



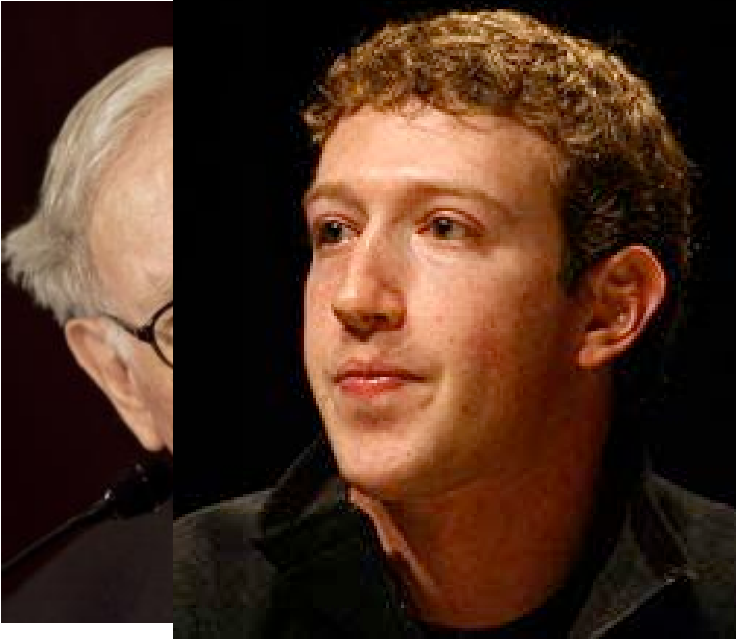
Financial Literacy and Decision Making over the Lifespan

Ye Li, Martine Baldassi, Eric J. Johnson, Elke U. Weber

Columbia University
Center for Decision Sciences

This work is supported by NIA grant 5R01AG027934

Seniors in charge



Why aren't the older worse off?



The older I grow, the more I distrust the familiar doctrine that age brings wisdom.

- H.L. Mencken (1922)

Decisions about Health and Wealth

- Decumulation of assets is a complex dynamic programming problem.
 - Inputs include beliefs about longevity, market returns and inflation, future costs including health costs.
 - Annuitization involves similar complexities
 - Choice of health care insurance, both prescription drugs, and primary insurance
- A myriad of housing and health decisions.
- How can we structure these decisions to maximize abilities?

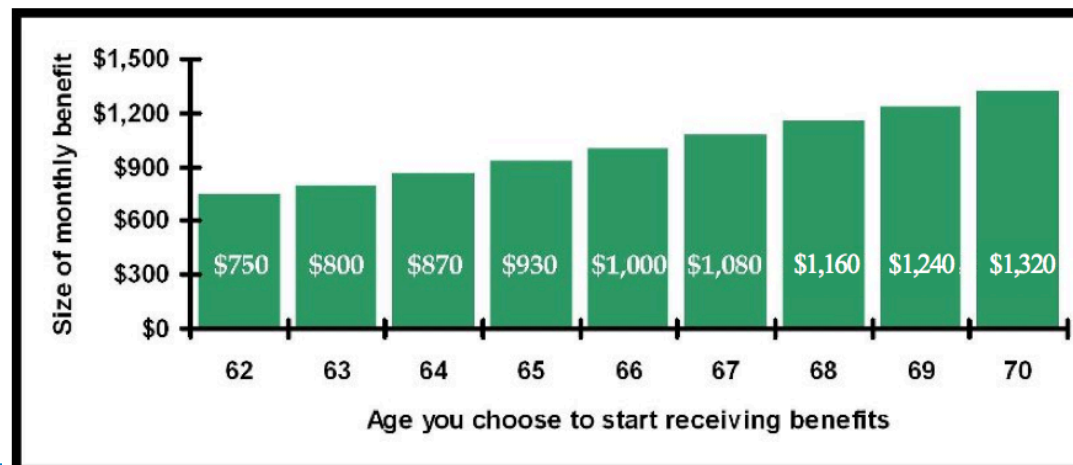
A concern for financial services firms.

- Older American (65+)s hold much in the way of assets:
34% of \$53.1 trillion = \$18.1 trillion (2007 Survey of Consumer Finances)
- But there is liability

e Agents

Decisions relevant to Public Policy (Appelt et al. 2012)

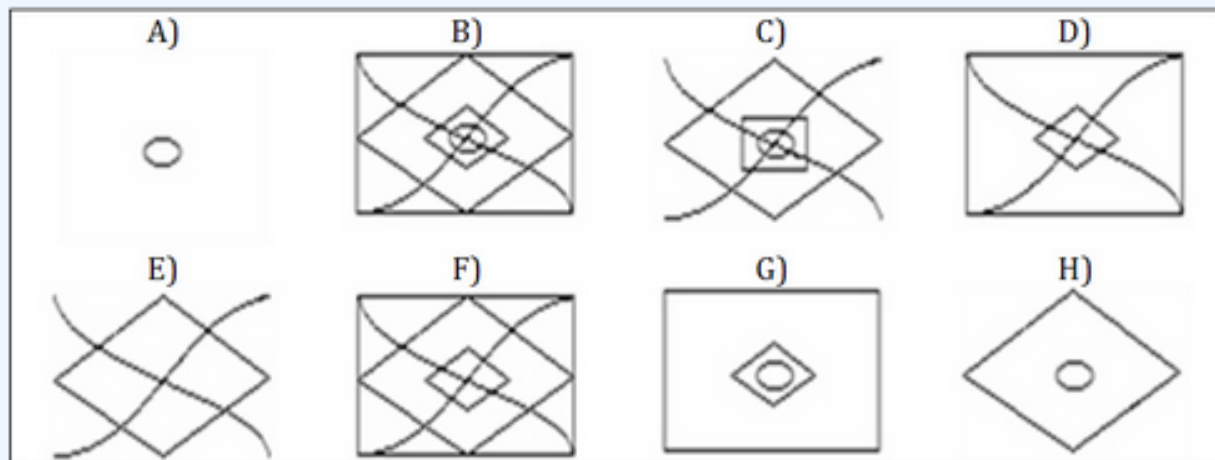
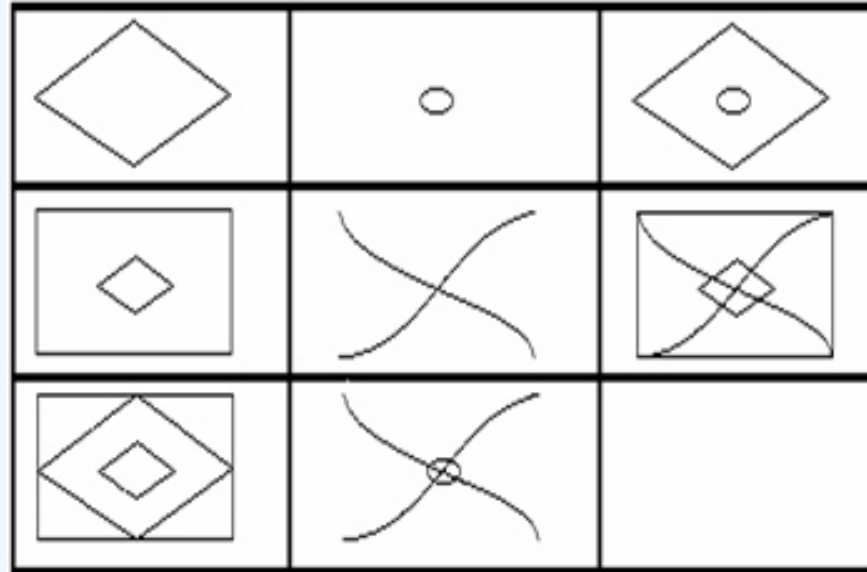
- SSA retirement benefits are a primary source of income for over 50% of older Americans (SSA, 2010)
- 40-50% of Americans claim benefits as soon as they are eligible (Muldoon & Kopcke, 2008; Song & Manchester, 2007)
- 22% of consumers first think about the retirement decision only a year before they retire, and another 22% first think about it only six months before (EBRI 2008).



