UNIVERSITÉ DE GENÈVE
FACULTÉ DE PSYCHOLOGIE ET DES SCIENCES DE L'ÉDUCATION

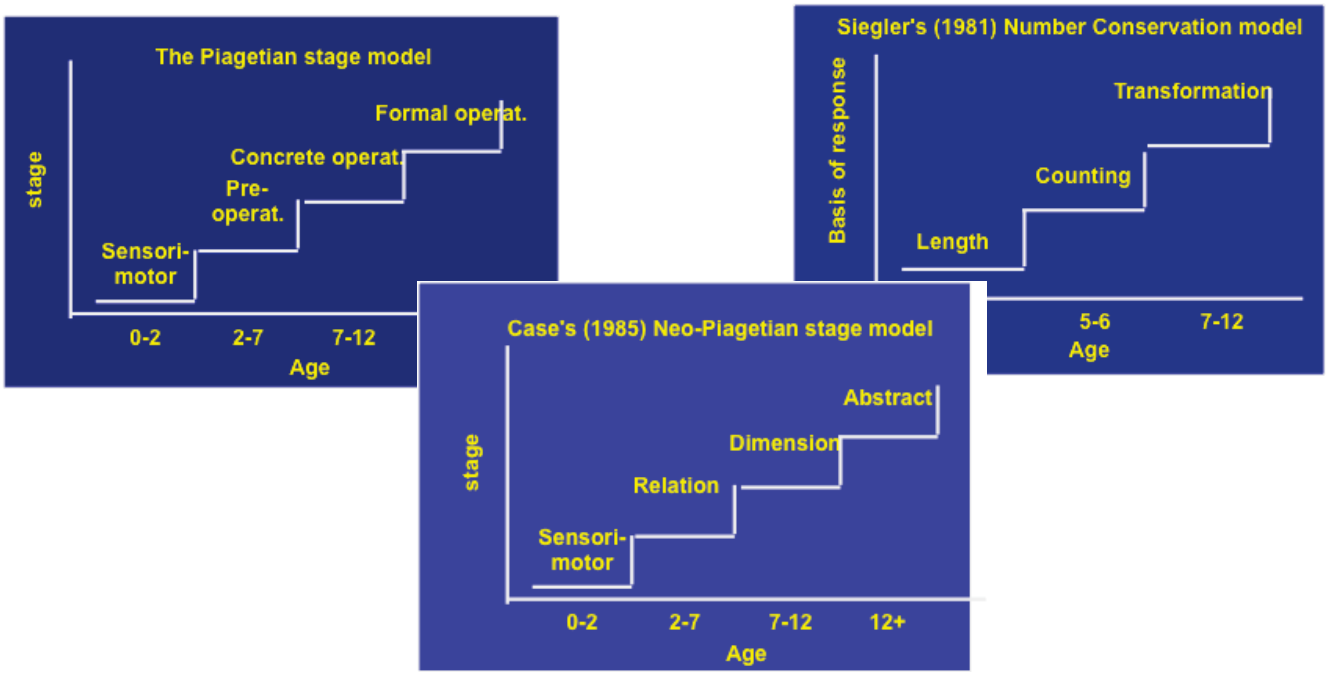
The concepts of a lifespan perspective on cognitive development: A refreshment

Anik de Ribaupierre
University of Geneva

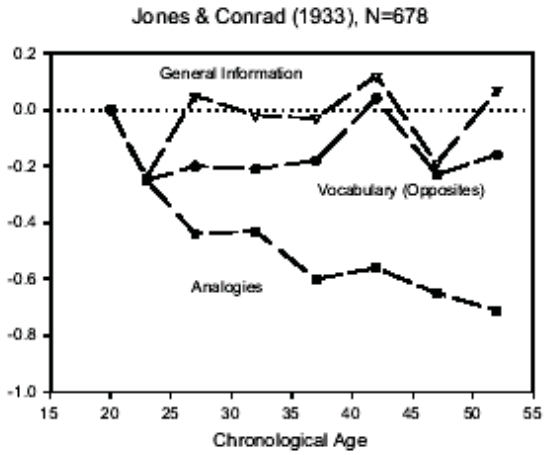
ISSBD workshop: Cognitive and socio-emotional development across the lifespan - Geneva, Sept. 2-6, 2015

UNIVERSITÉ DE GENÈVE
FACULTÉ DE PSYCHOLOGIE ET DES SCIENCES DE L'ÉDUCATION

Standard view of development



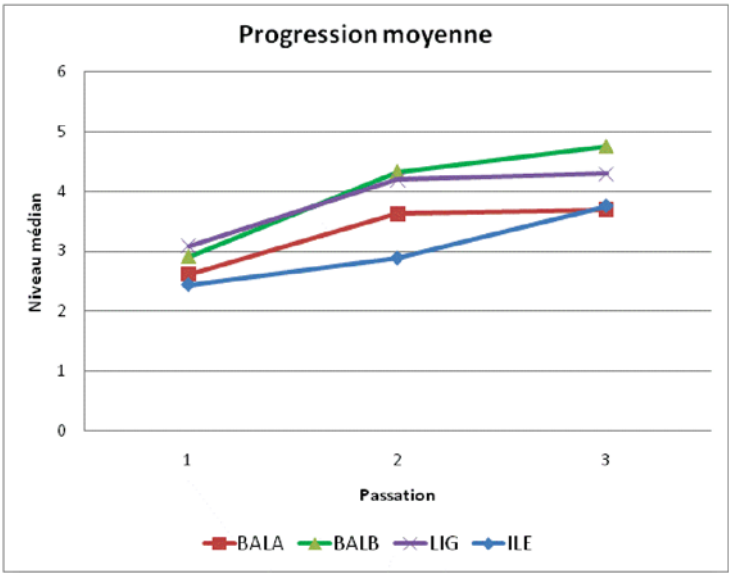
Cognitive aging: Age differences in psychometric tests



Some already very old data (reprinted in Salthouse, 2000)

Challenges to the standard view (child development)

1. Development is not the same in all the tasks (e.g., horizontal decalages)

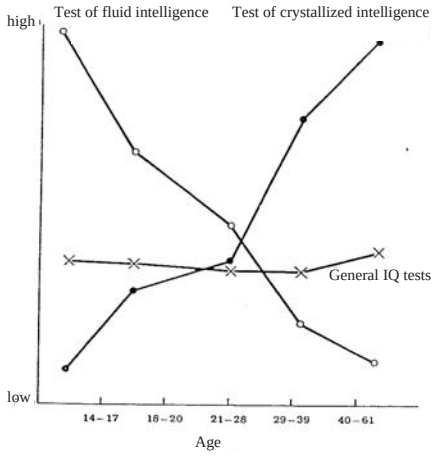


Adapted from (de Ribaupierre, 1998)

Challenges to the standard view (ctd – aging)

