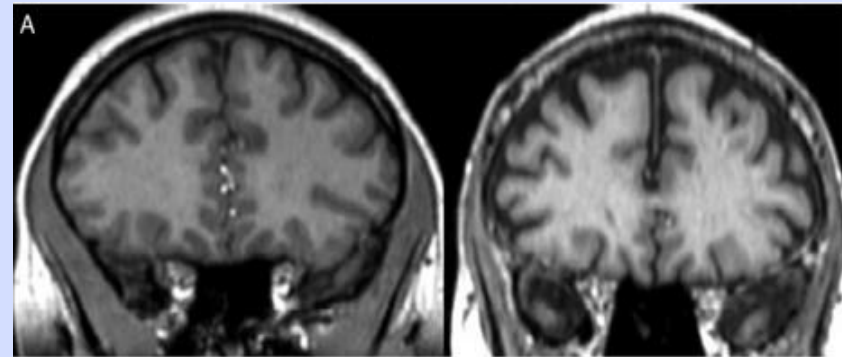
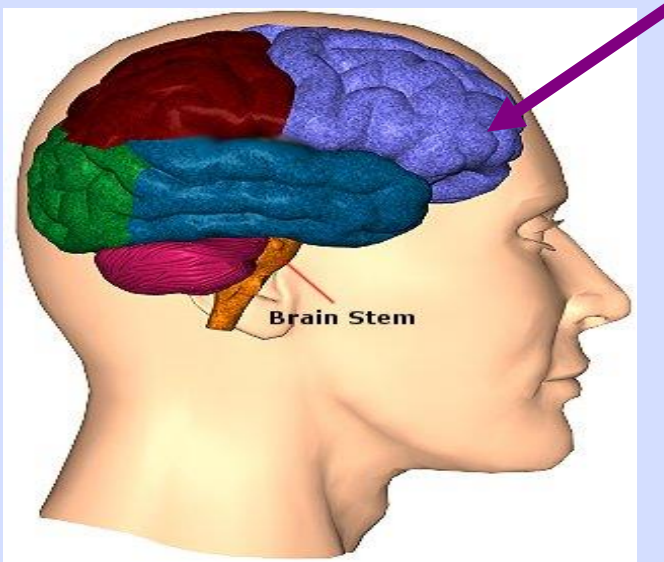
- With cognitive tasks heavily dependent on the frontal cortex (matching faces and recalling words) neuroimaging showed distinct age differences in which area of the brain is accessed.
- Older adults sometimes used additional areas in the same region of the brain. E.g., young adults performed a cognitive task by activating the left hemisphere of the prefrontal cortex, older adults activated both the 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 were asked to perform the same cognitive tasks as young adults, brain scans showed that different or more parts of the brain lit up (Cabeza 2002; Park et al. 2001)

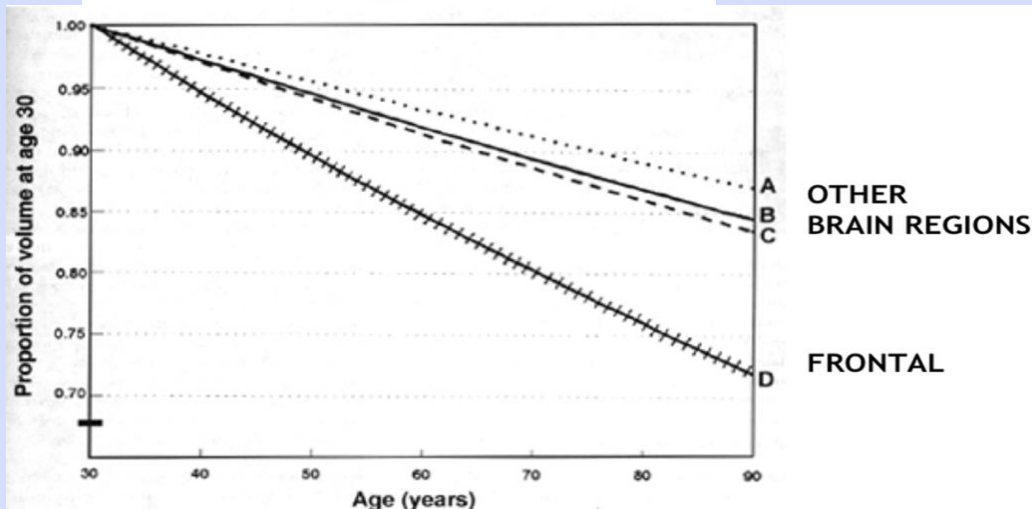
Working Memory

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



Young adult

Older adult



Working Memory & Processing Speed

Working memory declines with aging because of 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)



AGE & RESPONSE SPEED

- Response speed decreases with age
- It can occur for:
 1. Tasks involving presentation of information to a particular sensory modality.
 2. Tasks requiring a particular motor response.
- It is also suggested that age-related slowing occurs across all processing stages involved in speeded-response:

Encoding → Comparison → Response selection → Execution

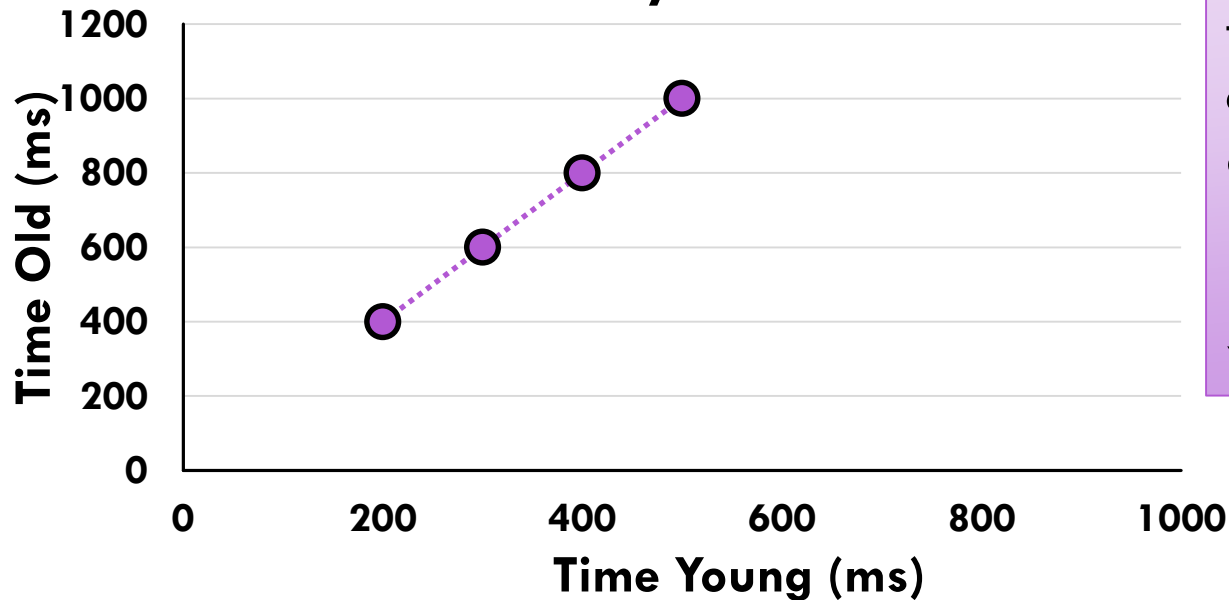
- Response slowing is thought to be general rather than specific and has been attributable to changes in the rate of central nervous system processing speed (Birren & Fisher, 1995).