Fluid intelligence declines with age

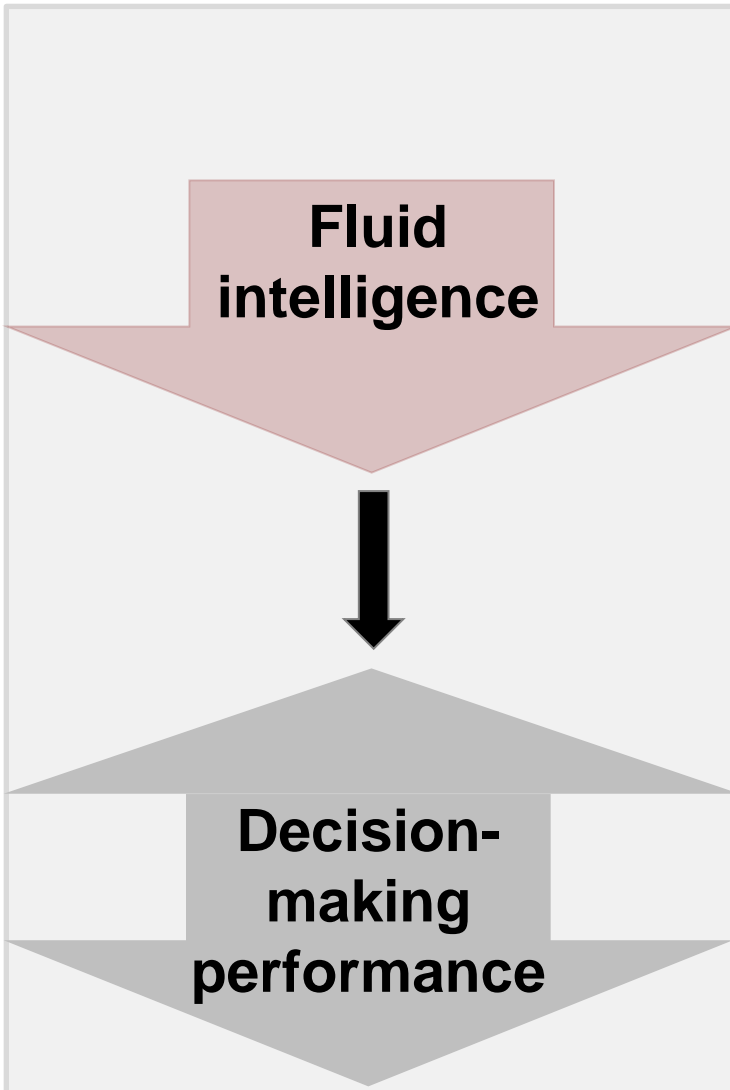
Changes with age...

Fluid
intelligence



Yet, mixed results on decision making

Changes with age...



- Older adults are **worse** for some decisions...

- Framing (Finucane et al 2005; Kim et al 2005)
- Applying decision rules (Bruine de Bruin et al 2007)
- Overconfidence (Crawford & Stankov 1996)
- Risk Aversion (Dohmen et al 2011)

- ...but sometimes **no different** from young...

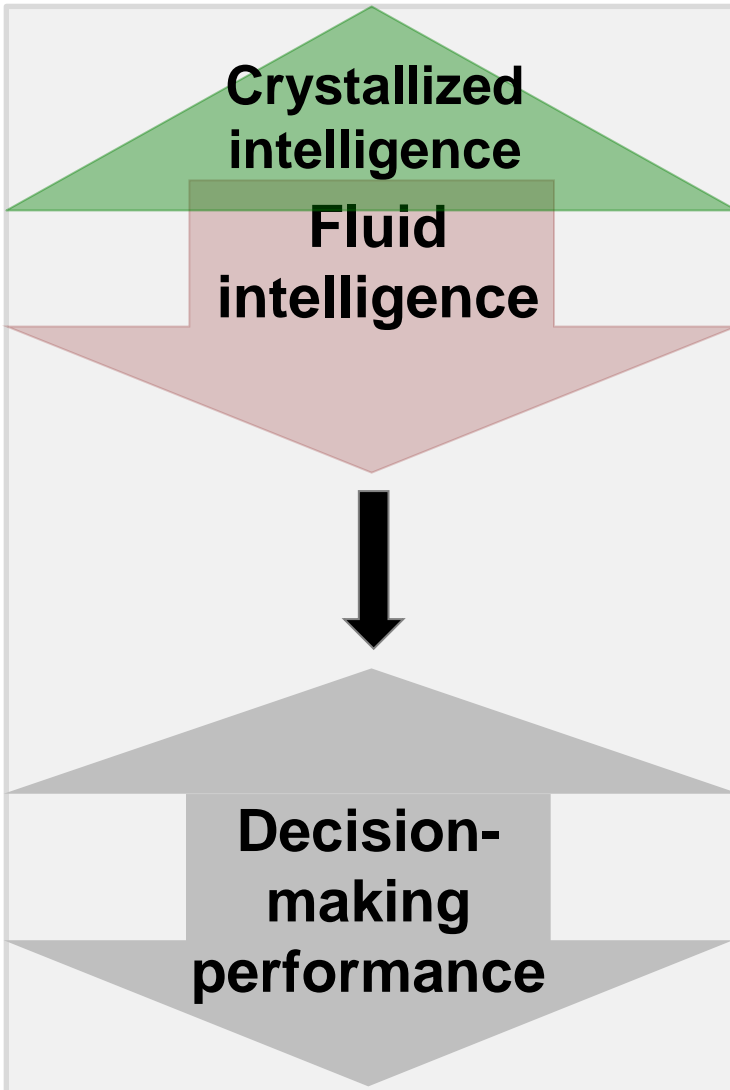
- Framing (Mayhorn et al 2002; Roennlund et al 2005)
- Iowa Gambling Task and endowment effect (Kovalchik et al 2004)

- ...and sometimes older adults are **better!**

- Sunk-cost fallacy (Strough et al 2008)
- Attraction effect (Kim & Hasher 2005)

Perhaps experience is compensating

Changes with age...



Crystallized intelligence (G_c) is a stable depository of knowledge acquired through culture, education, and life experience (Carroll, 1993; Cattell, 1971, 1987)

1.5

Question 4

7. CORPULENT

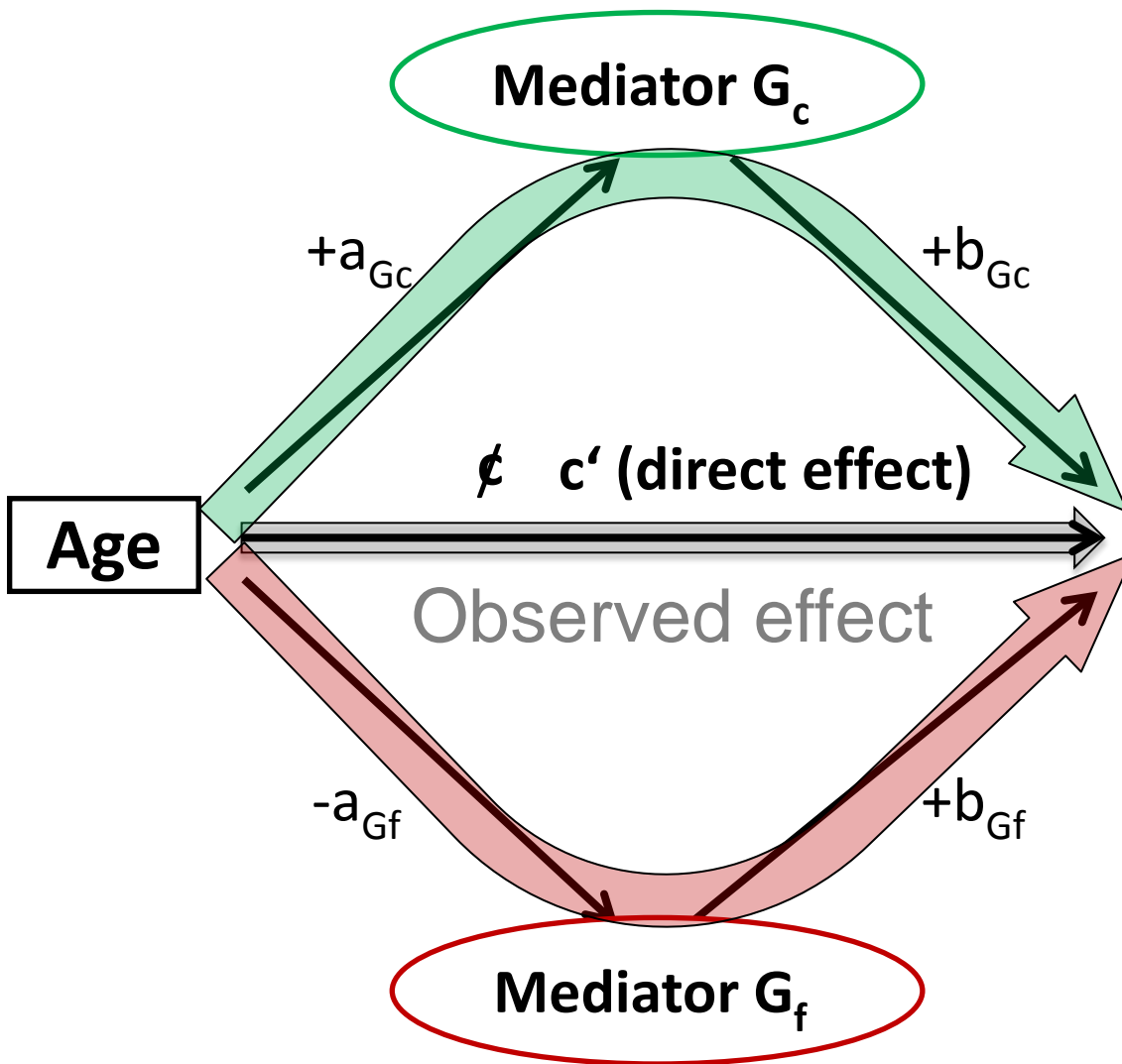
Select the word most nearly the opposite in meaning.

