

# Aging and Cognition: Decline and Compensation

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NICE Knowledge Exchange

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# Aging and Memory: Downhill all the Way?

Is it really downhill all the way??

Mostly YES!!!

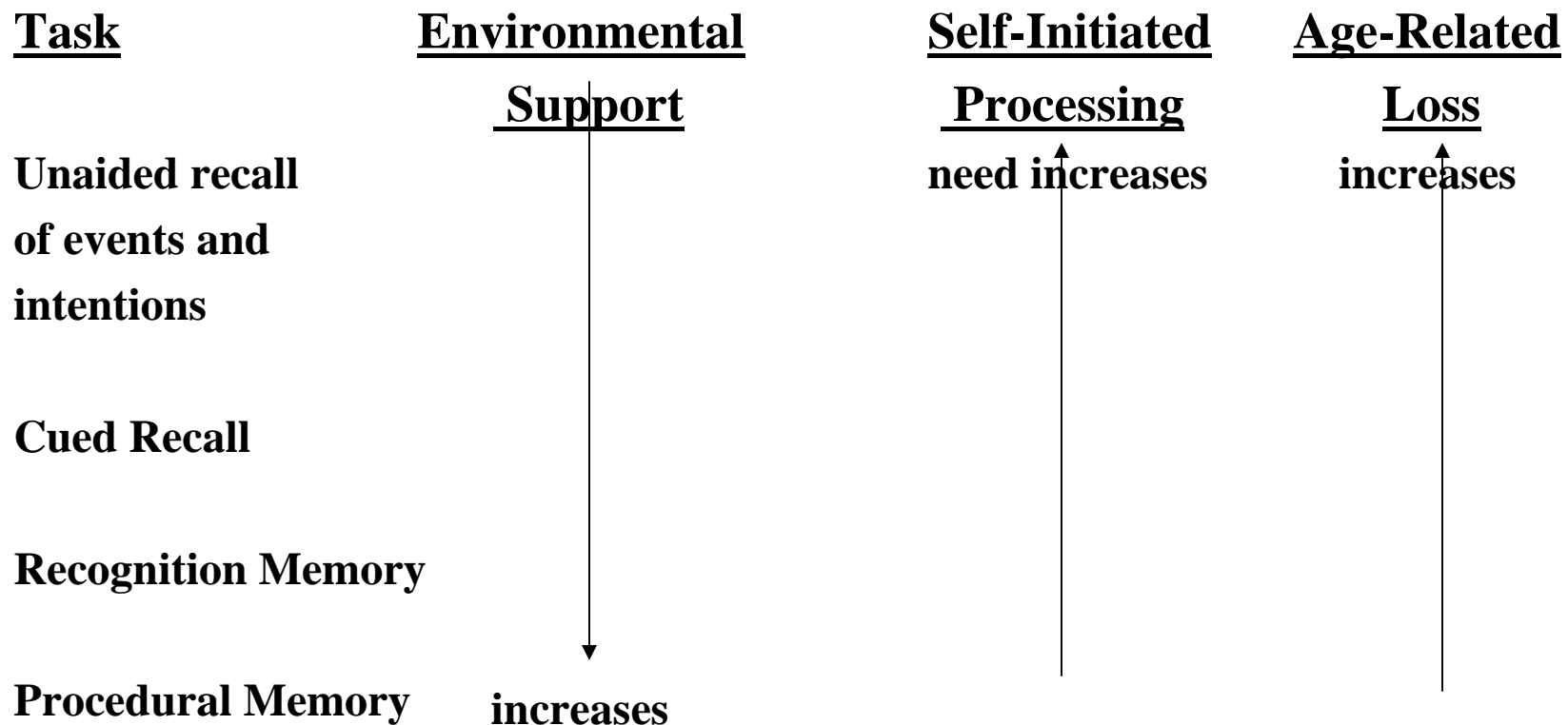
But losses differential!

# Age-related memory losses are differential

- Types of memory that hold up well
  - Primary memory (telephone numbers)
  - Long-term memory for facts (but access?)
  - Procedural memory
- Types of memory that fall off
  - Working memory
  - Episodic memory
  - Prospective memory

# Age-related memory loss a function of:

1. **PERSON** unable to execute controlled processing  
(self-initiated activity; frontal inefficiency)
2. **TASK** requires self-initiated processing
3. **ENVIRONMENT** fails to compensate (via cues, context)



# Some experimental studies

Usually two groups

- Older Adults (60-80 yrs.) Volunteers!!
- Younger Adults (18-30 yrs.) Usually students—paid or course credit
- Matched (as far as possible) on  
Years of Education (Young > Old)  
Vocabulary Level (Old >> Young!)