AGE & RESPONSE SPEED

- Age related speed performance becomes more pronounced as a task becomes more difficult or complex.
- The “Complexity Hypothesis”:
 - Differences in response times between older and younger adults become greater as:
 - Central processing demands are increased while,
 - Peripheral processing demands are controlled (Salthouse, 1985).
- This hypothesis tested using ‘Brinley Plots’ (Brinley, 1965):
 - Mean RTs for older adults were a linear function of mean RTs for younger adults.

AGE & RESPONSE SPEED

Brinley Plot



Meta-analysis has revealed that across all levels of complexity and in a variety of different tasks, mean choice RTs for older adults were linearly related to those of younger adults (Cerella, 1985)

- However, these findings seem to provide support for a generalised slowing hypothesis.
 - Increments in RTs for older adults are proportionately similar in all tasks regardless of complexity.
- Use of Brinley plots to discriminate between models has been question.

AGE & RESPONSE SPEED

- Alternative: The “task-specific slowing” hypothesis:
 - Slowing in one task component process independent of slowing in other task component processes.
 - So, age-related slowing depends on the nature of the task being performed.
 - Across different tasks, the ratio of mean RTs for older adults to mean RTs for younger adults can vary.
 - E.g., degree of slowing in lexical decision task not as pronounced in older adults as expected based on their performance in non-lexical decision tasks (Lima, Hale, & Myerson, 1991).
- Therefore, although response does slow with increased age, there is dispute about the extent to which it is general or specific.

AGE & RESPONSE SPEED

- Accounts of why any age-related slowing occurs at all has included psychological and biological explanations.
- However, difficulty distinguishing between these as older individuals may compensate for biological changes in response speed by altering the way they carry out the task.
 - E.g., with the speed-accuracy trade-off: older adults favour caution while younger people adopt riskier strategies.
 - Older adults may also be less sensitive to error feedback on RT tasks, and then make inappropriate adjustments to the response criteria.

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?

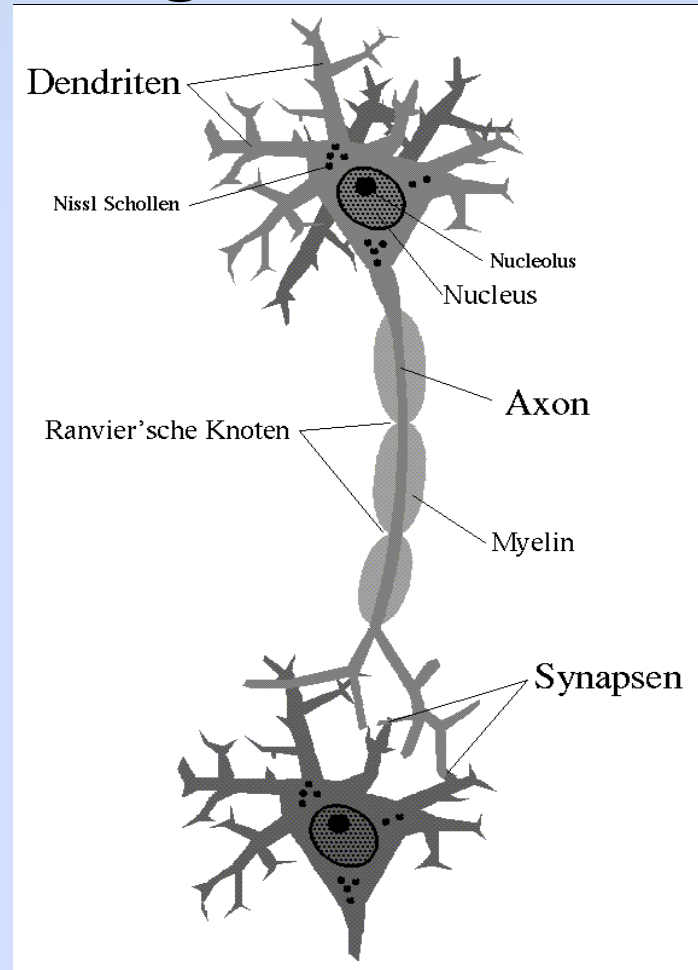
If it takes you longer to process “Fred walks up to a store counter with 3 packs of sweets”, you may miss that they each cost 50p.

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

The Aging Brain: Slowing Down

Changes in the speed of neurotransmission (the passing of chemical and electrical signals from one brain cell to another) likely underlie these age-related changes in processing speed

These neurotransmission changes are particularly pronounced in the 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)

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)