- sallow
- affiliated
- emaciated
- entrepreneur
- anemic

Fig. 1. Means (and standard errors) of performance in four cognitive tests as a function of age. Each data point is based on between 52 and 156 adults.

Salthouse, 2010

Compensating Cognitive Capabilities Hypothesis



Indirect effect via G_c

$$a_{G_c} \times b_{G_c} > 0$$

Positive mediation
(Age is a benefit)

Decision
performance

$$a_{G_f} \times b_{G_f} < 0$$

Negative mediation
(Age is a detriment)

Indirect effect via G_f

Decision tasks with real-world economic consequences

FL1. Imagine that the interest rate on your savings account was 1% and inflation was 2% per year. After 1 year, would you be able to buy more than, exactly the same as, or less than today with the money in this account?

- More than today
- Exactly the same as today
- Less than today
- Do not know

FL2. Do you think that buying a single company stock usually provides a return that is more safe, equally safe, or less safe than the return of a stock mutual fund?

- More safe return than a stock mutual fund
- Equally safe return as a stock mutual fund
- Less safe return than a stock mutual fund
- Do not know

FL3. Is using money in a bank savings account to pay off credit card debt usually a good or a bad idea?

- Good idea
- Bad idea
- Do not know

		YES	NO
	Heads		
	Tails		
	Lose \$0.50	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$1.00	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$1.50	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$2.00	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$2.50	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$3.00	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$3.50	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$4.00	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$4.50	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$5.00	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$5.50	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$6.00	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$6.50	Gain \$6.00	<input type="radio"/> <input type="radio"/>
	Lose \$7.00	Gain \$6.00	<input type="radio"/> <input type="radio"/>

Cognitive measures

Fluid intelligence (G_f)

- Raven's Progressive Matrices (Raven, 1936; Salthouse, 2005)
- Letter Series (adapted from Salthouse, 2005)
- Number Series (McArdle & Woodcock, 2009) (HRS)
- Numeracy (Lipkus et al., 2001)
- Cognitive Reflection Test [CRT] (Frederick et al., 2002)

The chance of getting a viral infection is .0005.

Out of 10,000 people, about how many of them are expected to get infected?

EATE)

Only numbers may be entered in this field

- PLIK
- QLIK
- THIK
- VLIK

5

Only numbers

A bat and a ball cost \$1.10 in total.

The bat costs \$1.00 more than the ball.

How much does the ball cost?

_____ cents

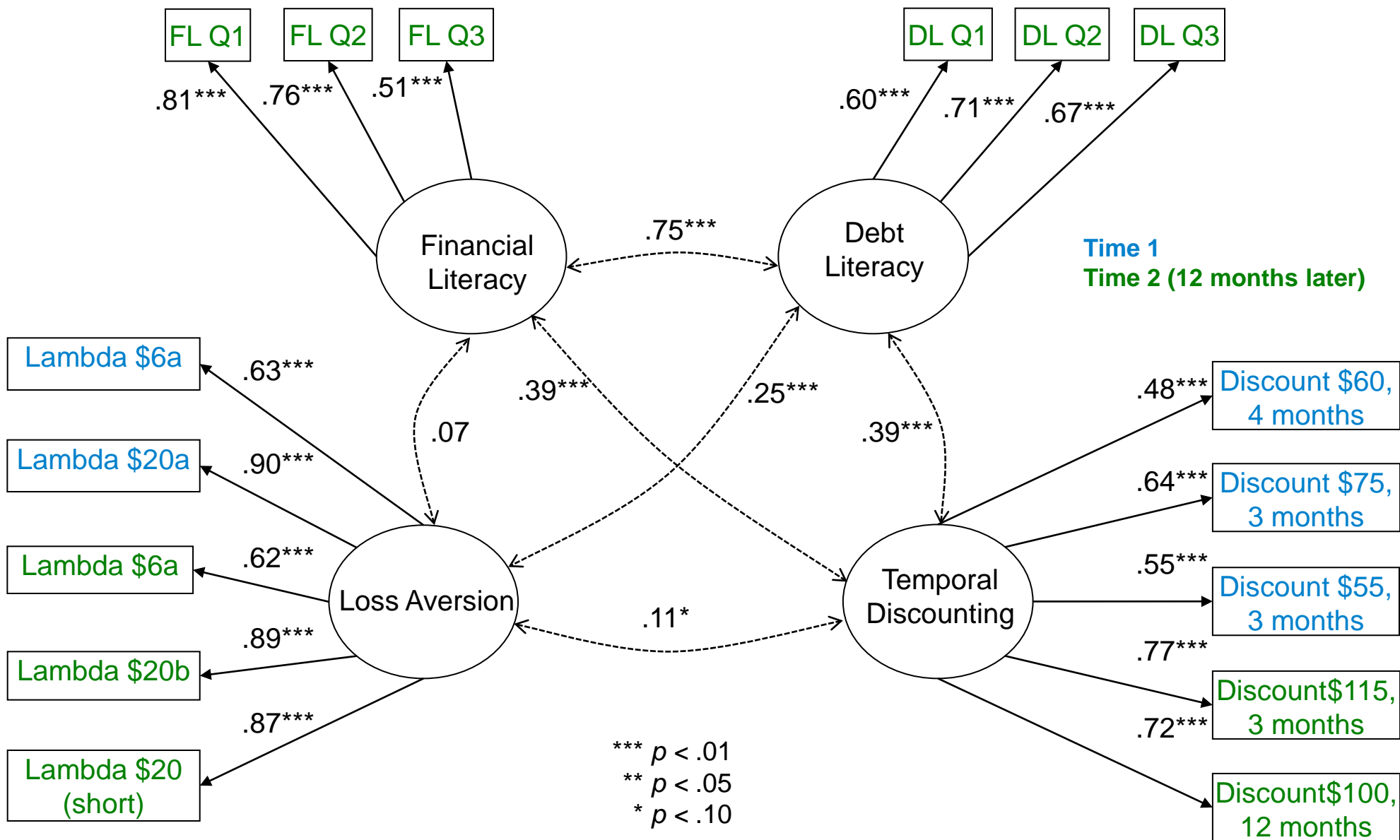
Sample characteristics

- **336 participants**
 - Center for Decision Sciences Virtual Lab database
 - No middle-age (30-59)