# Locating the Loss

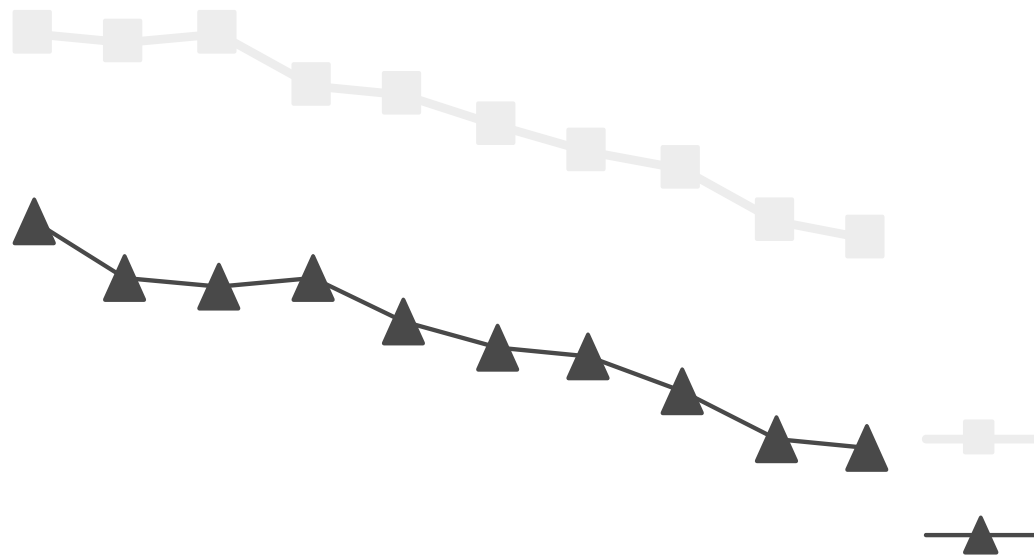
Encoding? Retrieval? Both??

“Repair” encoding – Age decrement reduced?

- 1) Performing actions
- 2) (a) Enhance meaningfulness (LOP)  
(b) Plus recognition
- 3) Schematic Support .....using knowledge

# ‘Subject-Performed Tasks’

- Participants asked either to learn a list of verbal commands, e.g.
- “Pick up the watch”
- “Point to the ceiling”
- Or ....carry out the actions
- Later unexpectedly asked to recall all the commands and actions
- Study by Michael Ronnlund et al.



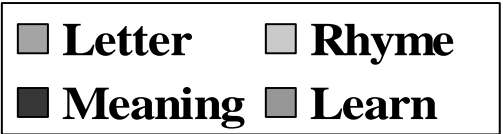
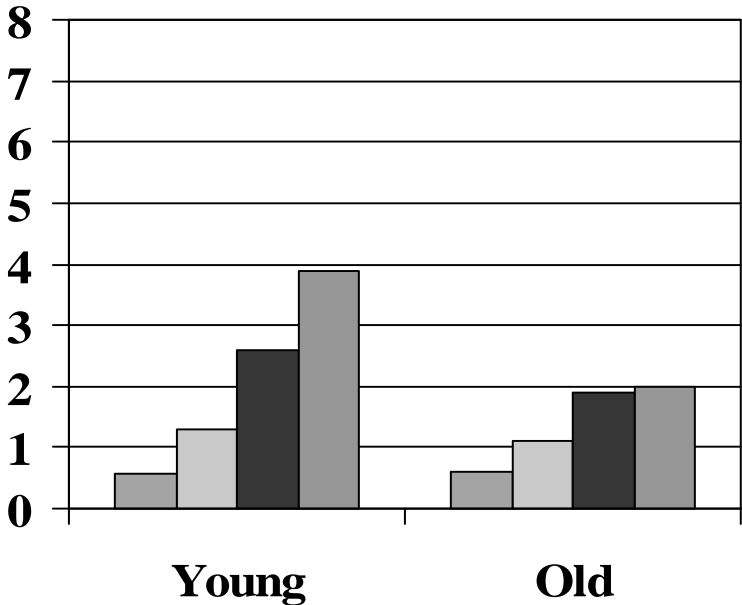
# Learning Names

(Experiment with Dr. Angie Troyer)

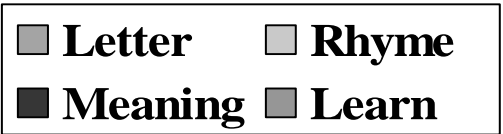
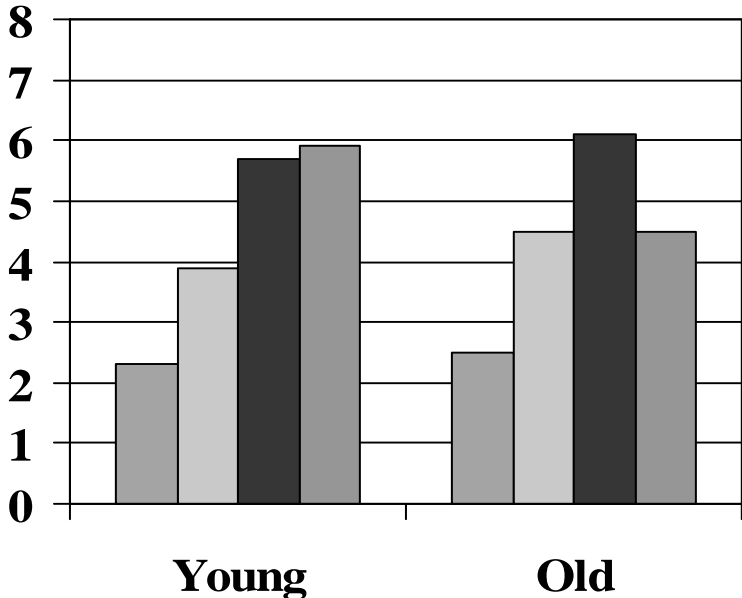
- Participants asked to LEARN 8 names
- Three other sets of 8 names – “interference”
- “Say first LETTER of name”
- “Generate a RHYME to the name”
- “Generate a MEANINGful association”
- All 32 types mixed up
- “Please recall ALL names”
- Recognition test --- 32 names plus 64 new names