The Good News: Working Memory & Attention

Older adults have
extensive
expertise to draw
upon

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graph TD; A[Older adults have extensive expertise to draw upon] --> B[Can find connections between information that young adults have a harder time seeing]; B --> C[This can often compensate for the difficulties with task-switching and with attention focusing]; C --> A;
```

This can often
compensate for the
difficulties with task-
switching and with
attention focusing

Can find connections
between information
that young adults have
a harder time seeing

Successful aging & working memory

**use it or
lose it**

- maintain mental flexibility
- maintain expertise

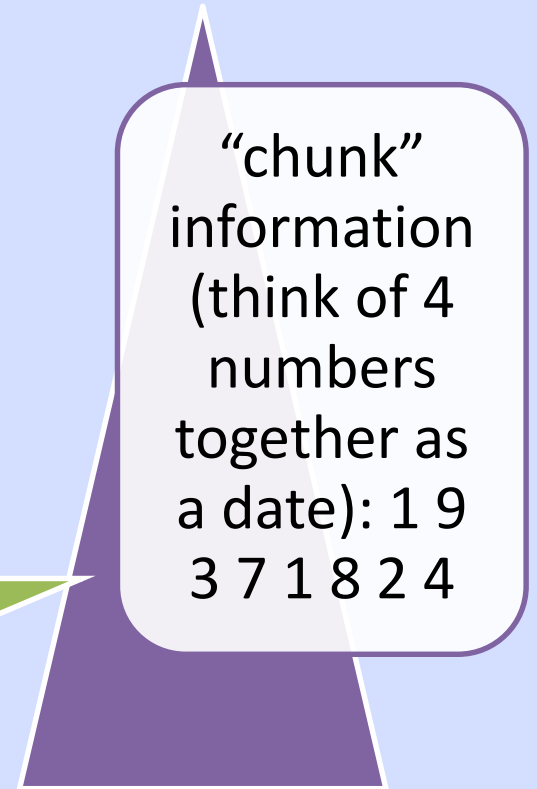
**organize
information**

**“chunk”
information**
(think of 4
numbers
together as
a date): 1 9
3 7 1 8 2 4

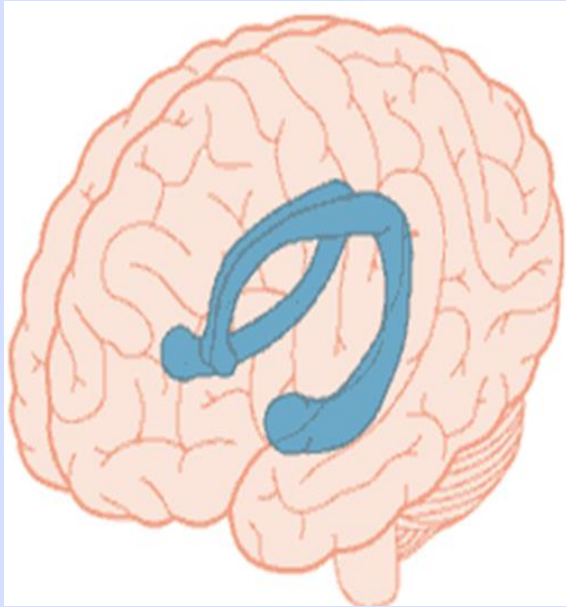
**eliminate
distractions**

**reduce
attention
demands**

**make information
meaningful and self-
relevant**



Long-Term Memory



Must LEARN information (e.g., people's names)

Attend to information

Process meaning of information

Learning improves when use strategies to make information meaningful or to organize information (e.g., imagery, associations)

Learning improved when stress minimized (reduce anxiety about remembering the information)

Must STORE information
(e.g., people's names)

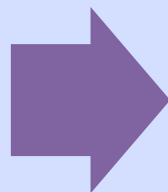
This is one of the regions that shrinks some with aging, and even more with Alzheimer's disease

Hippocampus
- declarative memory

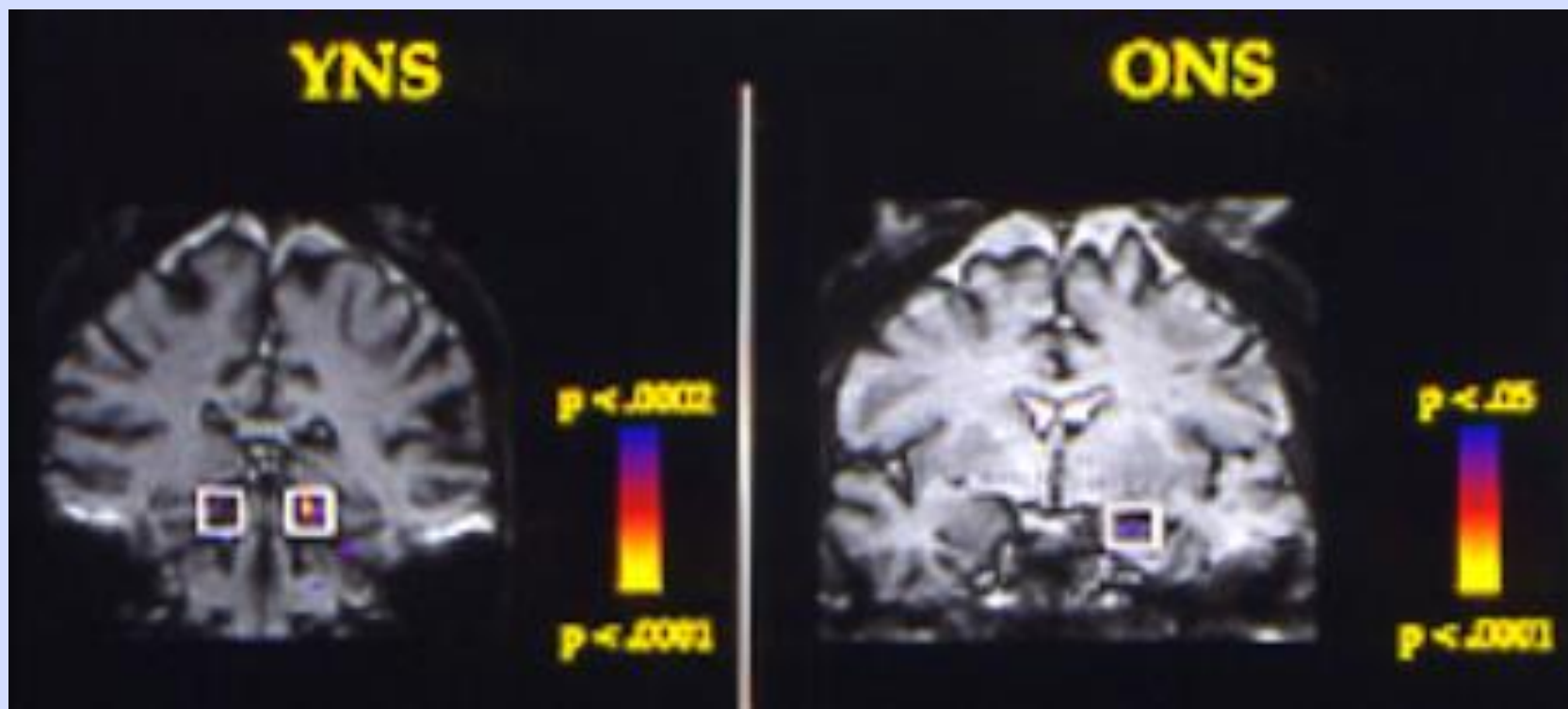
Requires functioning of the hippocampus

Aging & Long-Term Memory

Less activity in the hippocampus when older adults are trying to learn pictures than when young adults are trying to learn



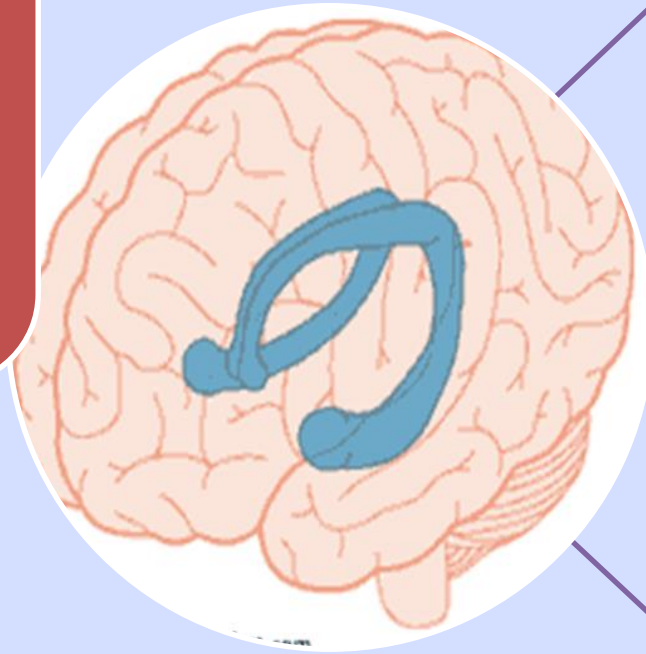
May be connected to inefficient storage of the information in older adults



Long-Term Memory

The loss of cells in the hippocampus means that there tends to be more overlap in the cells representing different memories, causing more interference

Also means that fewer cells may represent each memory, making memories less “rich” and less resilient



Must RETRIEVE information (e.g., people's names)

Better when “cues” are given (select names from among alternatives) than when must generate the cues

Much better when no similar, interfering information

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.

Successful aging & long-term memory

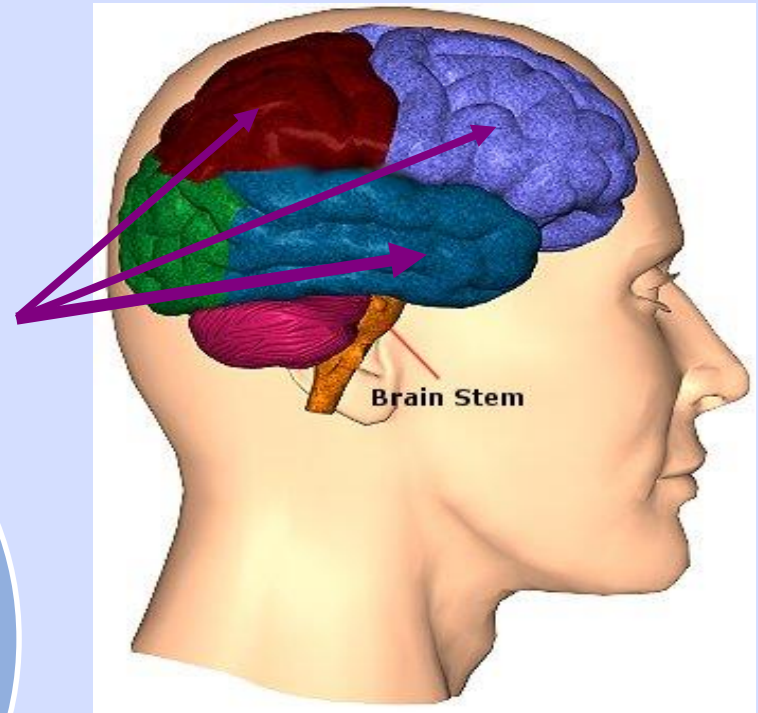
- **attend** to the information
- think about why the information is **important** to remember