1. Decline of cognitive aptitudes is not uniform for all aptitudes

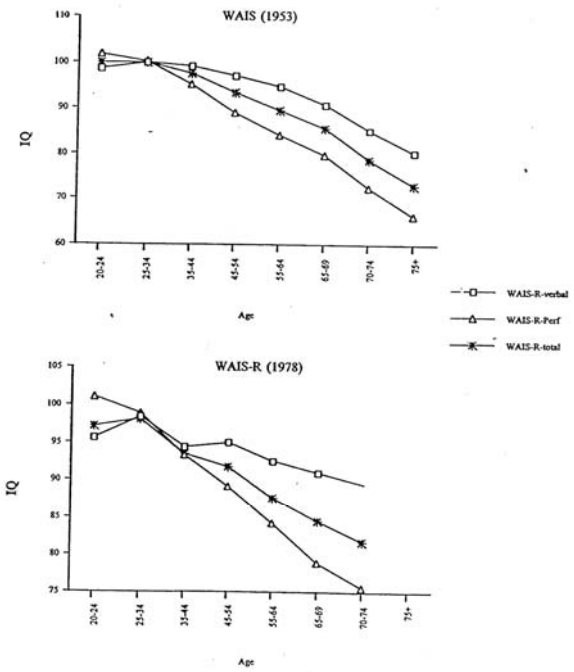
Cattell (1940), & Horn (1970) : distinction between fluid (gf) and crystallized intelligence (gc)



gf: inductive reasoning, associative memory, speed, reasoning.
Closer to a physiological substrate. Highest during adolescence and younger adulthood. Declines with age

Gc: verbal comprehension, vocabulary, etc. Reflects in good part acquisition of social and cultural knowléedge. Relatively independent from cognitive aging. Highest around 60 years of age.

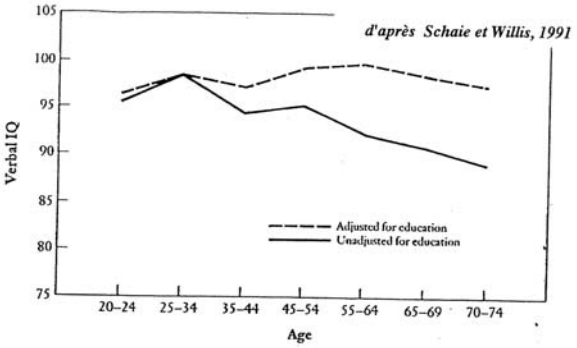
IQ change with age
(when compared with young adults scores)

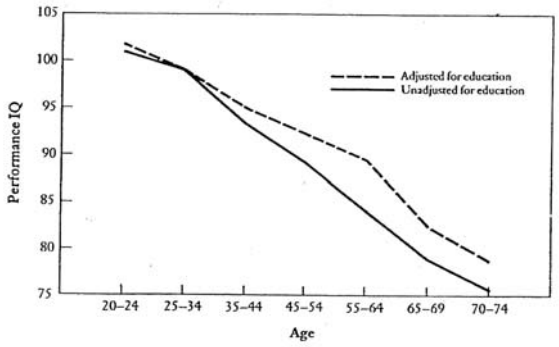


IQ adjusted for education

Change in verbal IQ (20-74 years) with and without adjustment for education ; IQ based on norms for 25-34 years of age

(Schaie et Willis,1991 / based on Kaufman et al.,1989)





Change in Performance IQ (20-74 years)

Challenges to the standard view (ctd)

2. Individual differences are important

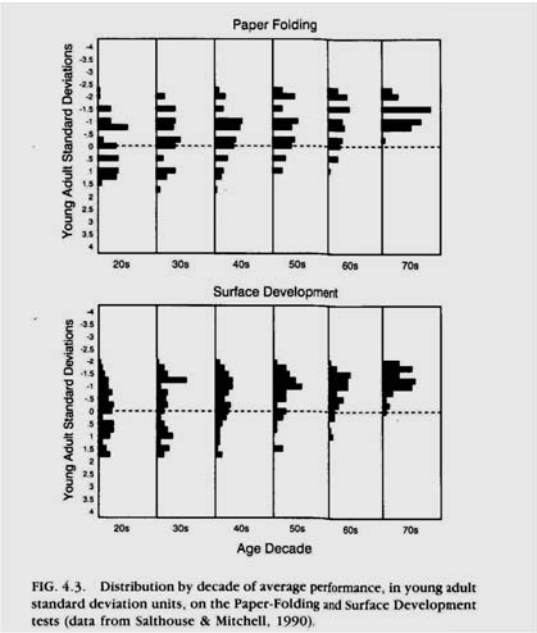


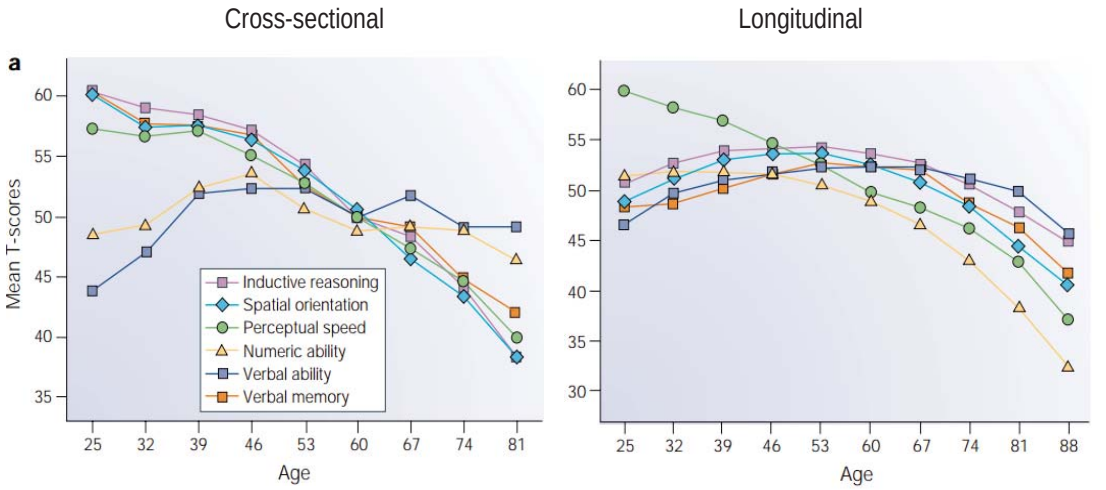
FIG. 4.3. Distribution by decade of average performance, in young adult standard deviation units, on the Paper-Folding and Surface Development tests (data from Salthouse & Mitchell, 1990).