# Recall and Recognition as a Function of age and type of processing

Recall



Recognition



# Memory for Numerical Information

- Older adults show impairments for arbitrary associations
- Critical factor: the degree to which information can be meaningfully related to form a unit of information
- Memory for grocery prices, regular or inflated
- Study by Dr. Alan Castel

- How does “schematic support” influence binding for grocery items and prices?
- Block 1-Market-value items (regular price)
- Block 2-Over-priced items (unusual price)
- Cued recall: given each item, recall price
- Older adults should be better at binding market value prices than unusual prices

Cereal \$3.59



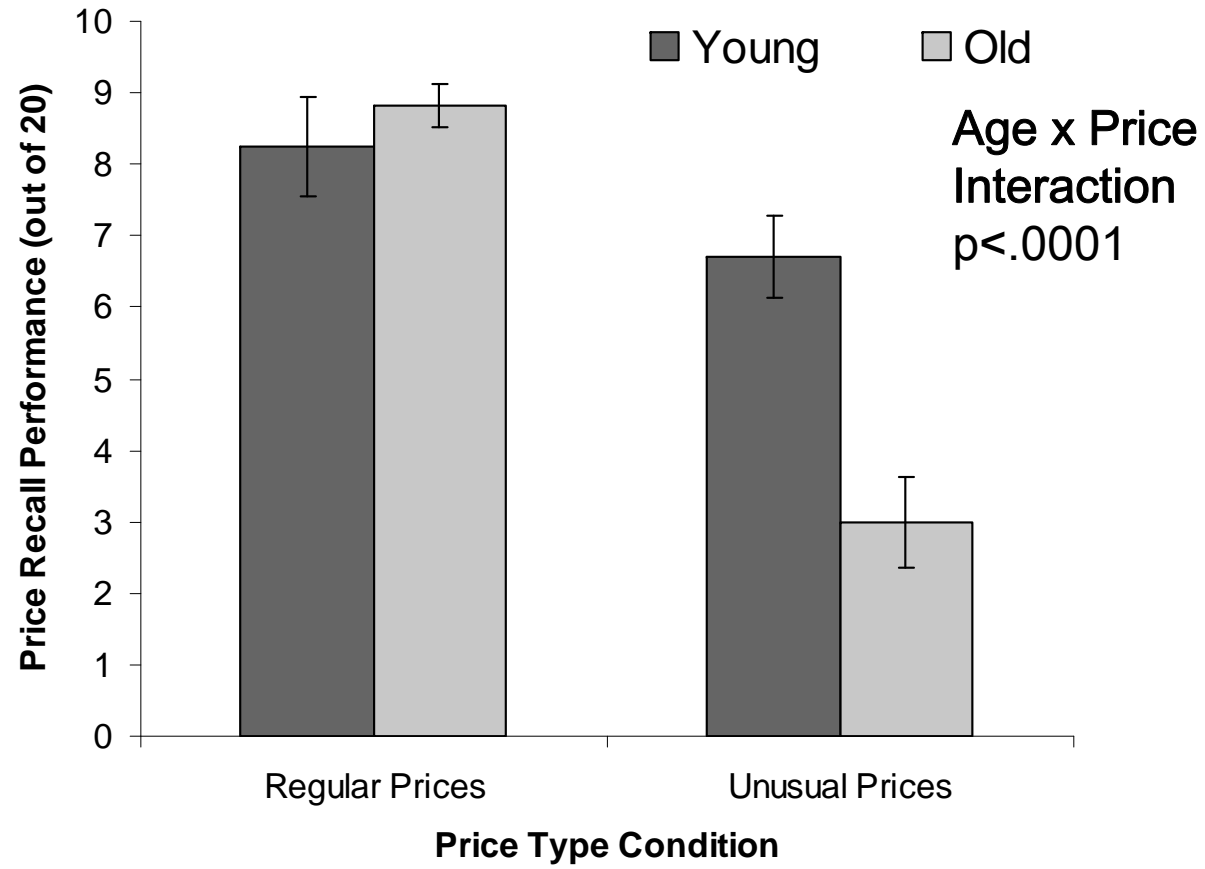
Juice \$17.19



# Recall Price?



# Recall Accuracy



# Contextual Support and Aging

Studies with Astrid Schloerscheidt

Contexts - rich pictorial scenes  
Targets - words or photos of objects

10 scenes, each paired with 8 or 12 targets

1. Recall of scene given target object
2. Recognition of target, varying context

Effects of aging?