- **organize** the information
 - Don't just use rote rehearsal
 - Clump like items together when trying to learn them; this will increase the likelihood that you will have retrieval cues
 - When learning someone's name, associate it with other information about that person
 - Use mental imagery to help you remember (e.g., as your placing your keys on the table, close your eyes and imagine the action)
- use **spaced rehearsal** (why cramming for an exam never did work)

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

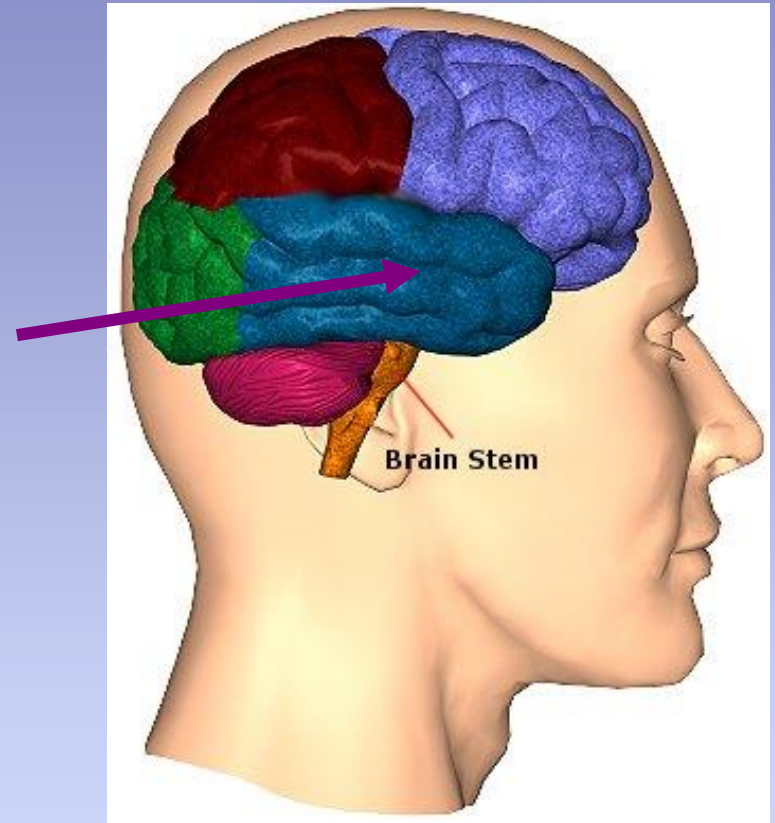
Remote memory - ability to remember things that happened years ago

L. Nadel, M. Moscovitch

Semantic Memory

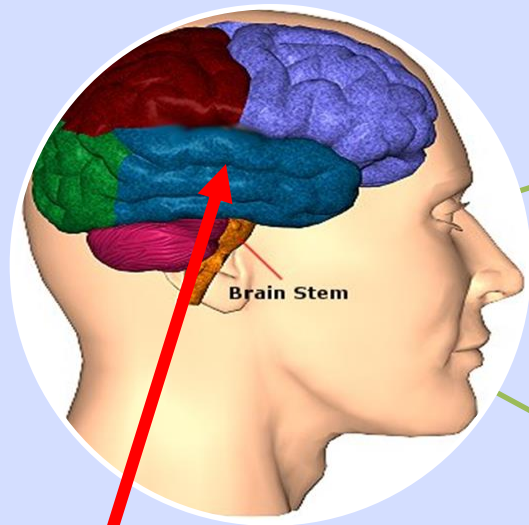
No longer contains details about the time and place in which the learning occurred

- 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)

Semantic Memory



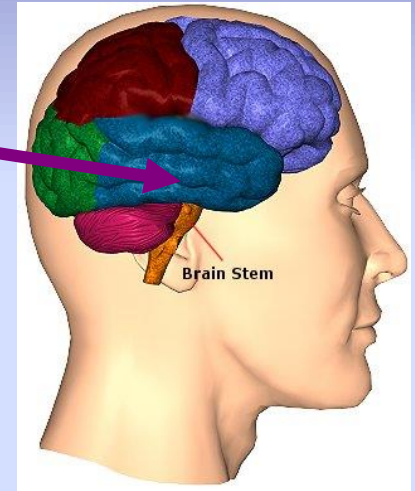
Reliant on
the
temporal
lobe cortex

This region is
preserved
with aging

Older adults tend to have
much better semantic
memory than young
adults (perform better on
tasks of vocabulary &
world knowledge)

Remote Memory

These memories can include information about the time and place in which an event occurred.



Often, this feels like “family lore,” or the re-telling of stories that you have often heard.

These memories are typically preserved with aging.

- - It can be harder to remember what happened last week than to remember what happened 40 years ago.



“Use it or lose it!”

Individuals who remain mentally active perform better on cognitive tasks than those who engage in mental activity less often

Use strategies to help remember information

One of the largest changes with age is the decline in the spontaneous use of mnemonic strategies to remember information

Avoid distraction and excessive worry as try to learn information

Yet when told what strategies to use, older adults can use them just as effectively as young adults

Strategies for Successful Aging

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

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)



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).

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 (Carstenson, 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..

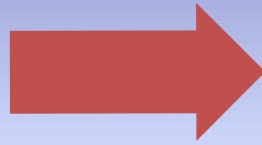
Chronological age is associated with paying more attention to emotional gratification and the emotional aspects of life (Carstensen 2006; Mather and Carstensen 2005).

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

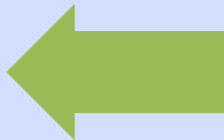


Shaping Goals Based on Perceived Time Left