(In Craik & Salthouse, 1992)

Challenges to the standard view (ctd)

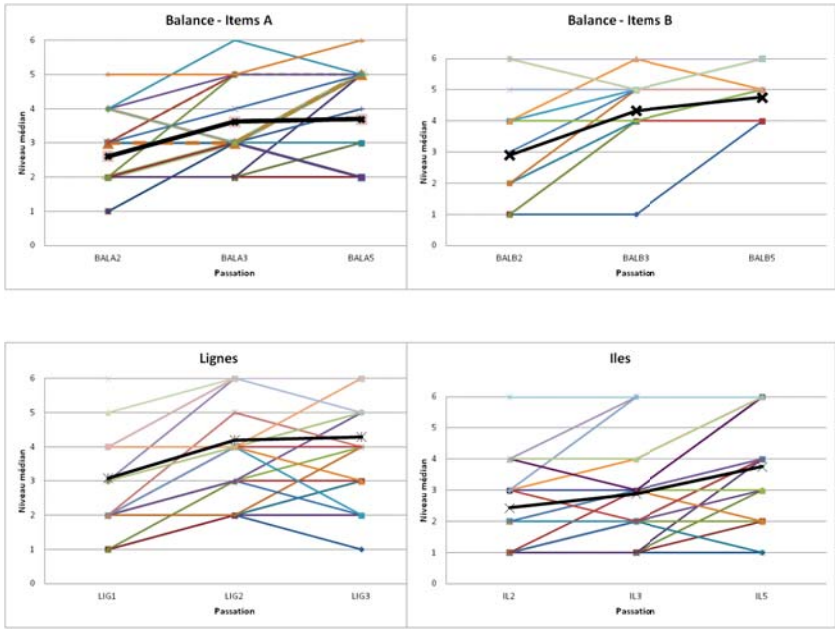
3. Cross-sectional and longitudinal results provide a different view of aging

At the group level



Schaie, 1996

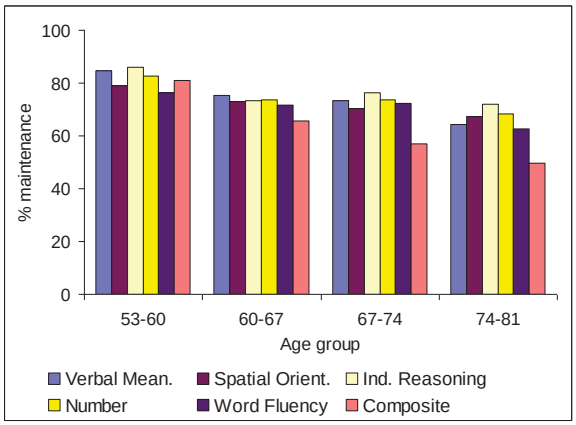
Longitudinal perspective: individual differences in developmental trajectories (childhood)



Adapted from (de Ribaupierre, 1998)

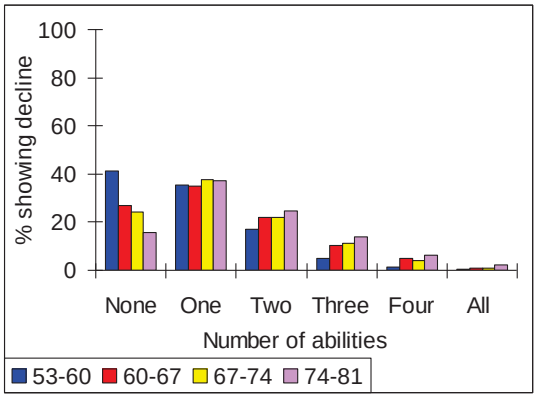
UNIVERSITÉ DE GENÈVE
FACULTÉ DE PSYCHOLOGIE ET DES SCIENCES DE L'ÉDUCATION

Individual differences in aging patterns



Proportion of individuals presenting **no** drop in performance, over 7 years, by age group and aptitudes

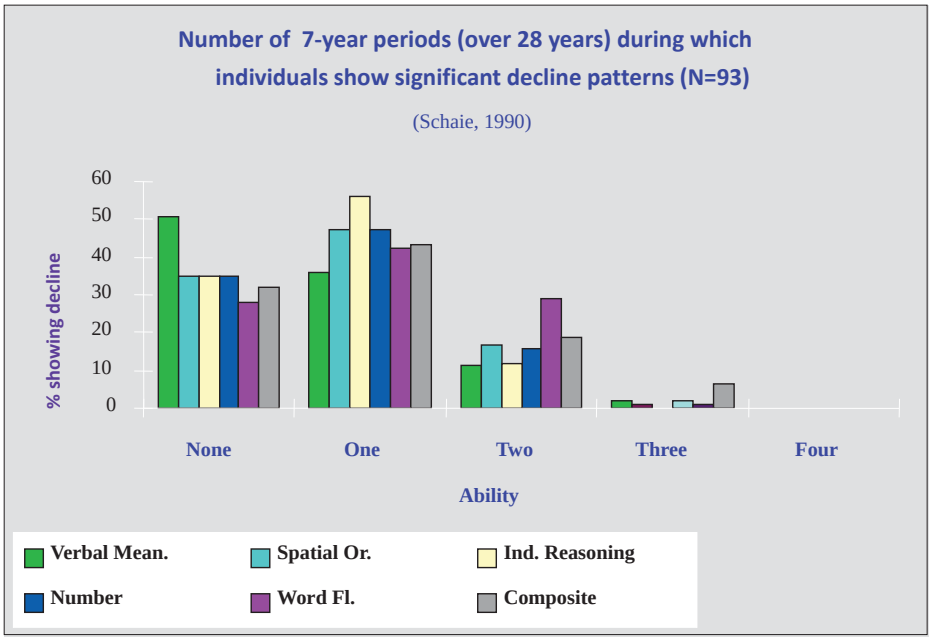
Proportion of individuals presenting a decline over 7 years, by age group and by number of abilities



In Schaie, 1990

UNIVERSITÉ DE GENÈVE
FACULTÉ DE PSYCHOLOGIE ET DES SCIENCES DE L'ÉDUCATION

Individual differences in aging patterns



In Schaie, 1990

On the ambiguity of the Variable Age

(e.g., de Ribaupierre, 2003, 2005)

- Empirical findings are ample and robust on the importance of age
- But relatively little discussion of the psychological meaning of age.

=>Chronological age is obviously a very ambiguous variable:

- it reflects the influence on behaviors of multiple factors, ranging from purely physiological, organismic mechanisms (such as maturation or decline in different nervous systems) to purely cultural and environmental effects, including interactions between these different effects.
- risk of confound between descriptive and explanatory variable

In children, all these factors covary in the same direction => impossible to dissociate

In adults, probable dissociation: neurophysiological factors might concur to a decrease in performance, and environmentale factors to an increase/maintenance

Concept of age in psychology

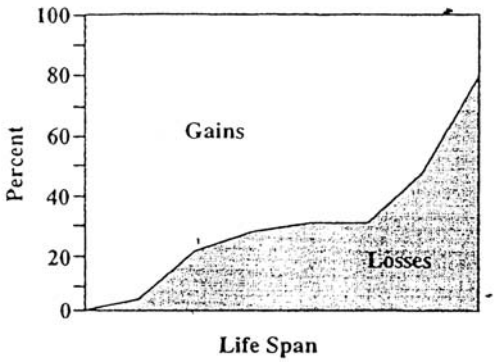
At least 3 functions:

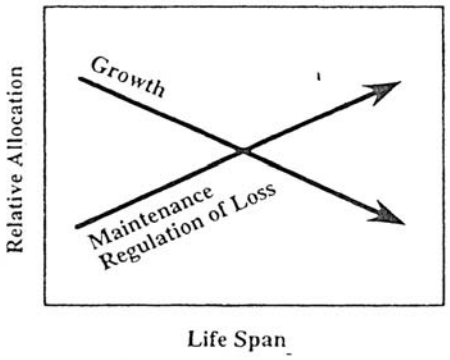
- Statistical norm: means of defining groups of individuals supposedly reflecting the unfolding of time (developmental psychology): Child psychology or psychology of the elderly: description of the organization of behavior in a group defined by age. Overall or synchronic picture
- Comparaison of age differences, diachrony: Psychology of the Age (Birren and Schroots, 1996): focus on age differences (mostly cross-sectional)
- Age as a proxy for Change or Unfolding of time: Developmental psychology, Psychology of Aging. Focus on change with age, study of intraindividual change (mostly longitudinal)

