Diversity in successful aging: Deep cognitive phenotyping of the Cam-CAN cohort

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Introduction

What is the nature of “successful” cognitive aging?

Avoiding cognitive decline

Cognitive aging = end of life, age-related decline² 
Key measures decline with age and intercorrelate (e.g., fluid intelligence, memory, speed, inhibitory control)³

Models aim to identify small numbers of factors underpinning declines \( ^{4,5} \)

“Successful” aging and proposed interventional focuses on avoiding or reversing decline in key measures³

Lifespan cognitive development

Cognitive aging = lifelong process³, variable trajectories² 
Key measures include range of spared and impaired functions, both domain-general and domain specific

Models are underdeveloped: few studies collect cross-domain measures, examine lifespan trajectories, or propose mechanisms of preservation

“Successful” aging may be multivariate; interventions may involve spared as well as impaired abilities

Prediction: small number of factors underpinning declines

Results

Age relationships

Diverse measures: Age-related declines, stability, and improvements 
Across tasks, declines at different ages and to different degrees

Cognitive decline measures

- Age-related decline in all measures 
- Across tasks, similar trajectories of decline

- Mean correlation \( r = 0.50 \)

Cognitive decline measures replicate previous findings of common factors that decline with age

“Cognitive decline” measures analyzed for Subgroup 2 only, who were administered memory task

Simple factor structure is replicable across all age groups, but factor loadings are variable across age range

Participants

N=706 adults cognitively healthy adults, aged 18-88

Sample of \( \approx 1000 \) participants drawn from the general population within Cambridge, UK.

Group of \( \approx 700 \) participants recruited across 7 decades, equal number of men and women

3 age groups used in some analyses:
- Young = 18-47
- Middle = 48-67
- Older = 68-88

Cognitive measures

5 cognitive domains \( \rightarrow 16 \) cognitive tasks

domains: Intelligence & attention

- Fluid intelligence
- Crystallized intelligence
- Multitasking
- Proverb knowledge
- Comprehension speed

memory

- Visual short term memory
- Source memory
- Memory recall

language

- Picture naming accuracy
- Comprehension accuracy
- Memory recall

emotion

- Visual short term memory
- Visual short term memory
- Memory recall

motor & action

- Fluid intelligence
- Fluid intelligence
- Multitasking

5 typical “cognitive decline” measures

- Comprehension speed
- Tip-of-the-tongue task
- Familiar face recognition
- Emotion reactivity & regulation³
- Motor learning

Principle components

Cognitive measures

- Fluid intelligence
- Fluid intelligence
- Multitasking
- Proverb knowledge
- Comprehension speed

Diverse measures

- Proverb knowledge
- Comprehension accuracy
- Motor learning

Summary & Conclusions

Current findings

- “Cognitive decline” measures replicate previous findings of common factors that decline with age
- Diverse cognitive measures support notion of cognitive diversity across age range

Implications for models of cognitive aging

- Need multivariate accounts of lifespan cognition, not just mechanisms of decline in old age

Future research question: How do spared and impaired abilities interact across the lifespan?
- Do cross-domain interactions underpin age-related change in factor loadings?
- Do preserved abilities provide support to declining abilities?