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



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



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



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

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.

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.

Intelligence

traditional v. contemporary views of intelligence

theories of change in cognitive abilities

cognitive changes: attention, perception, memory

what is IQ?

fluid v. crystallized intelligence

life span views on intelligence

effects of intellectual “exercise”

Traditional views of adult intelligence



**“You can’t
teach an old
dog new
tricks.”**

**This is the
decrementalist
perspective**

**Intellectual decline is
inevitable with aging**

Contemporary views of adult intelligence

“You’re not getting older, you’re getting *better!*”



Lifespan development consists of dual processes of gain and loss

This is the continued-potential perspective

Theories of Changes in Cognitive Abilities Across Adulthood

Traditional psychometric approach: measure “IQ”

Piaget’s stage theory

- **Formal operations in adulthood**

Neo-Piagetian theories

- **Post-formal thinking skills**

Information processing theories: cognitive science

Pragmatic theories of intellectual aging

Denney’s theory of optimally exercised and un-exercise abilities

Changes in attentional capacities

- **Attention: the mechanisms used to prepare to process stimuli, focus on what to process, and determine how much to process the stimuli**
 - **Selective attention (age-related decline – effortful)**
 - Automatic vs. effortful processing
 - **Divided attention (decline)**
 - **Sustained attention**
 - Older adults' attentional abilities are lower compared to younger adults

Changes in perceptual processing speed

Perceptual speed accounts for >80% of age-related variance in performance on memory tasks

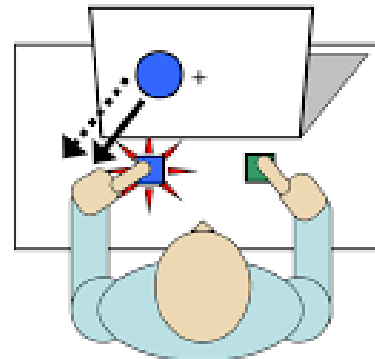
Older adults' performance on *timed* tests is adversely affected

Can observed cognitive declines be attributed solely to slowing of perceptual processing?

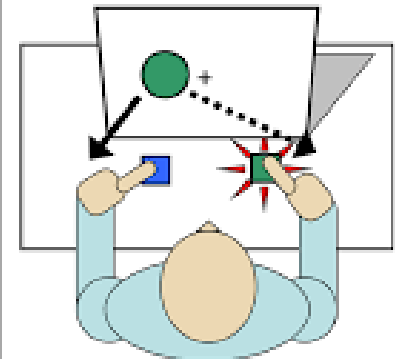
Reaction time tasks

press button quickly as possible every time light flashes

COMPATIBLE



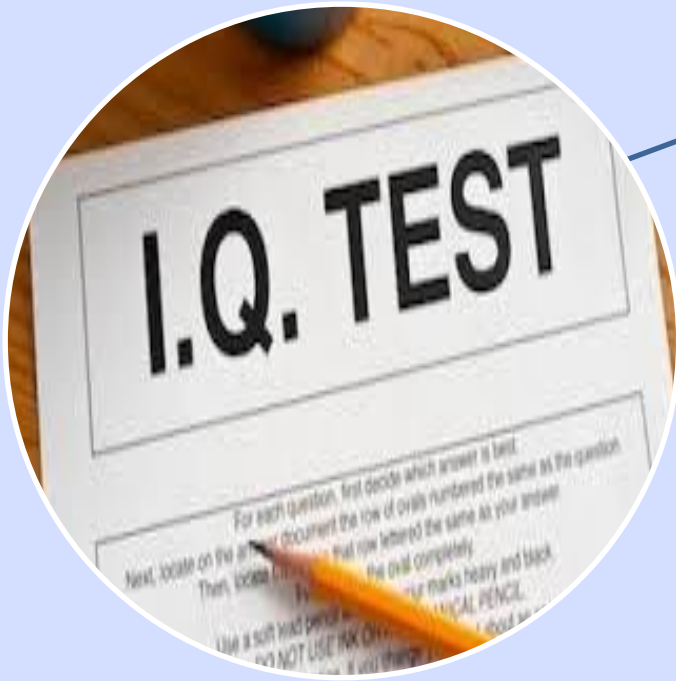
INCOMPATIBLE



Adult Intelligence: *What is IQ?*

“the mental activity involved in successful adaptation to the changing demands of the environment”

IQ is the score derived from performance on an intelligence test; it is an indicator of the “amount” of intelligence possessed by the individual.