Theoretical propositions characteristic of a lifespan perspective in developmental psychology (adapted from Baltes, 1987, p.613)

1. Development across the lifespan	Ontogenetic development takes place throughout life. Consists in continuous and discontinuous processes
2. Multidirectionality, Multidimensionality	The direction of change may change with age and with categories of behavior. Increases (growth) and decreases (decline) during a same developmental period.
3. Gains/Losses	The developmental process does not only consist in a simple increasing efficacy, but in a combination of gains (growth) and losses (decline).
4. Plasticity	Large intra-individual modifiability. The task of developmental psychology consists in identifying the range of plasticity and its constraints
5. Historical embeddedness	Ontogenetic development may vary as a function of historical-cultural conditions
6. Contextualism	Individual developmental trajectories result from the interaction (dialectics) among at least three systems of developmental influences: age-graded (physiological, neurological, etc.), history-graded, and non normative (non universal) influences.
7. Multi-disciplinarity	Psychological development needs to be studied within an interdisciplinary context (sociology, biology, anthropology).

Hypothetical changes across lifespan: Losses and gains (e.g., Baltes, 1987)





Gains and losses: some examples

Weir (1964) : problem solving

An elaborate cognitive functioning can prove costly in a task which does not present a clear logical solution.

Adults will assume the presence of a logical solution, leading to an inadequate strategy. Children will perform better than adults

Kellerman & Smith (1986) : acquisition of a second language:

It may be more difficult to acquire a second language when first language is more developed.

Salthouse (1984) : study on skill typing performance and age

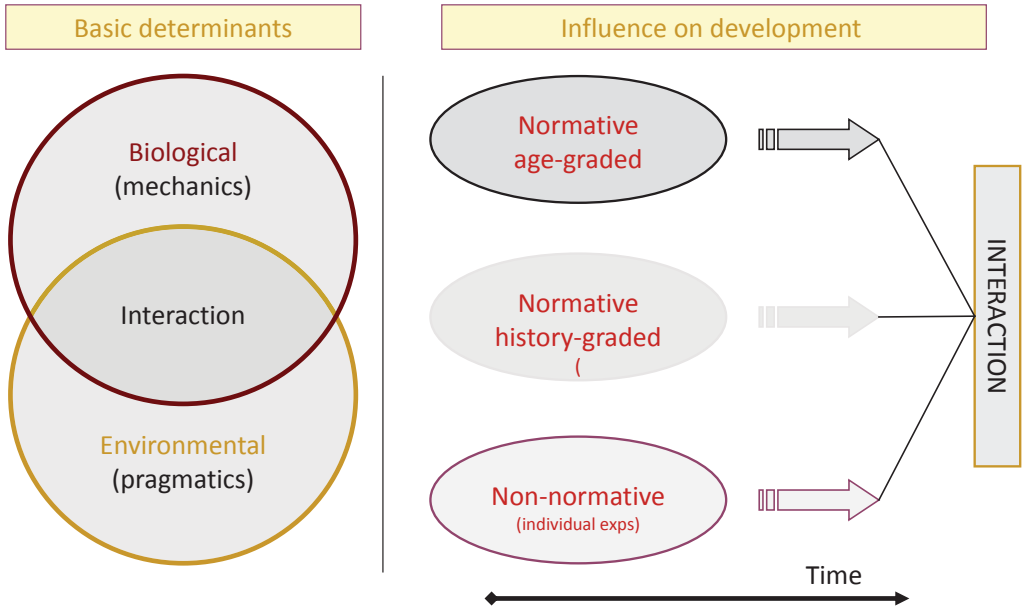
No difference between age groups:

Older adults slower when have to type letters individually (decrease in response times), but anticipate better sequences of letters/words.

Theoretical propositions characteristic of a lifespan perspective in developmental psychology (adapted from Baltes, 1987, p.613)

1. Development across the lifespan	Ontogenetic development takes place throughout life. Consists in continuous and discontinuous processes
2. Multidirectionality, Multidimensionality	The direction of change may change with age and with categories of behavior. Increases (growth) and decreases (decline) during a same developmental period.
3. Gains/Losses	The developmental process does not only consist in a simple increasing efficacy, but in a combination of gains (growth) and losses (decline).
4. Plasticity	Large intra-individual modifiability. The task of developmental psychology consists in identifying the range of plasticity and its constraints
5. Historical embeddedness	Ontogenetic development may vary as a function of historical-cultural conditions
6. Contextualism	Individual developmental trajectories result from the interaction (dialectics) among at least three systems of developmental influences: age-graded (physiological, neurological, etc.), history-graded, and non normative (non universal) influences.
7. Multi-disciplinarity	Psychological development needs to be studied within an interdisciplinary context (sociology, biology, anthropology).

Three systems of developmental influence
(e.g., Baltes et al., 1979)



Theoretical propositions characteristic of a lifespan perspective in developmental psychology (adapted from Baltes, 1987, p.613)

1. Development across the lifespan	Ontogenetic development takes place throughout life. Consists in continuous and discontinuous processes
2. Multidirectionality, Multidimensionality	The direction of change may change with age and with categories of behavior. Increases (growth) and decreases (decline) during a same developmental period.
3. Gains/Losses	The developmental process does not only consist in a simple increasing efficacy, but in a combination of gains (growth) and losses (decline).
4. Plasticity	Large intra-individual modifiability. The task of developmental psychology consists in identifying the range of plasticity and its constraints
5. Historical embeddedness	Ontogenetic development may vary as a function of historical-cultural conditions
6. Contextualism	Individual developmental trajectories result from the interaction (dialectics) among at least three systems of developmental influences: age-graded (physiological, neurological, etc.), history-graded, and non normative (non universal) influences.
7. Multi-disciplinarity	Psychological development needs to be studied within an interdisciplinary context (sociology, biology, anthropology).

UNIVERSITÉ DE GENÈVE
FACULTÉ DE PSYCHOLOGIE ET DES SCIENCES DE L'ÉDUCATION

Processes at work throughout the lifespan: Sélection - Optimisation - Compensation (SOC model) (e.g., Baltes, 1997)

- Elective selection or loss-based selection: Out of a very large number of options, individuals select a subset on which to focus their resources
- Optimization: To reach higher levels of functioning, goal-relevant means need to be acquired, refined, coordinated, and applied in the selected goal domains
- Compensation: Investment of resources into counteracting losses (find alternative means) in order to maintain a given level of functioning

UNIVERSITÉ DE GENÈVE
FACULTÉ DE PSYCHOLOGIE ET DES SCIENCES DE L'ÉDUCATION

More recent results: Cross-sectional versus longitudinal

Decline of mnesic aptitudes with aging?