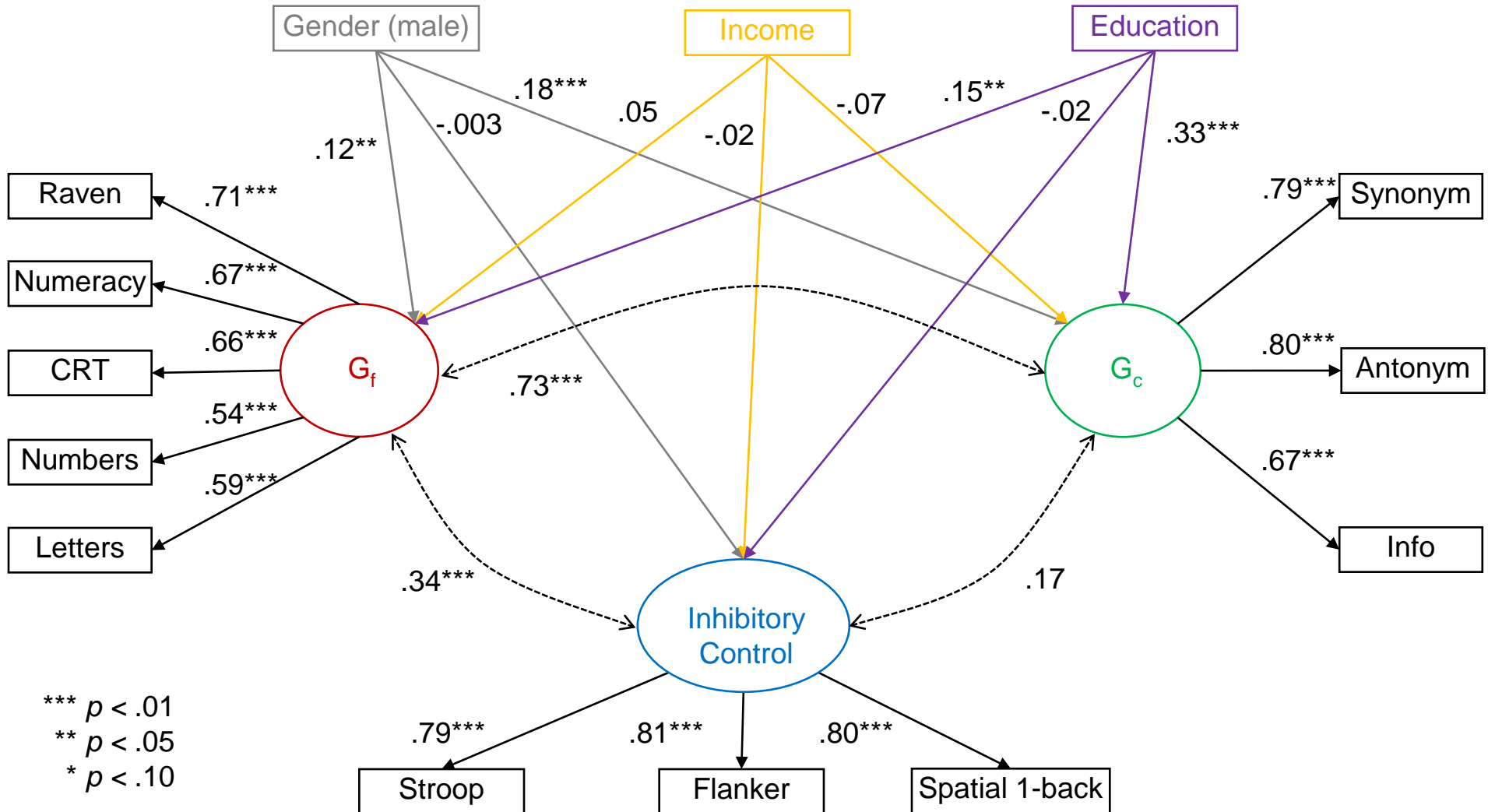
Young (N = 173)	Old (N = 163)
18 – 29 years	60 – 82 years
mean = 24.8 years	mean = 66.4 years
67% female	64% female

- Four-wave online study (last wave 1 year later)
 - **Same participants** completed all four waves of the study
 - Dropout rates do not differ between young and old
 - No demographic, cognitive or decision-making variable predicts dropout

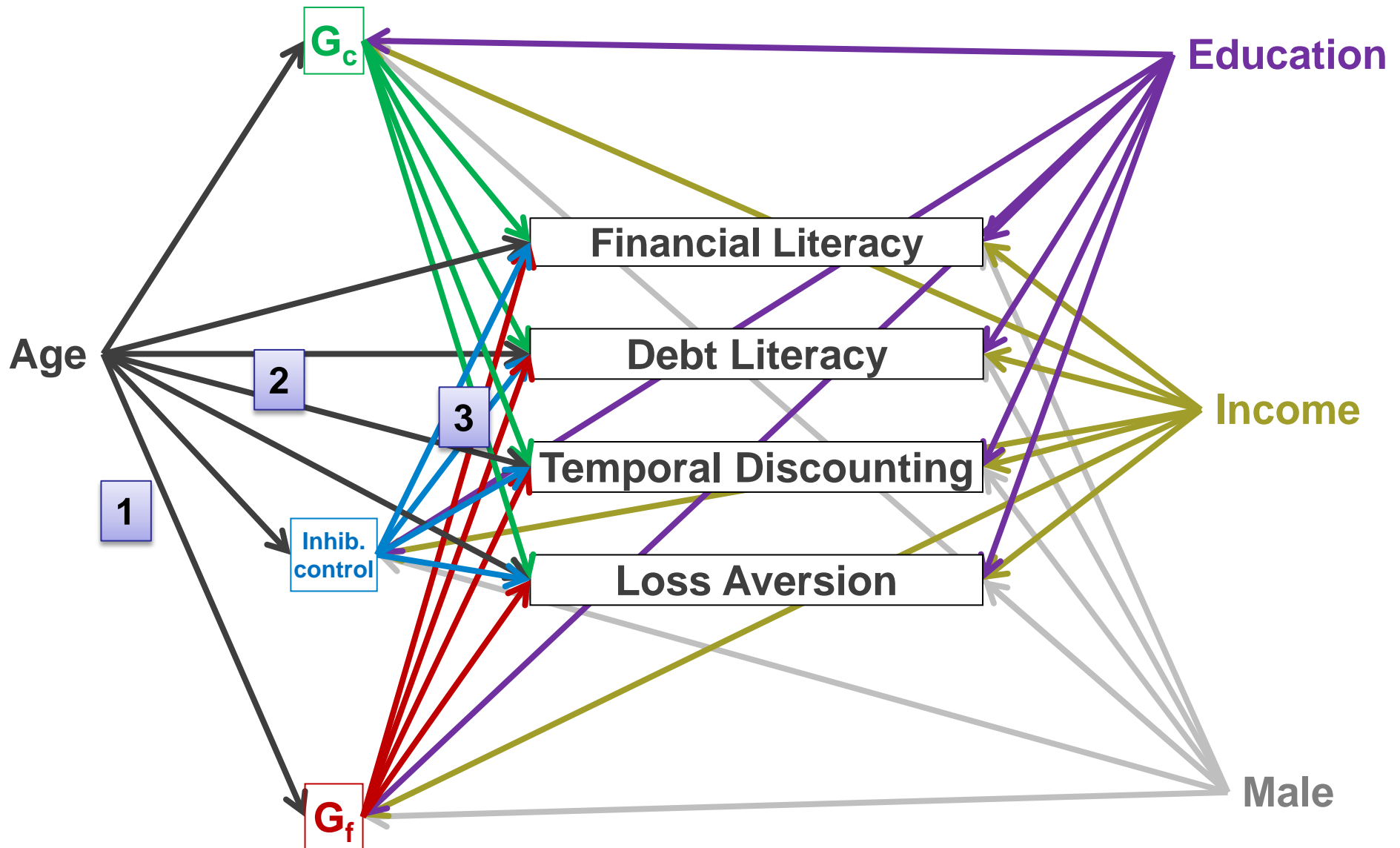
Decision-making traits



Cognitive capabilities



Structural Equation Model (SEM)