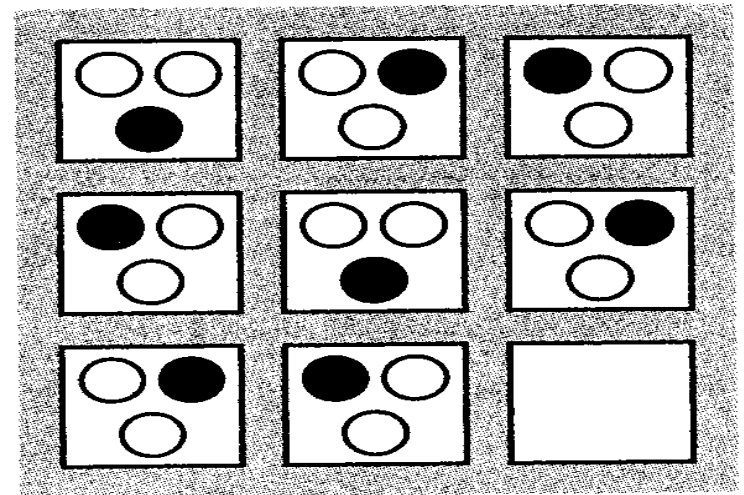


Adult Intelligence: *Traditional vs. contemporary views*

- **Traditional intelligence:**
 - Fluid versus crystallized intelligence
 - Primary mental abilities (E.L. Thurstone)
 - Verbal comprehension (*Cryst*)
 - Word (verbal) fluency (*Cryst*)
 - Spatial reasoning (*Fluid*)
 - Associative memory (*Fluid*)
 - Perceptual speed (*Fluid*)

Fluid intelligence

Matrices Indicate the figure that comes next in the series



Letter series Decide which letter comes next in the series
A D G J

Figure relations Decide which shape is related to the first shape in the same way as the second shape is related to the first shape

Fluid intelligence -the abilities that make you a flexible and adaptive thinker.
Crystallized intelligence - culturally-determined, schooling or other life experiences.

What does the research evidence show regarding changes in intellectual functioning over the adult life span?

K. Warner Schaie



Followed samples of adults over many decades (beginning in the mid-1950s), and assessed their intellectual performance, using Thurstone's Primary Mental Abilities Test.

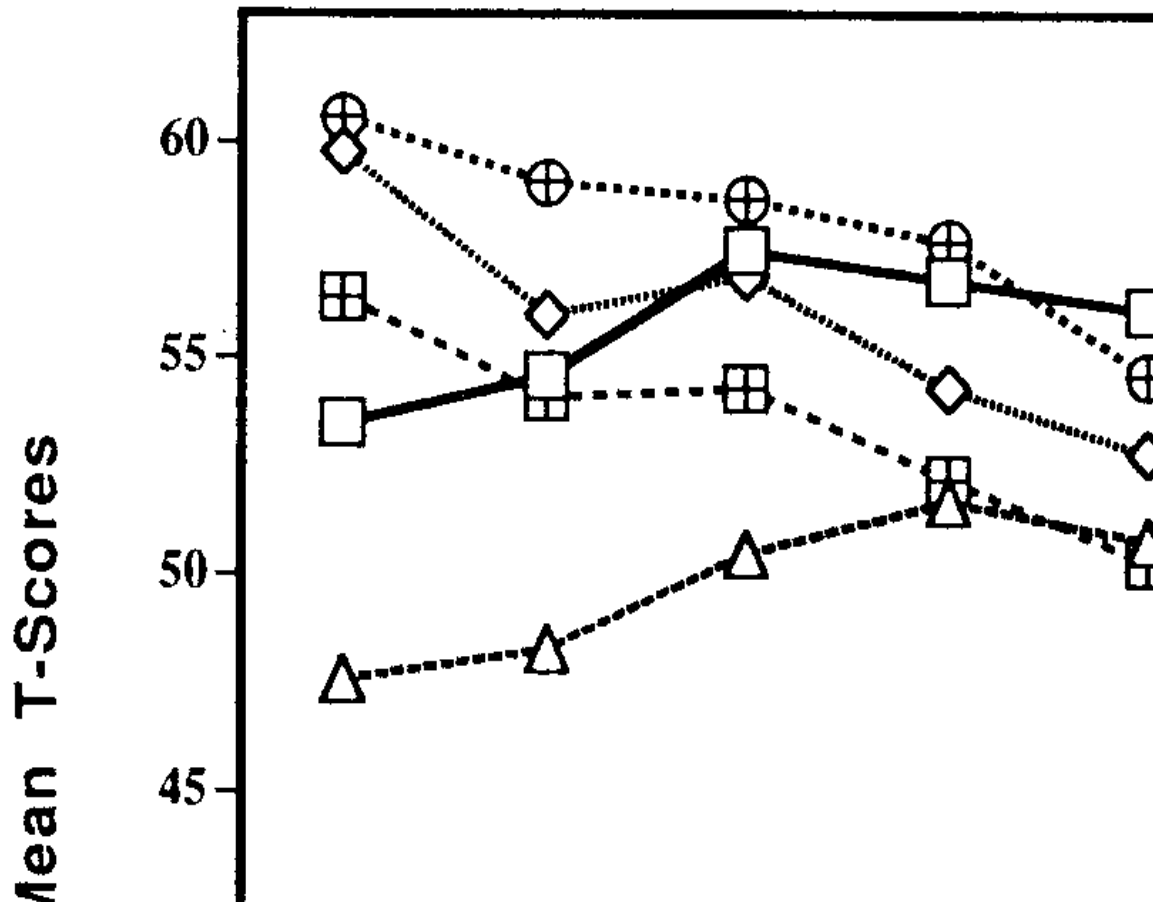
How intelligence changes over the life span.

*Cognitive Psychology, Fourth Edition, Robert J. Sternberg
Chapter 13*

Thurstone's 7 Primary Mental Abilities

- Verbal comprehension
- Verbal fluency
- Inductive reasoning
- Spatial visualization
- Number
- Memory
- Perceptual speed

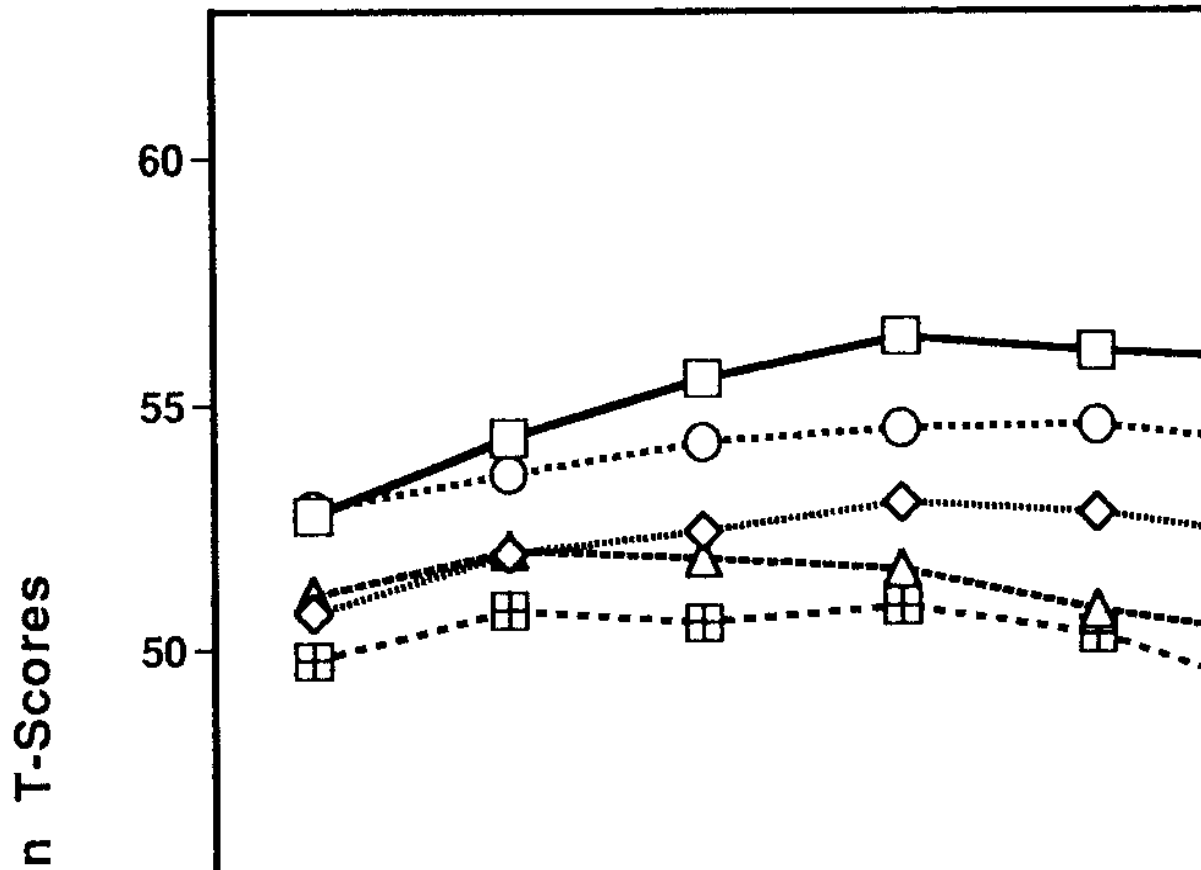
K. Warner Schaie (Cross-sectional study)



The primary intellectual abilities are maintained, or even improve, up to the mid-50s, but then begin to decline with advancing age.

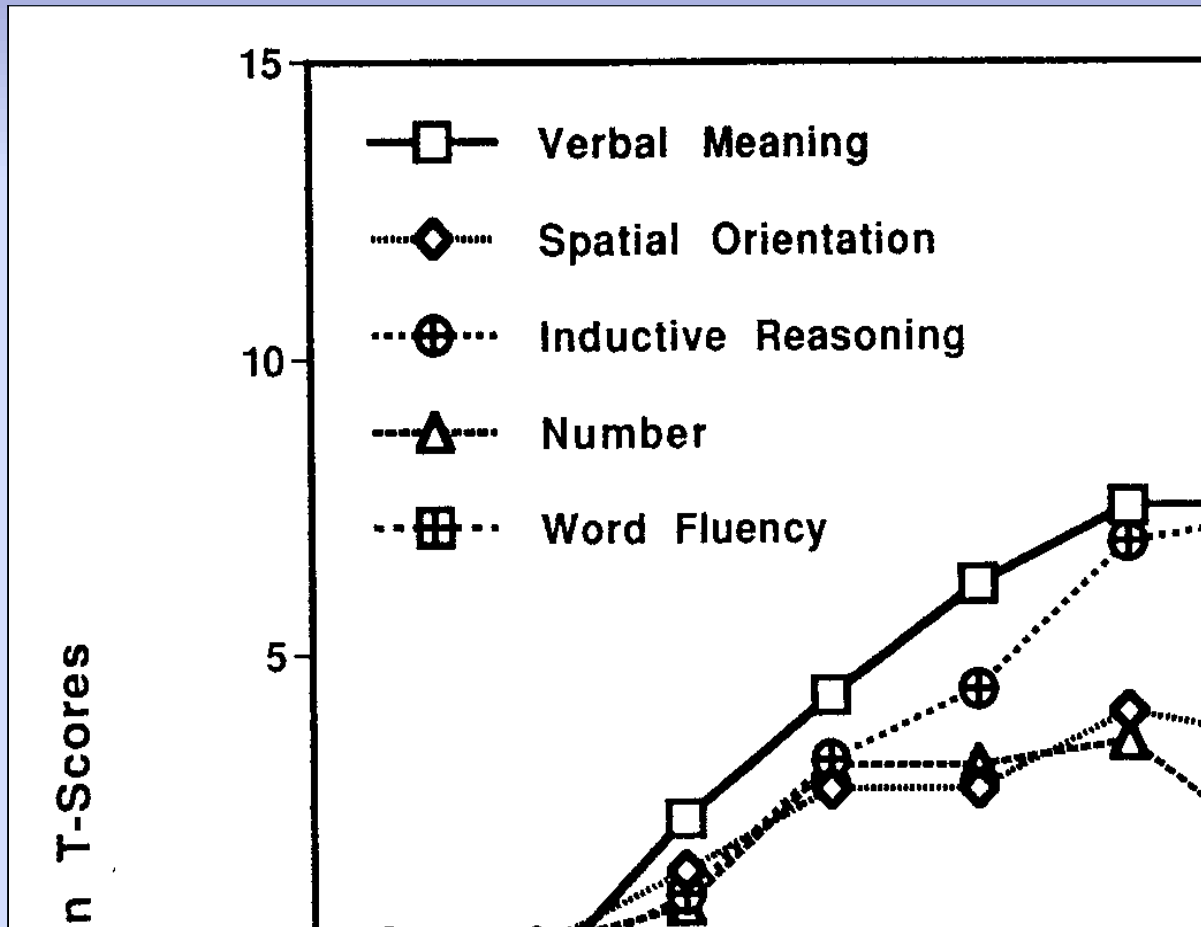
Age-related differences in the five primary mental abilities for 9 different adult age groups.

K. Warner Schaie (Longitudinal study)



The primary mental abilities either improve slightly or are maintained into the mid-60s and begin to decline thereafter. So, the longitudinal picture of age-related changes is a little more positive than the cross-sectional picture.

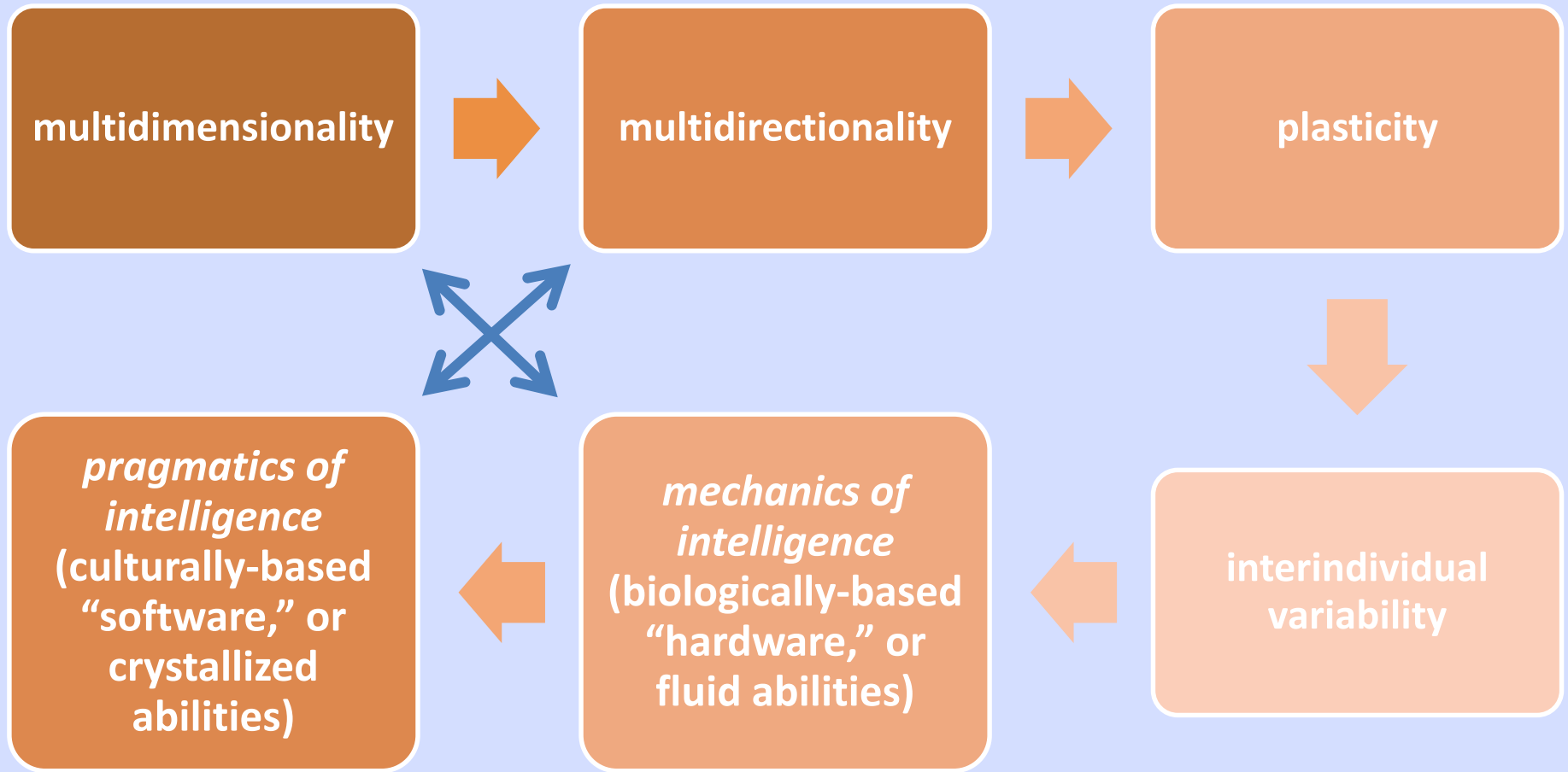
K. Warner Schaie



For 3 of the PMAs, there seem to be quite dramatic increases in the abilities; there is decline in one ability and stability in another.

However, closer inspection of the graph shows that we are not tracking change over time. Rather, this graph is a comparison of **different birth cohorts**—that is, adults born at different times, from 1889 up to 1966.

Life span views on intelligence



Psycho-gerontologist **Paul Baltes**

Fluid intelligence

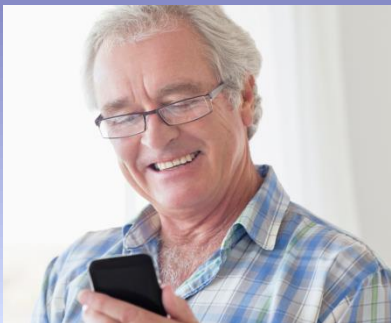