Cross-sectional

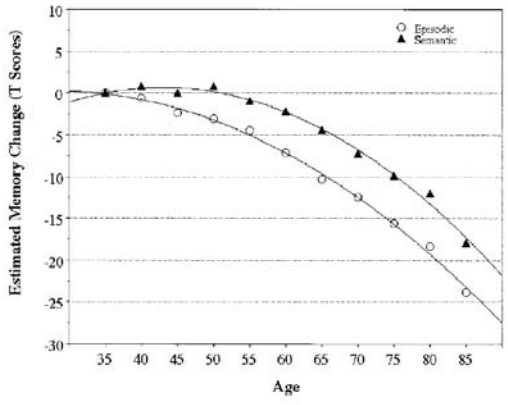


Figure 1. Estimated memory changes across age (*T* scores) for episodic and semantic memory on the basis of cross-sectional data.

Longitudinal

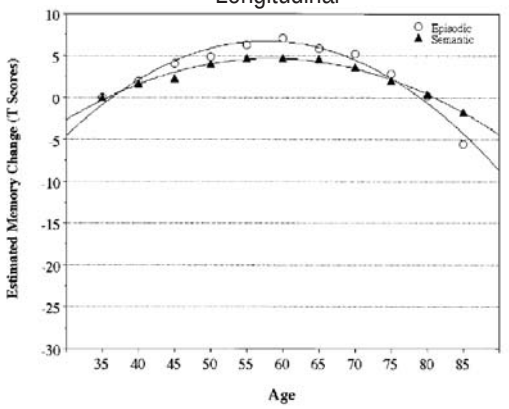
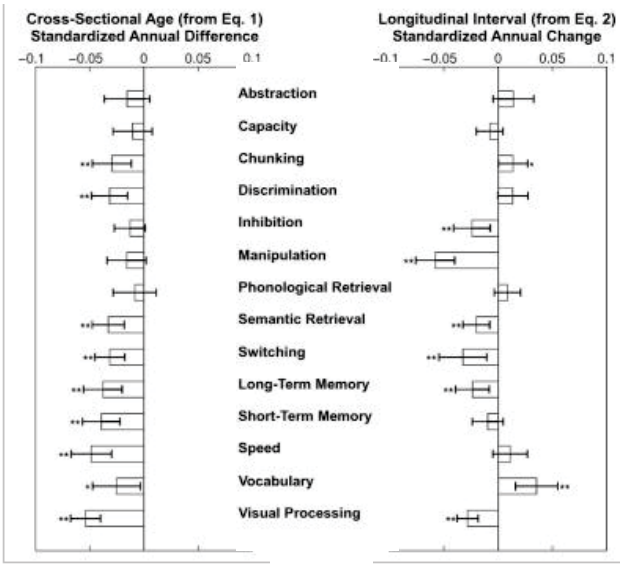


Figure 2. Estimated memory change across age (*T* scores) for the episodic and semantic memory factors on the basis of longitudinal data.

Rönnlund, Nyberg, Bäckman, Nilson; 2005

Cross-sectional versus longitudinal studies (ctd)



Cross-sectional: decline on most tasks:

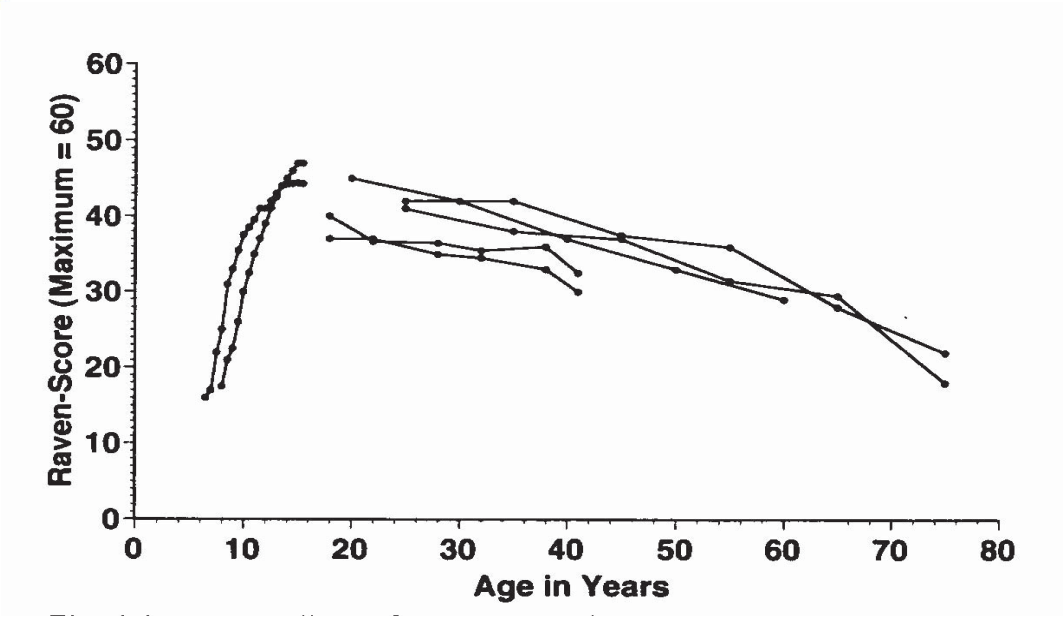
Longitudinal : increase or decrease depending on task

Goh, An, Resnick; 2012

On the similarity of cognitive development and cognitive aging…

- Studies of cognitive development in children and of cognitive aging address similar problems, but have rarely interacted
- Commonalities and differences between development in children and cognitive aging can point to fundamental processes in cognitive change and in variability (e.g., differentiation- dedifferentiation)
- In the 90's: very similar hypotheses brought forward by both child developmentalists and cognitive aging theorists with respect to age differences in cognitive resources: speed (activation), inhibition, executive functions, working memory
- Yet, very few empirical studies have administered identical tasks to children and older adults
- Necessity to study intra-individual patterns, rather than different groups on different tasks

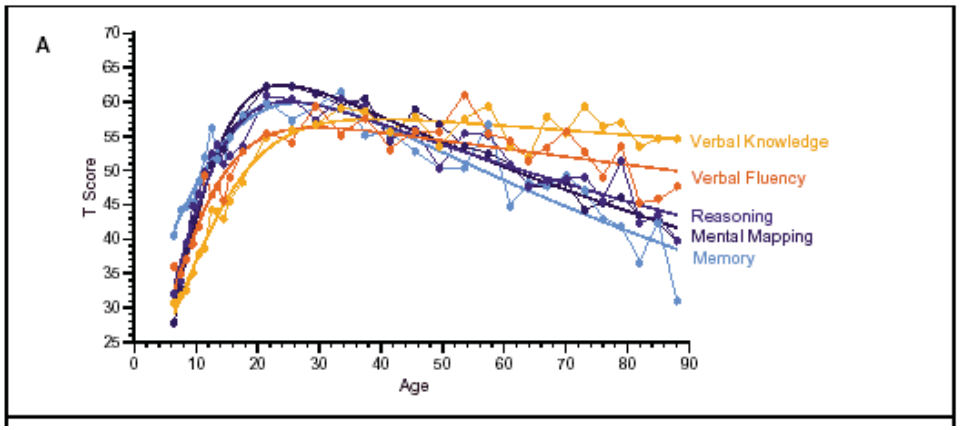
Raven et âge (In Frensch, Lindenberger & Kray, 1999)