Cognitive capabilities by age

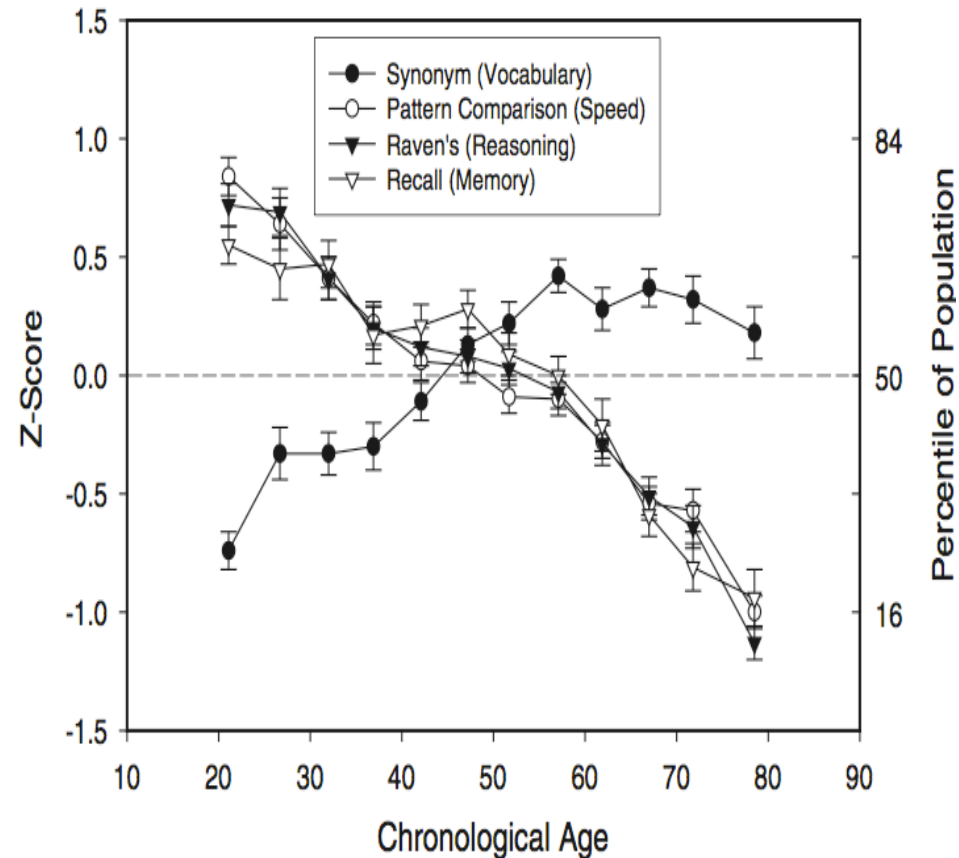
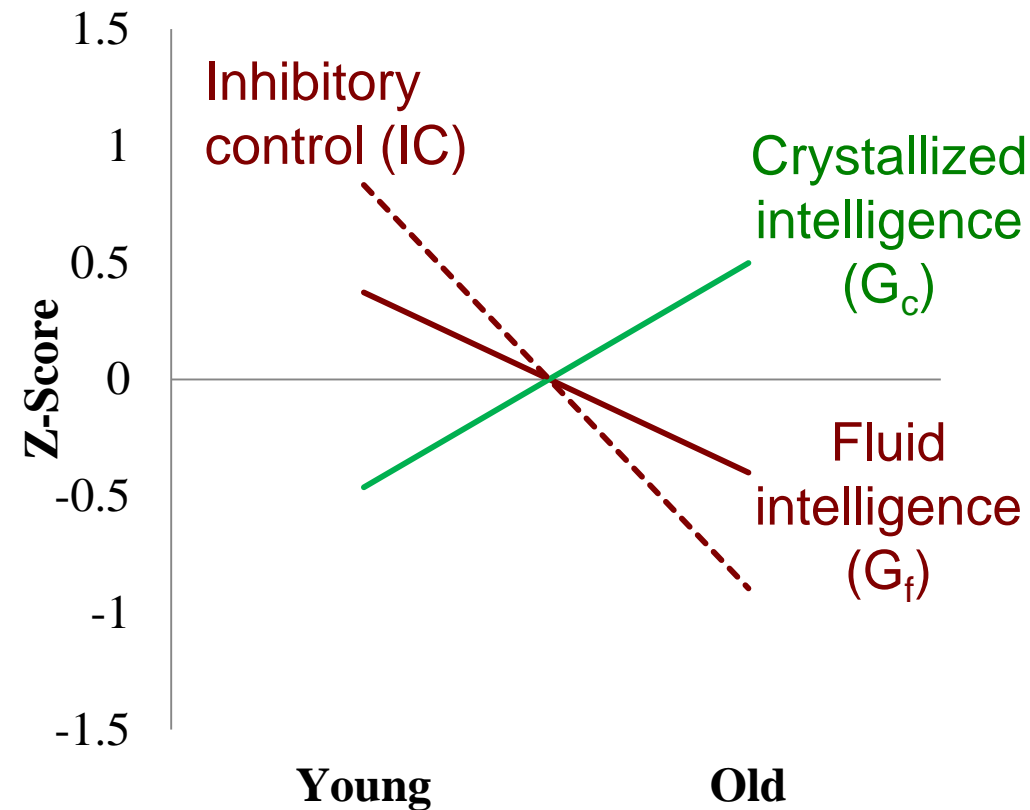
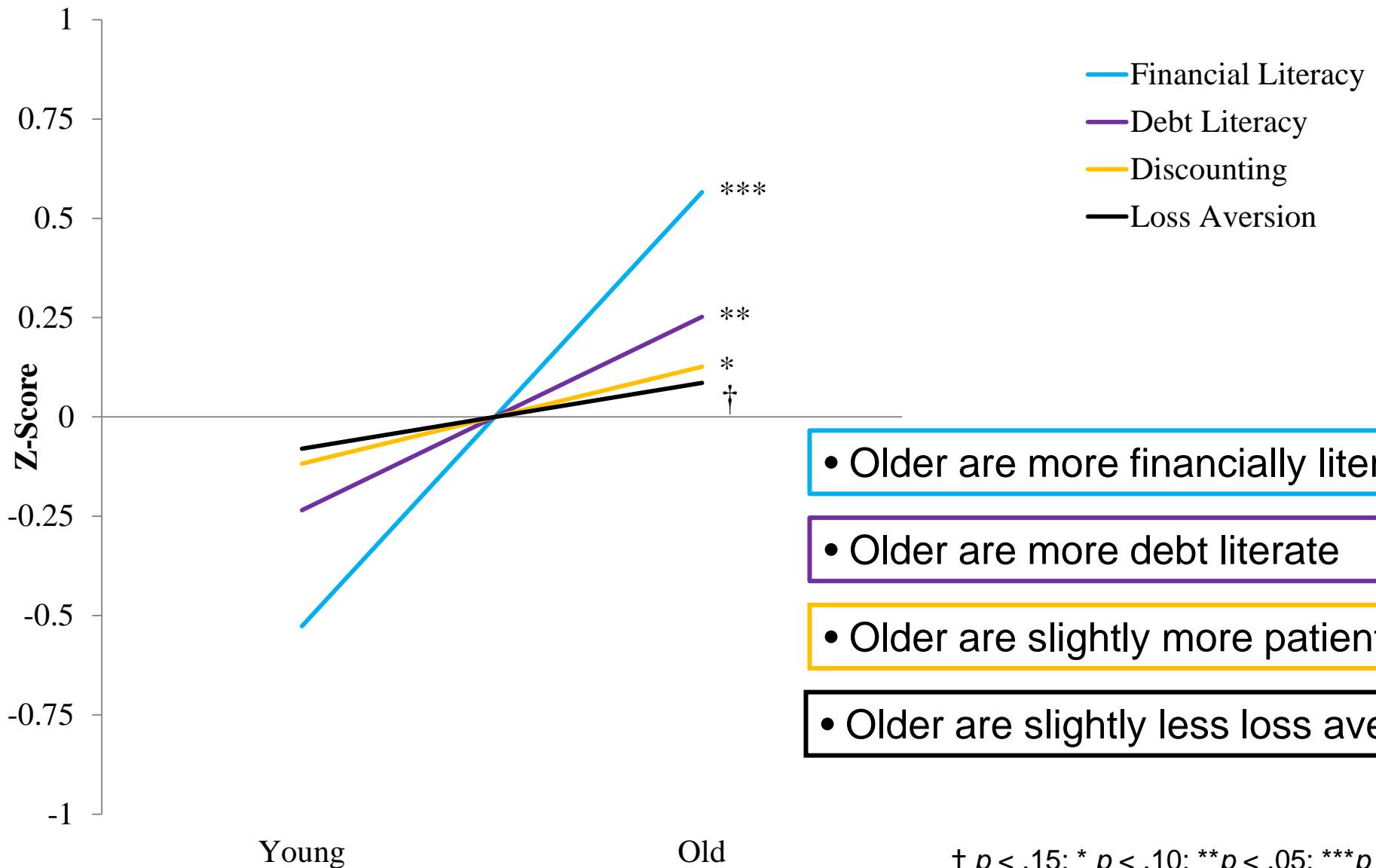