Horn and Cattell (1967) - report an age-related decline in performance on fluid intelligence tasks.

Salthouse (1996, 2001a) - the age-related decline in a variety of cognitive abilities, including reasoning, can be accounted for by a single mechanism, generalized slowing.

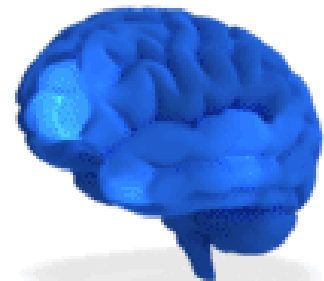
Detrimental effect on cognitive function

- inability to effectively execute the component operations involved in a task due to time limitations
- inability to hold information on-line that is necessary for task completion





Fluid intelligence



PresenterMedia

Age-related cognitive decline relates to the functioning of the frontal lobes.

Prefrontal cortex theory (West, 1996) - that goal-oriented functions of the prefrontal cortex (e.g., integrating information, executing complex, sequential behaviours, handling novelty, and inhibiting distracting or interfering information) are most susceptible to age effects because of the neurophysiological changes occurring in this area of the brain.

The frontal lobes are one of the first areas of the brain to be negatively affected by aging.

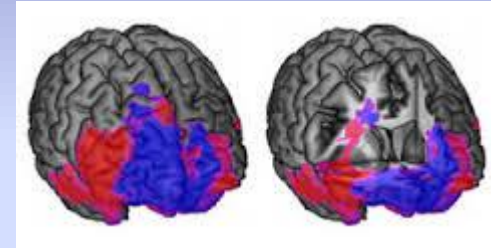
- decreases in frontal lobe volume (DeCarli et al., 2005)
- also alterations in frontal cell morphology (Buckner, 2004) with age.

In addition, the largest age-related reductions in cerebral blood flow have been localized to the frontal and prefrontal areas (Schroeter, Zysset, Kruggel, & von Cramon, 2003; Shaw et al., 1984).

Schretlen et al. (2000)

“age-related atrophic changes in frontal brain structures undermine the functioning of executive abilities, and that this results in the gradual decline of fluid intelligence” (p. 53).

found that executive ability and frontal-lobe volume, but not non-frontal volume, significantly reduced the age-related variance in fluid intelligence.



processing speed also reduced the age-related variance in fluid intelligence.

the contribution of executive ability and frontal volume to the decline in fluid intelligence was largely unrelated to the contribution of processing speed.

Thus, reduced frontal functioning and reduced processing speed both contribute to the decline in fluid intelligence with age.

The effects of intellectual “exercise”

So... you can't teach an old dog new tricks

- Education and “training”
- Intellectual activity
- Physical exercise
- Environmental complexity



One study found that 10 one-hour cognitive training sessions, with follow-up booster sessions a year (and more) later, led to improved cognitive scores (Boron et al., 2007; Willis et al., 2006).

Factors that reduce the risk of intellectual decline in older adulthood