Age gradient for the Raven's Progressive Matrice Test. Each set of interconnected data points refer to a large cross-sectional reported in Salthouse (1991) or Raven (1989)

From: Shu-Chen Li, Ulman Lindenberger, Bernhard Hommel, Gisa Aschersleben, Wolfgang Prinz, Paul B. Baltes- Psychological Science, 2003 – Figure A

T scores – Fluid and crystallized intelligence



Fluid intelligence:
(1) Mental Mapping (Perceptual Speed): accuracy of Digit-Letter Substitution, Digit-Symbol Substitution, and Identical Picture tests;
(2) Memory : Activity, Paired Associate, and Text Recalls;
(3) Reasoning: Figural Analogies, Letter Series, and Practical Problems;

Crystallized intelligence:
(4) Verbal Knowledge: Practical Knowledge, the Spot-a-Word and Vocabulary tests;
(5) Verbal Fluency: naming names of animals, red things, and words beginning with S.

Life-span trajectories

Hypothetical lifespan trajectories of various global mechanisms with age (cursory review of literature)

	Children	Young	Y-Old (55-75)	Old-old (> 80)
Processing Speed	↗	→	↘	↘
Inhibition	↗	→	↘	↘
Executive schemes	↗	→	→	↘
WM (or gf)	↗	→	↘	↘
gc	↗	→	→	↘

de Ribaupierre, 1996

General hypotheses

- There are a number of general and specific processes to account for **any** performance (overdetermination, e.g. Pascual-Leone, 1987, etc.)
- Mechanisms accounting for age differences, if they are general, ought to be the same across the lifespan, **but** may vary in their developmental trajectories and in their relative importance across the lifespan as well as for different individuals (Reuchlin's hypothesis of vicarious or optional processes – Reuchlin, 1978)
- Similar patterns of behavior may be caused by different reasons (e.g. co-construction vs compensation) => same behavior based on different combination of processes

Two Genevan studies on age differences across the lifespan as an illustration

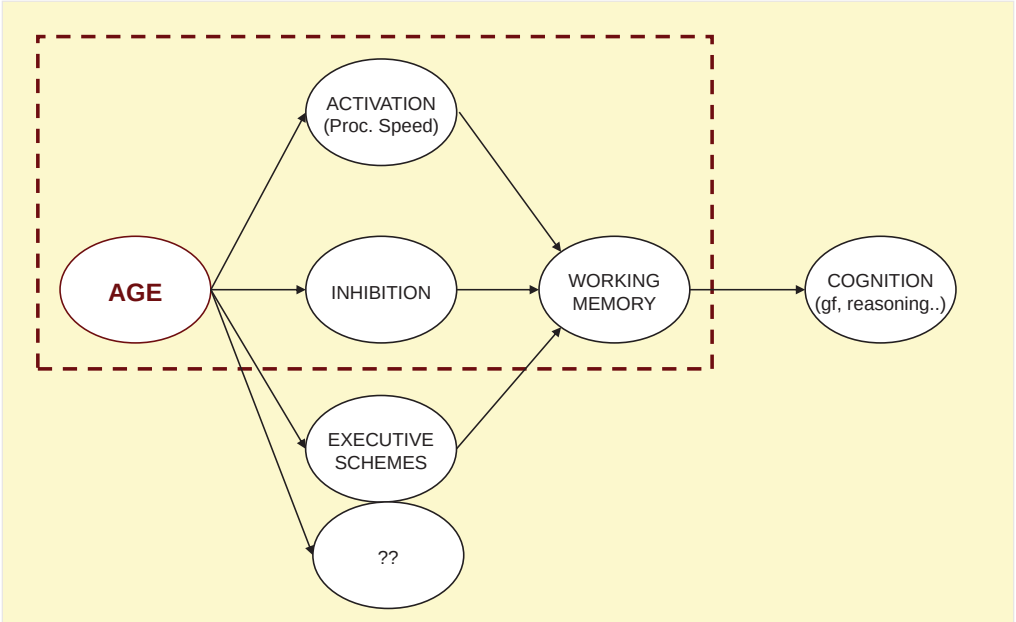
Two studies assessing

- Age differences in Working memory capacity
- Whether Speed and Resistance to interference (Inhibition) account jointly for age differences both during childhood (comparing children and young adults) and during adulthood (comparing young and older adults)
- Whether relative weight of Speed and Inhibition varies across the lifespan

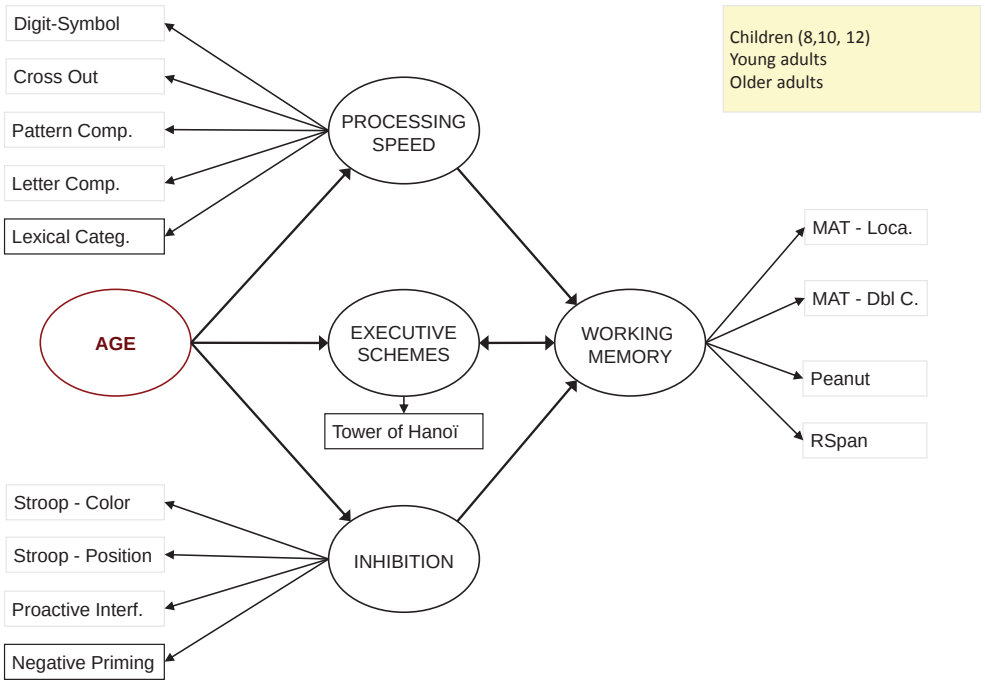
Study 1: about a dozen tasks (Working memory, Speed, Inhibition) administered to ~150 children (8, 10, 12 years – 50/age group), 100 young adults (mean age = 23.2) and 140 older adults (60-80 years, mean age = 69.2)

Study 2: about twenty tasks, administered to ~220 children (8-12), 160 young adults (mean age = 22.3), and 150 older adults (mean age = 69.9). Main objective: assess generality of inhibition. Present paper: relations between speed, WM and inhibition.