1. Poor recall of context ?
2. More dependent on context ?

# Schloerscheidt & Craik (in prep)

8 objects with each of 10 scenes

## 1. Context recall

20 objects – scene?

Young = 0.72  $p < .001$

Old = 0.35

# Schloerscheidt & Craik (in prep)

Objects ( Words or Pictures) x Scenes

## Words

12 words paired with each of 10 scenes = 120

## Pictures

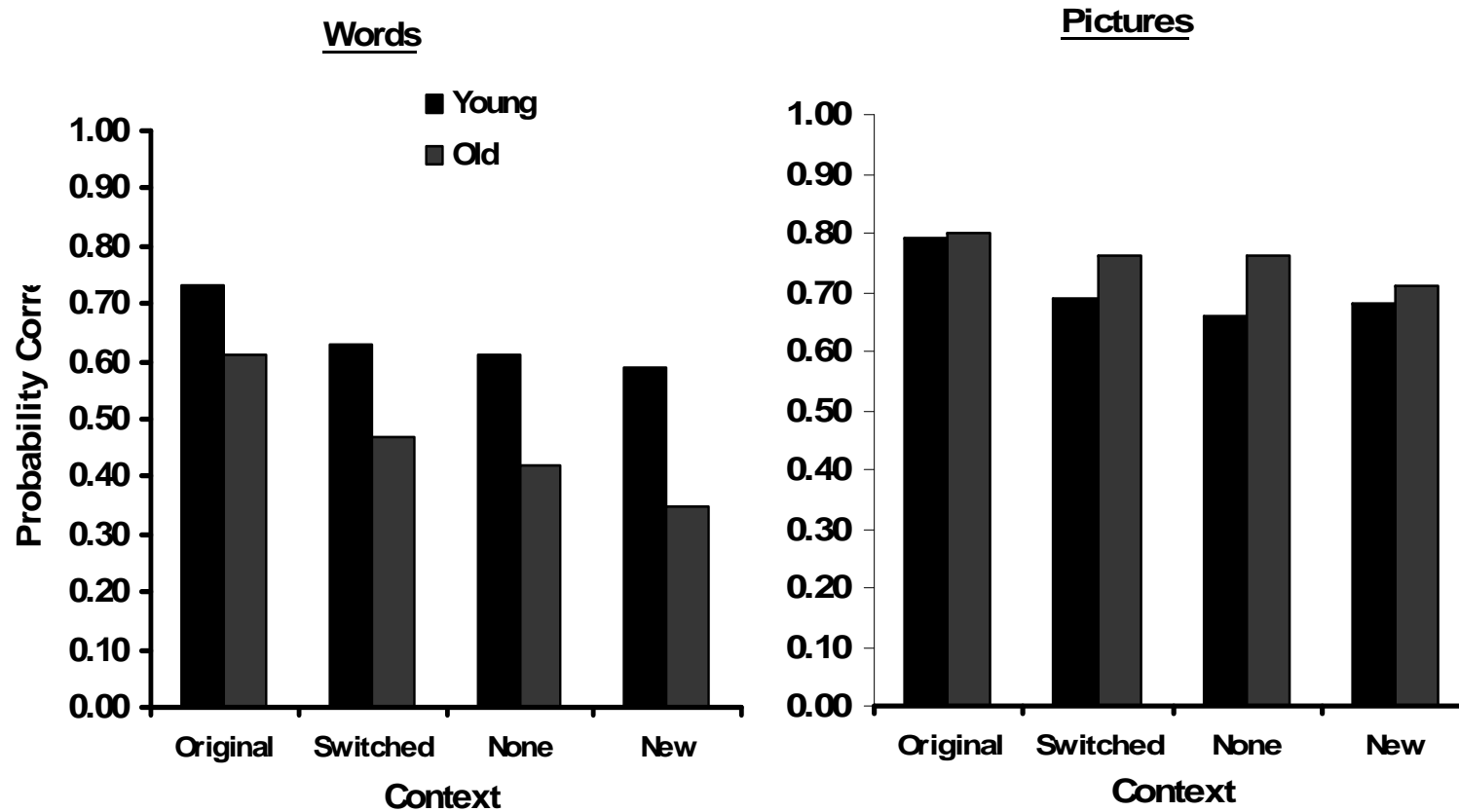
12 pictured objects with each of 10 scenes = 120