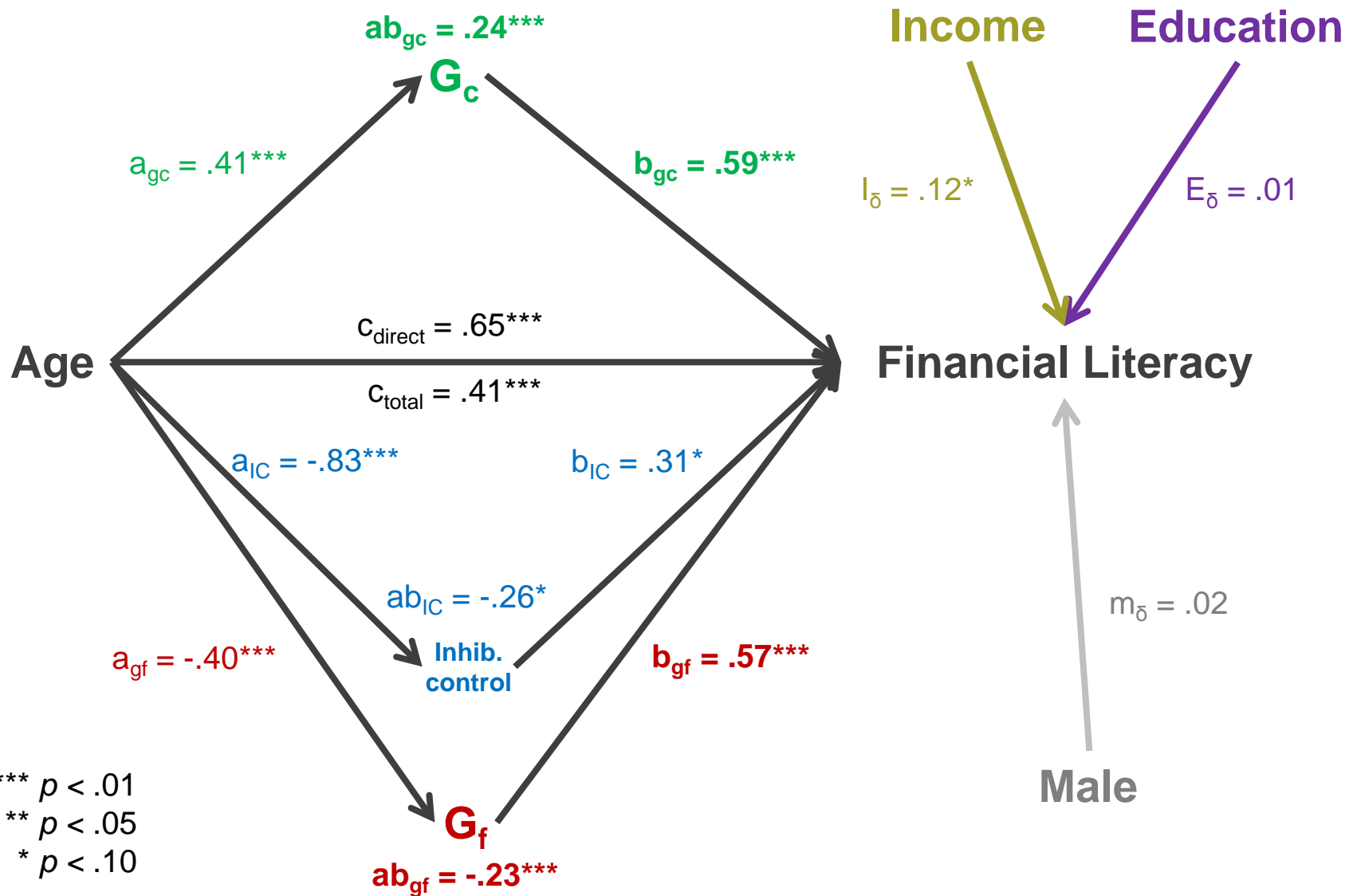
Fig. 1. Means (and standard errors) of performance in four cognitive tests as a function of age. Each data point is based on between 52 and 156 adults.