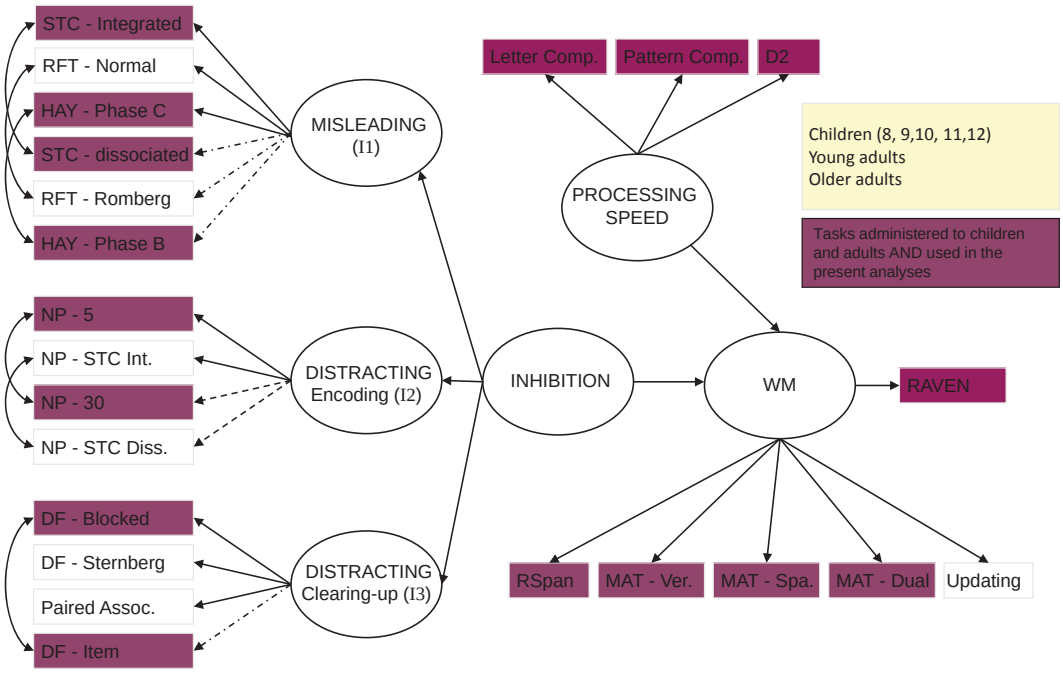
General framework



Geneva Life-Span study
(Study 1) (1995-1998)



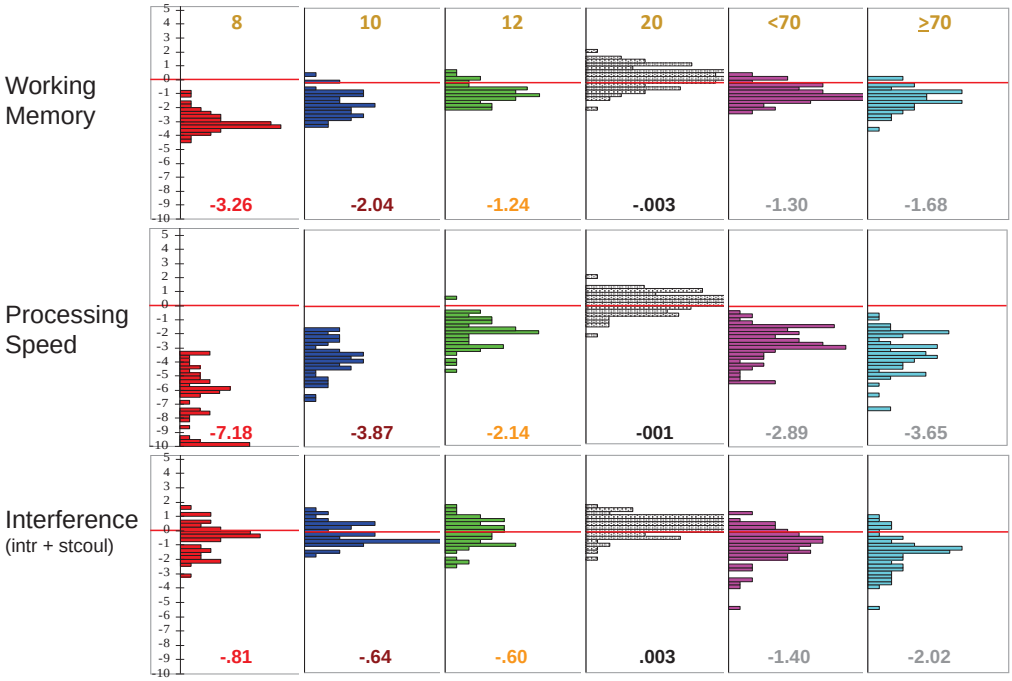
Dimensionality of inhibition
Study 2 (2000-2004)



UNIVERSITÉ DE GENÈVE
FACULTÉ DE PSYCHOLOGIE ET DES SCIENCES DE L'ÉDUCATION

Life-span Study

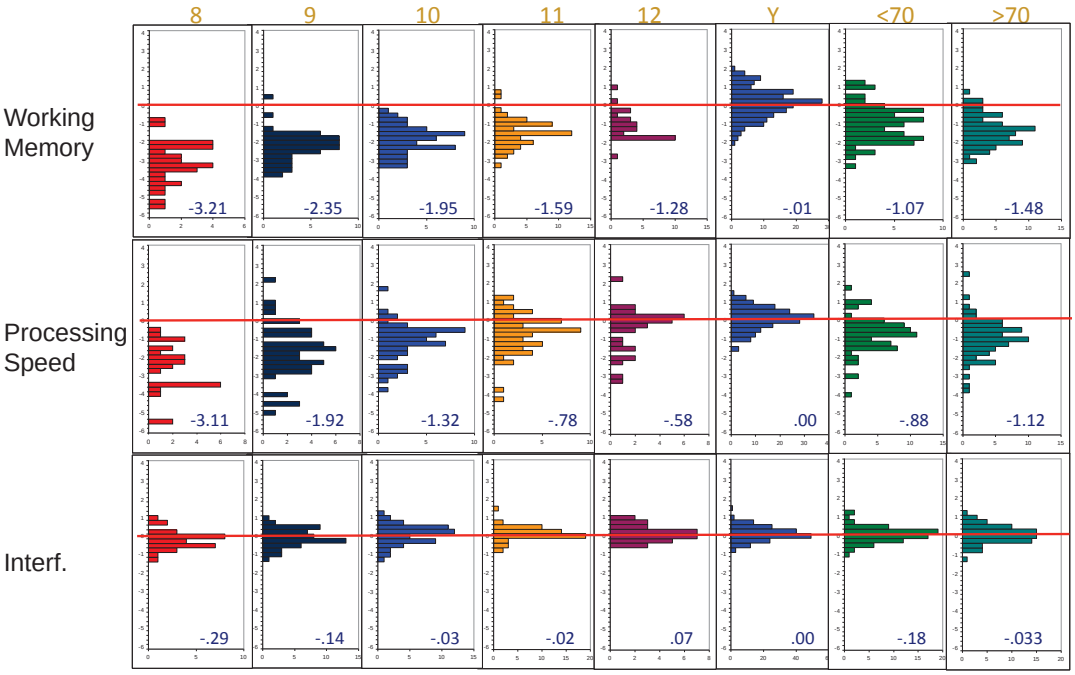
Age differences: Standardized units, relative to young adults (with means)