In each case 120 old items + 60 new items

Test was item recognition

Contexts = Original, Switched, None, New

# Recognition (Hits – New)



# Contextual Support - Conclusions

## 1. Context Recall

Old << Young

## 2. Item Recognition

Age x Words / Pictures  $p < .001$

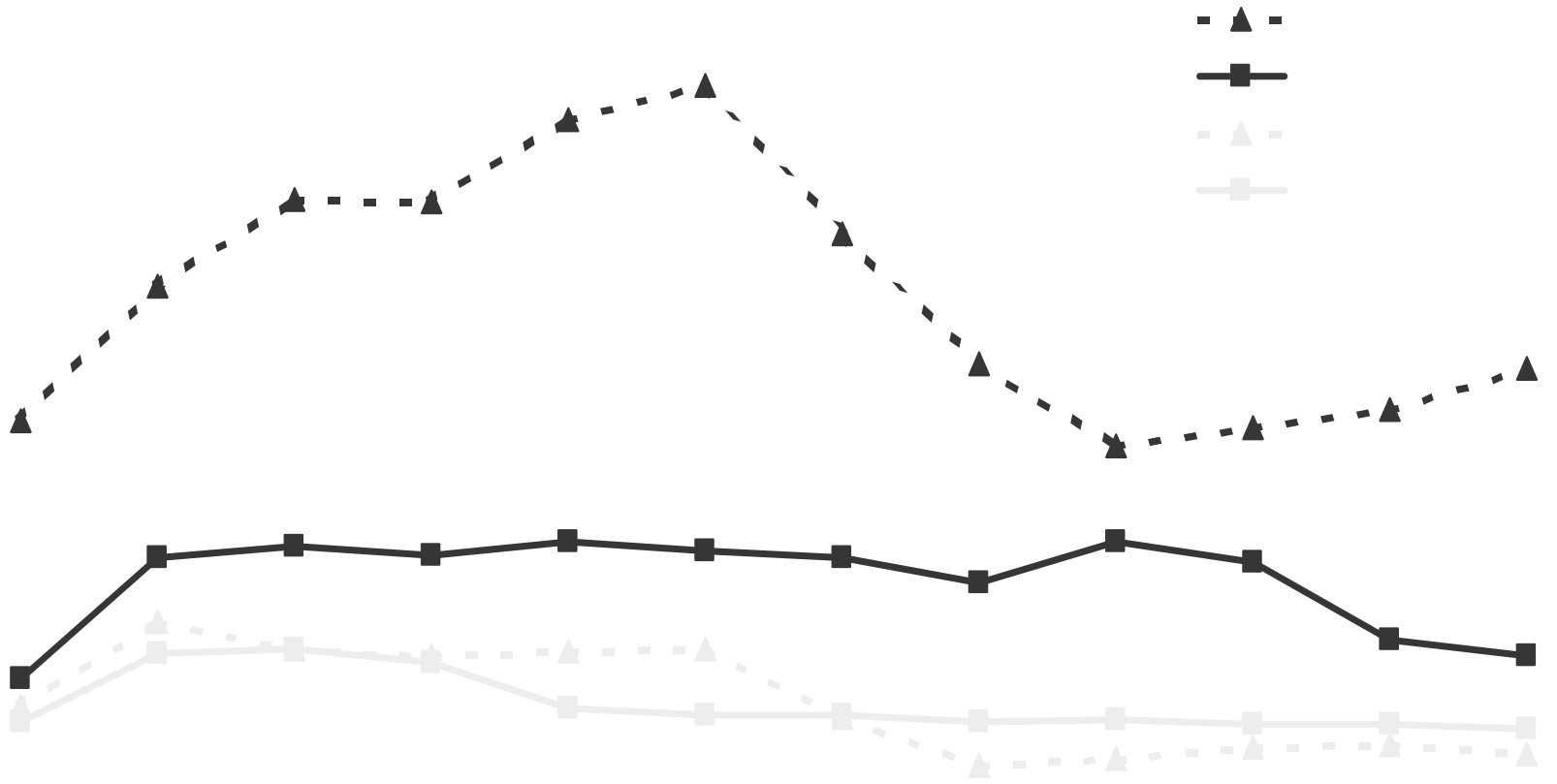
for Young - Original Context > Others

for Old - No context effects for Pictures

- Large effect for Words

# Measuring Processing Resource Costs

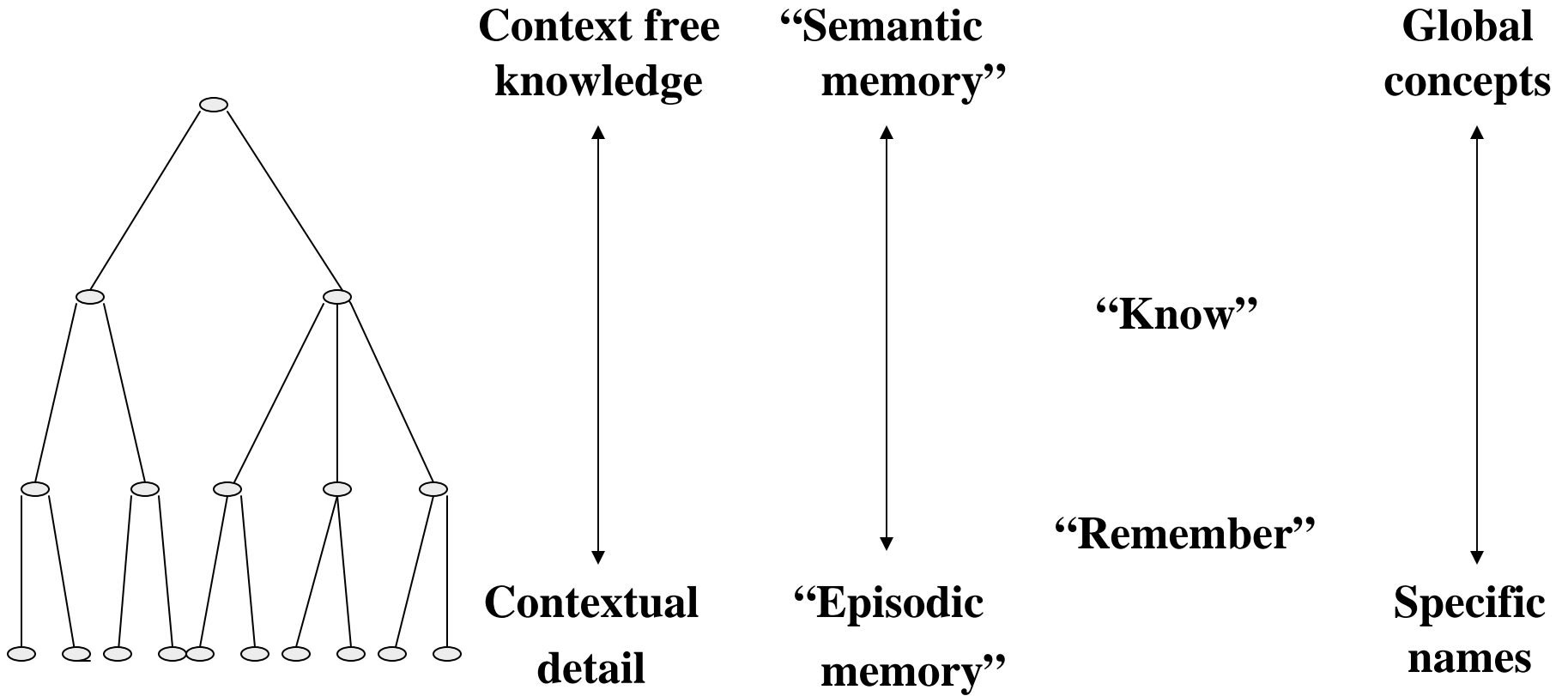
- 1) Compare encoding and retrieval costs
- 2) Compare costs for Young and Old
- 3) Visual tracking task
  - (a) Subject encodes or retrieves word pairs presented auditorily
  - (b) while tracking randomly moving target on screen
  - (c) Baseline: deviation while tracking only
  - (d) Dual-task costs – extra deviations while also encoding or retrieving (6-sec interval)



# Hierarchical Model

- 1) Older adults have especial problems with
  - (a) names
  - (b) specific contexts and sources
- 2) Something in common?
- 3) Notion that knowledge is represented hierarchically
  - (a) Individual episodes → general knowledge
  - (b) Specifics – names/instances – at ends of branches
  - (c) General facts, gist, etc. = higher nodes
- 4) Possibility that higher nodes easier to access; lower nodes difficult for
  - (a) Older adults?
  - (b) Younger under DA?
  - (c) Depressed patients?

# Hierarchical Model



# Bilingualism and Aging

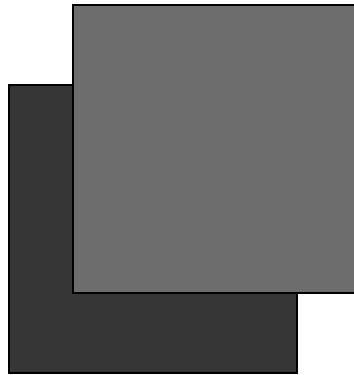
## Simon Task

Bialystok, Craik, Klein, & Viswanathan, 2004

- 94 participants between 30 and 80 years
- Half bilingual matched by age
- Background measures of working memory, language proficiency, intelligence (Cattell)