Salthouse 2004, 2010

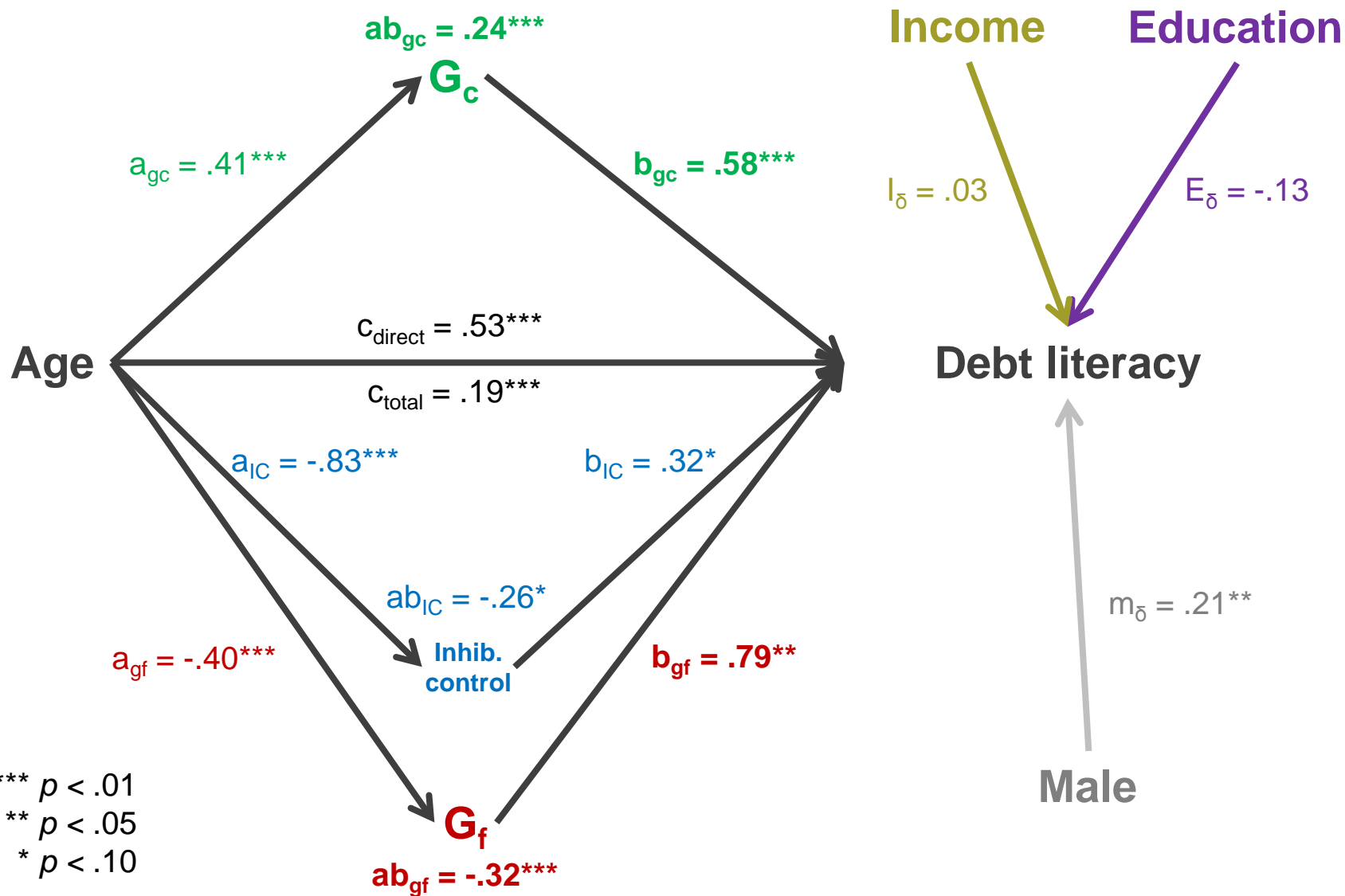
Decision performance by age



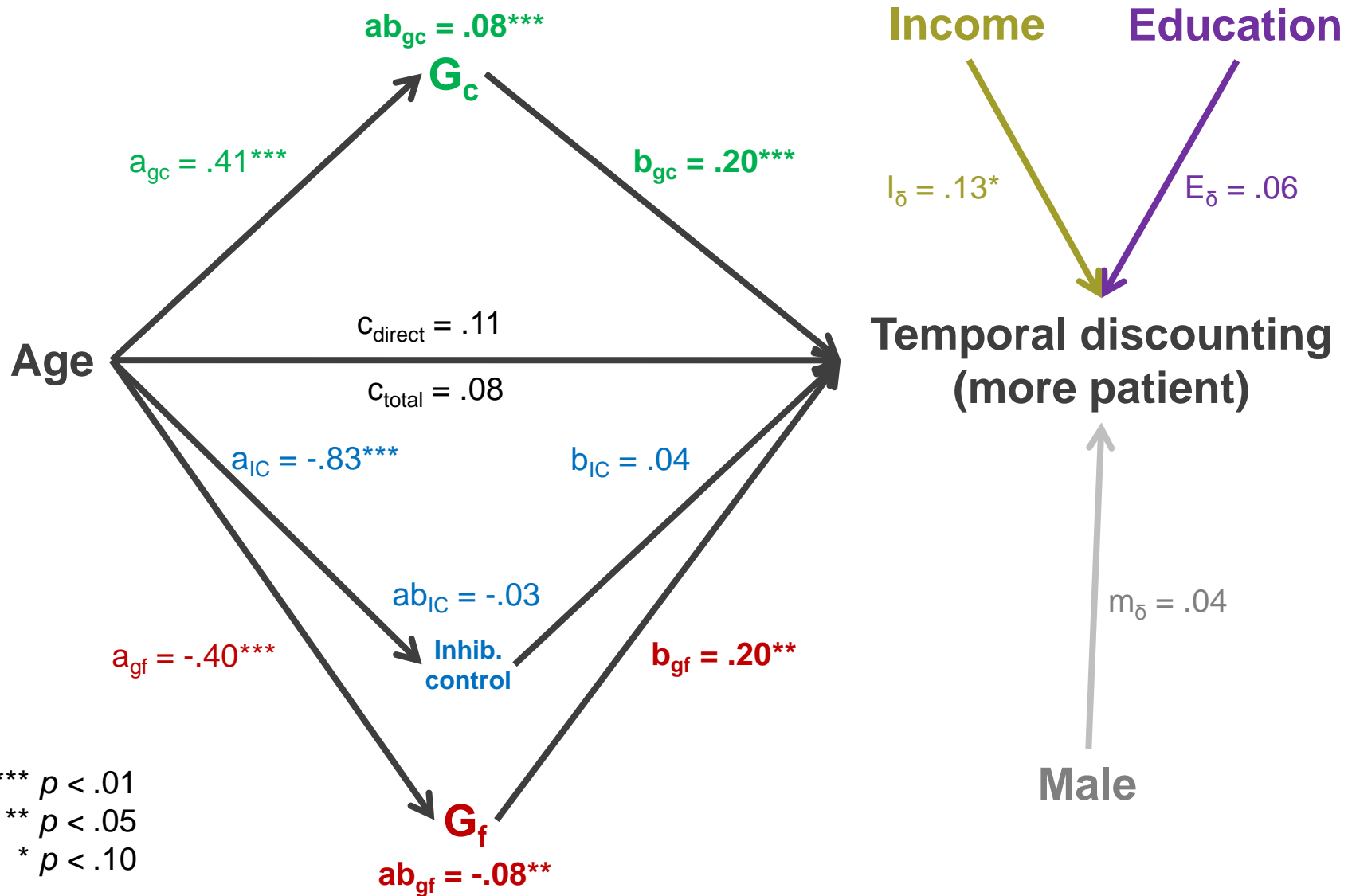
Financial Literacy



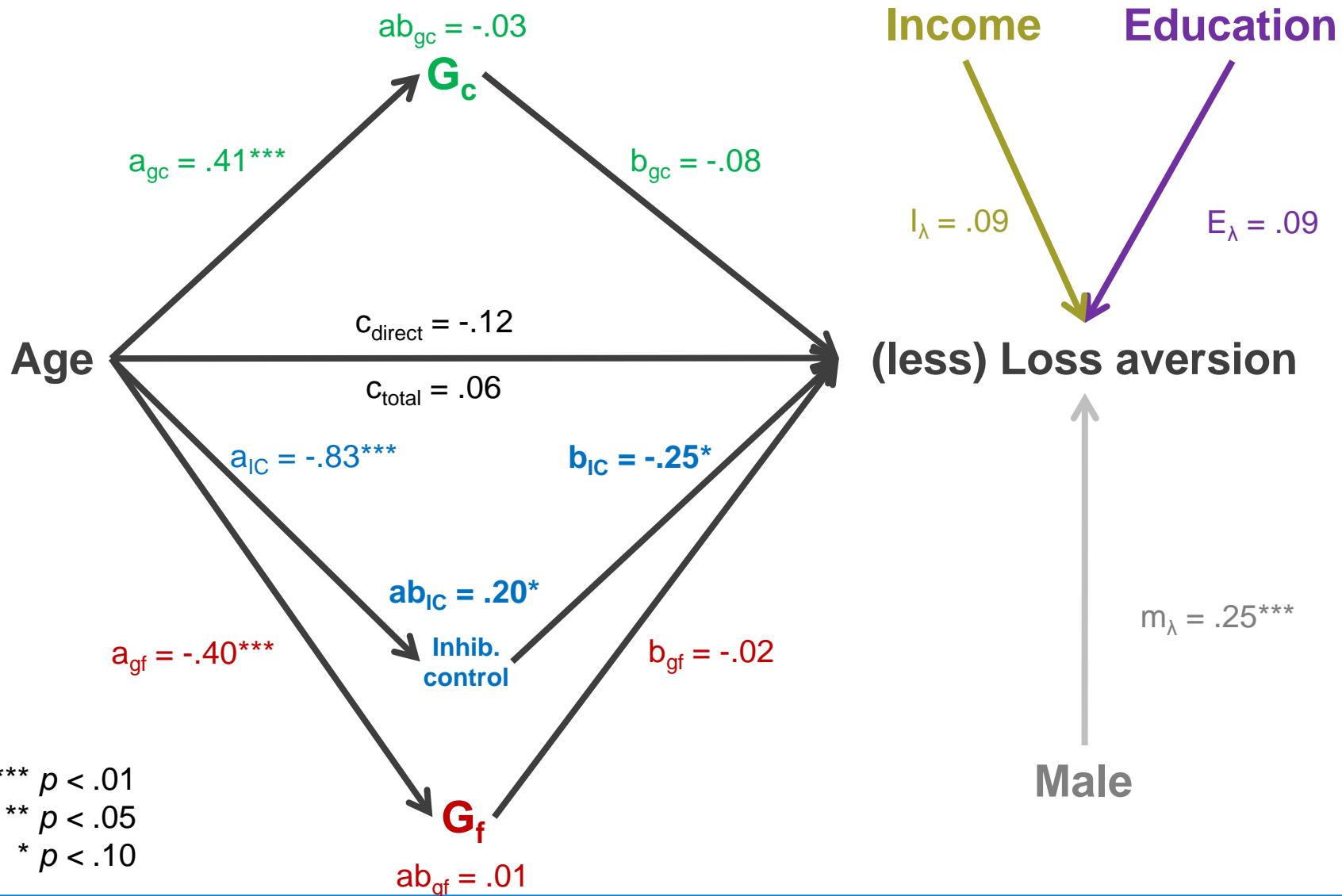
Debt Literacy



Temporal Discounting