UNIVERSITÉ DE GENÈVE
FACULTÉ DE PSYCHOLOGIE ET DES SCIENCES DE L'ÉDUCATION

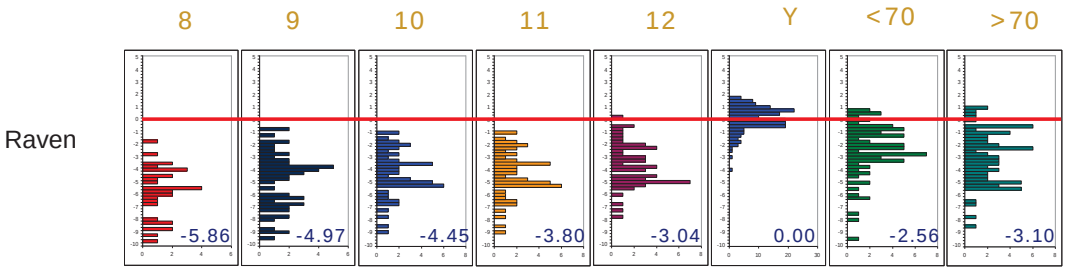
Inhibition study

Age differences: Standardized units, relative to young adults (means)

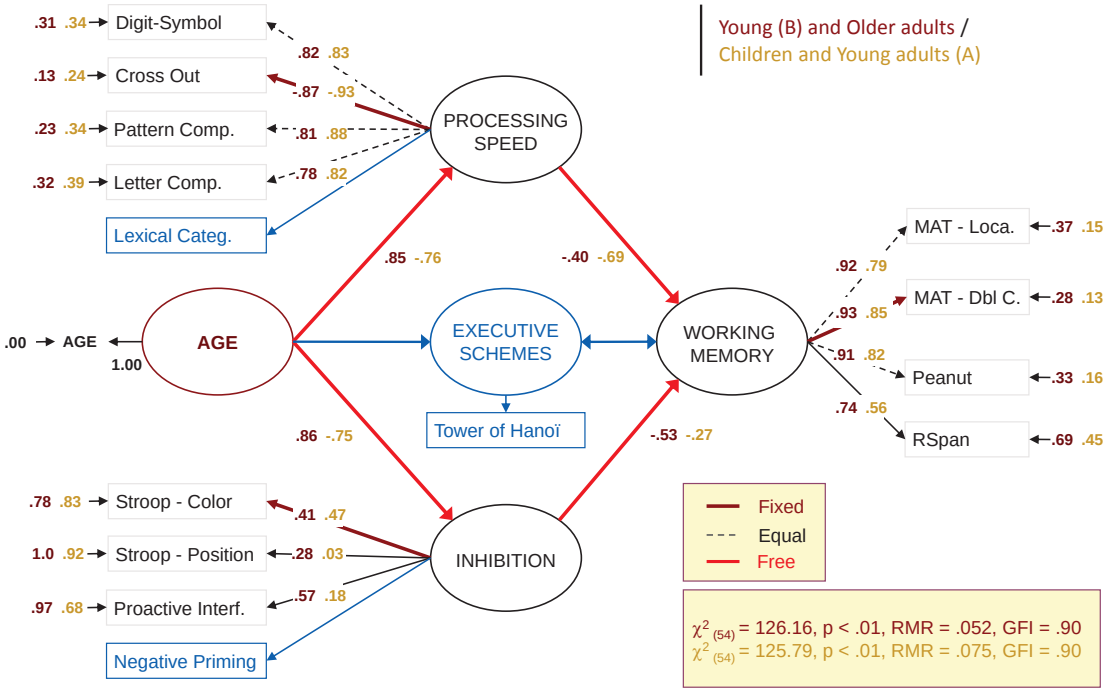


Study 2: Inhibition study

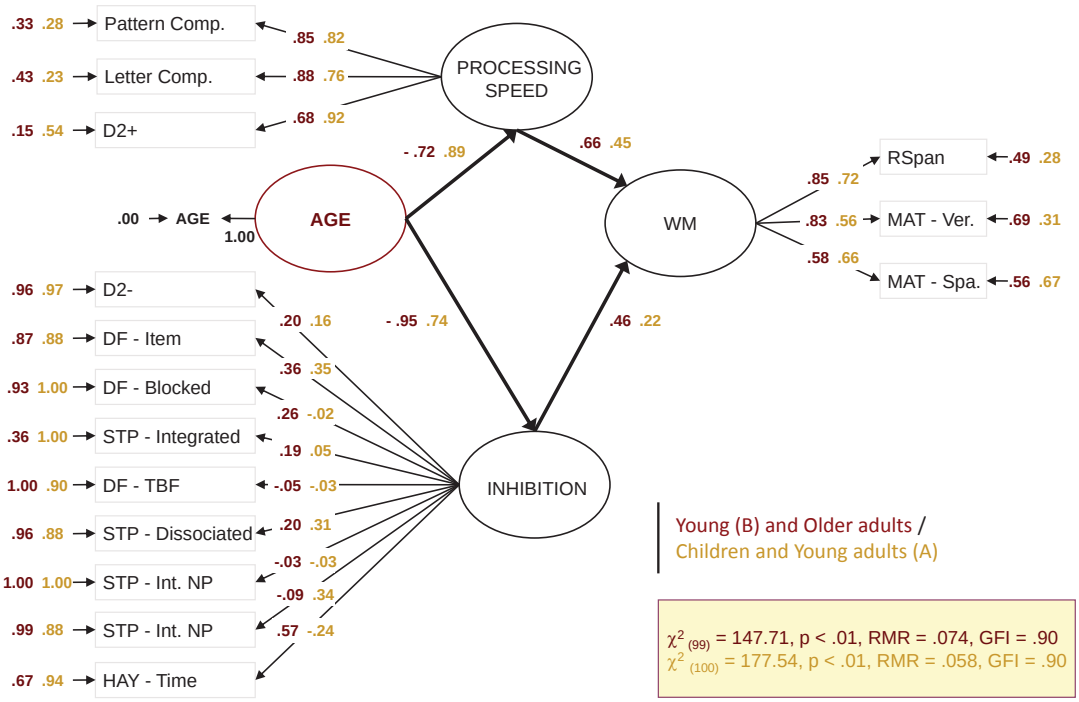
Age differences: Standardized units, relative to young adults (means)



Geneva Life-Span study (1995-1998)



Dimensionality of inhibition (2000-2004)



Young (B) and Older adults /
Children and Young adults (A)

$\chi^2_{(99)} = 147.71$, $p < .01$, RMR = .074, GFI = .90
$\chi^2_{(100)} = 177.54$, $p < .01$, RMR = .058, GFI = .90

Thank you for your attention

2010 - ...