# Control

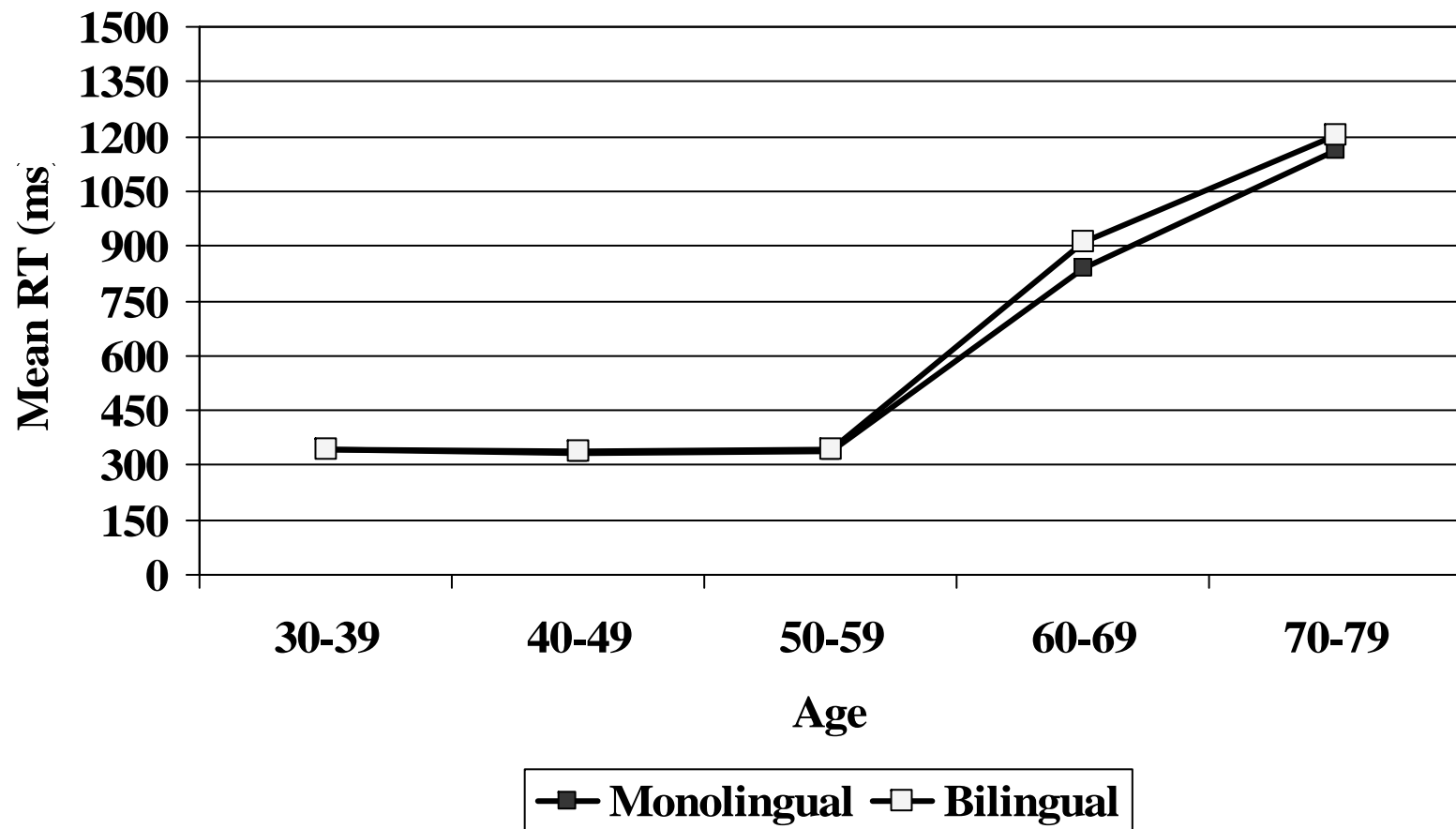
Rule: red square  $\rightarrow$  left      green square  $\rightarrow$  right