**Absence of
cardiovascular and
other chronic
diseases**

**Involvement
in complex
and
intellectually
stimulating
environment**

**Favorable
environment
mediated by high
socioeconomic status**

**High cognitive
status of
spouse**

**Maintain high levels of
perceptual processing
speed (Schaie, 1993).**

**Flexible
personality
style**

Other dimensions of intelligence:

Expertise



Creativity



Wisdom



- *the development of advanced skills and knowledge - well-practiced activity*
 - experts know more than novices do!
 - task-specific, not transferable
 - requires intense practice over many years
 - expertise immune to aging effects
- **George Burns:** Academy Award winner, age 80
- **Ghandi:** Indian independence movement, age 72
- **Mandela:** Nobel Peace Prize at age 75
- **Grandma Moses:** painting at age 100
- **GB Shaw:** writing plays at age 93
- **Strom Thurmond:** US Senator, age 100
- *an expert knowledge system applied to the fundamental pragmatics of life that permits exceptional insight, judgment, and advice involving the conduct and meaning of life*

*A 15 year old girl wants to get married.
What should she consider and do?*

- **Low wisdom:**
 - *“A 15 year old girl wants to get married? No, no way, marrying at age 15 would be utterly wrong. One has to tell the girl that marriage is not possible...It would be irresponsible to support such an idea. No, this is just a crazy idea.”*
- **High wisdom:**
 - *“Well, on the surface, this seems like an easy problem. On average, marriage for 15 year old girls is not a good thing. But, there are situations where the average case does not fit. Perhaps in this instance, special life circumstance are involved such that the girl has a terminal illness. Or the girl has just lost her parents. And also, this girl may live in another culture or historical period. Perhaps she was raised with a value system different from ours.”*

Can people *learn* to become wise?



Three factors
that can help:

- *general personality characteristics, such as mental ability and creativity*
- *specific expertise conditions, such as mentoring or practice*
- *facilitative life contexts, such as education or leadership opportunities*

Summary

Some aspects of intelligence decline with age, but generally not until *late in life*



Some aspects of intelligence are maintained or increase with age



Individuals can stave off the effects of intellectual aging through *activity* and good health



There are multiple ways that intelligence can be expressed: *creativity, practicality, emotions* etc.



Intellectual expertise and wisdom can be developed