L

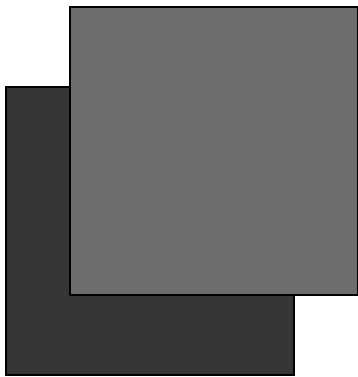
R

# Mean RT for Control by Decade

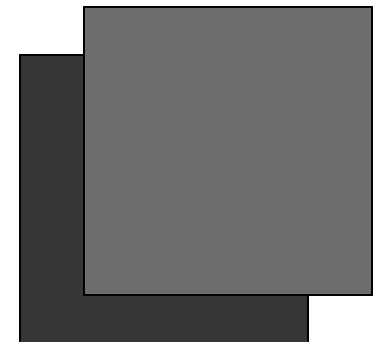


# Simon Effect

Rule: red square → left      green square → right

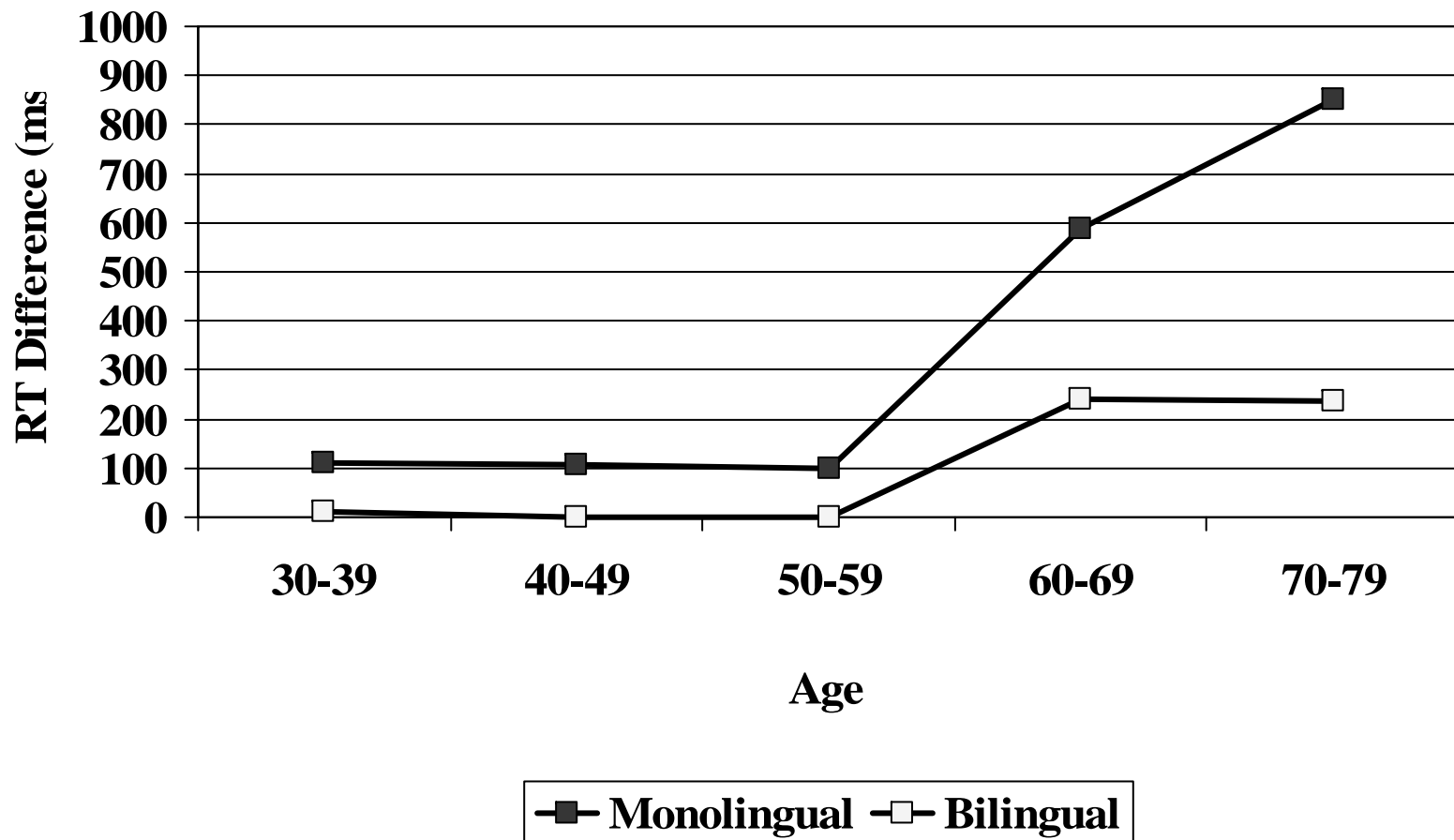


L



R

# Mean Simon Effect by Decade



# Bilingualism and Alzheimer's Disease

- Mentally stimulating activities →  
"cognitive reserve" (Stern, 2000)
- Years of education important component of  
cognitive reserve
- Significantly better cognitive functioning in  
AD for patients with cognitive reserve  
(Scarmeas et al., 2003)
- Does bilingualism contribute to cognitive  
reserve?

# Patient Study

- 159 patients at Memory Clinic
  - 78 monolingual
  - 81 bilingual
- All patients with diagnosis of dementia, MMSE < 26, classifiable by language group

# Results

Bialystok, Craik, & Freedman (2007)

Group	N	Years Duration	★ Years of Education	MMSE	★ Onset Age
Mono- lingual	78	3.5 (2.9)	12.2 (4.0)	19.9 (5.9)	71.9 (10.3)
Bilingual	81	3.2 (2.2)	10.8 (4.2)	18.5 (6.9)	75.9 (8.9)

# Bilingualism and Aging

- Bilinguals appear to have better “cognitive control”
- Better inhibition of unwanted information
- Better selection of wanted information
- Large effects in young children; small effects in young adults; larger again in older adults
- One of several ‘protective factors’ against aging?

# General Summary

- Age-related memory loss, but differential
- Tasks that require self-initiation, recollection
- Loss of processing resources = DA
- Need to repair both encoding and retrieval
- Retrieval costs are particularly high for Old
- Modifying aging effects? ....bilingualism?

# Acknowledgements

## Collaborators

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THANK YOU!!

THE END