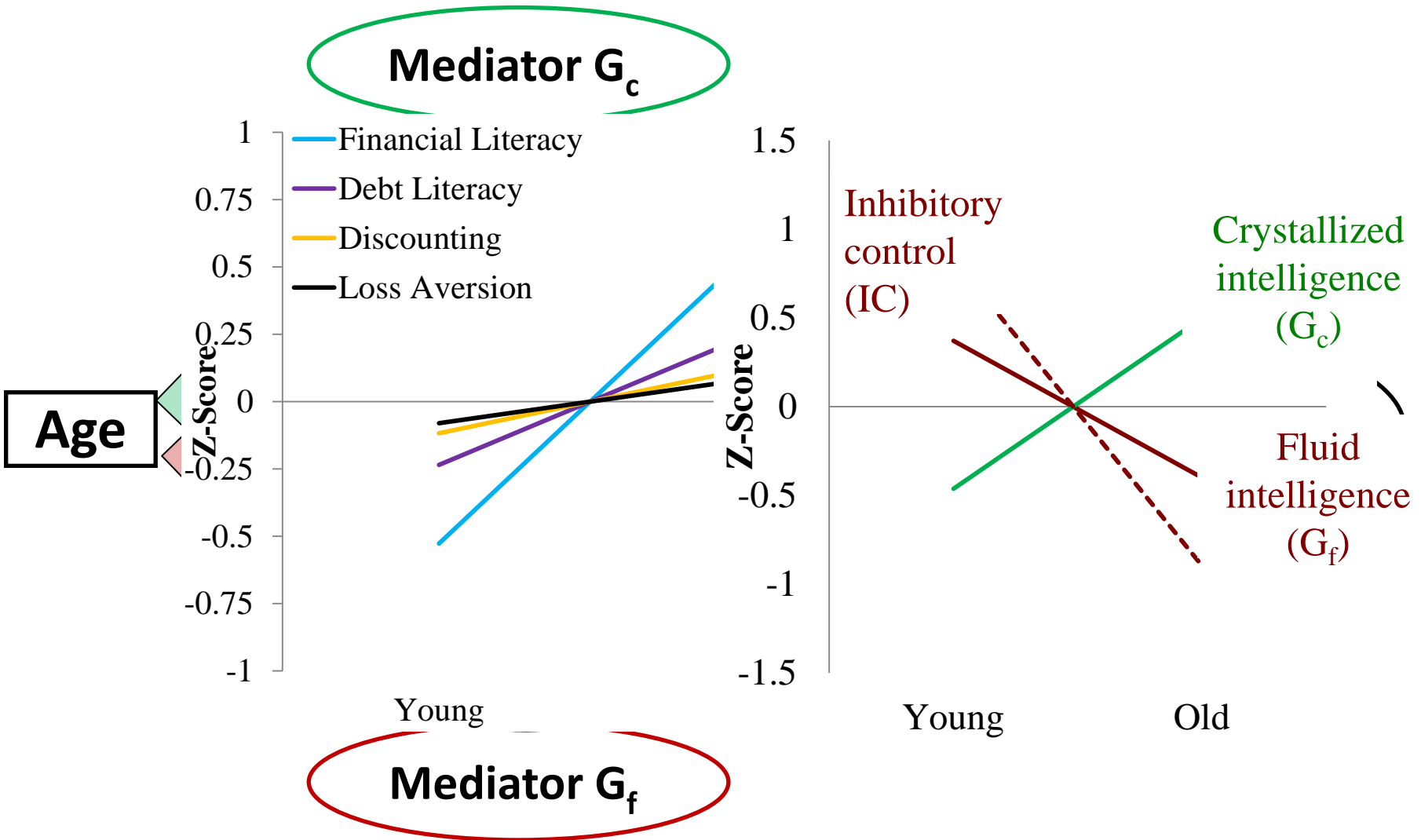


Loss Aversion

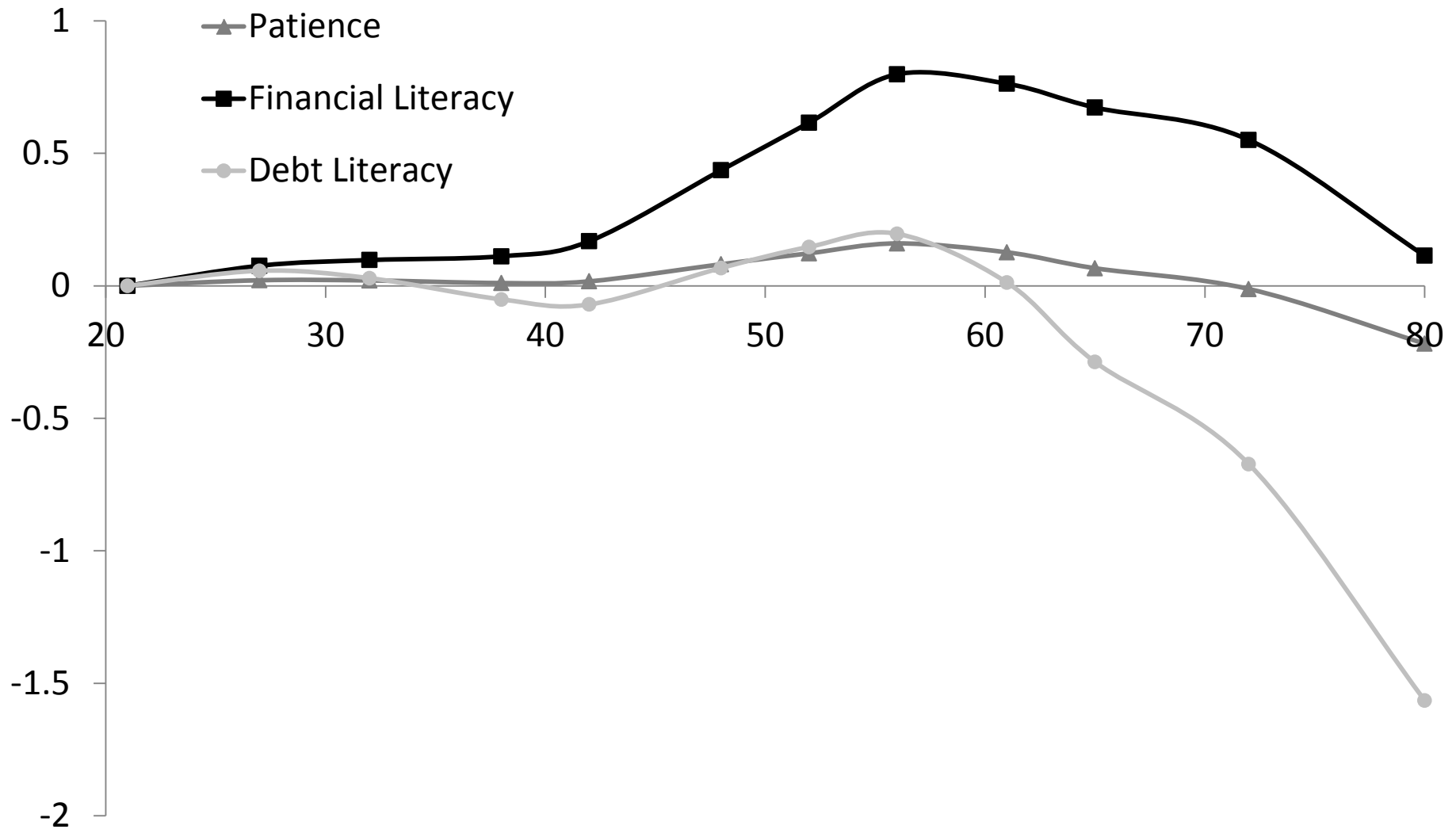


*** $p < .01$
 ** $p < .05$
 * $p < .10$

Summary



What happens over the full life course?



and 100 adults.

Salthouse, 2010

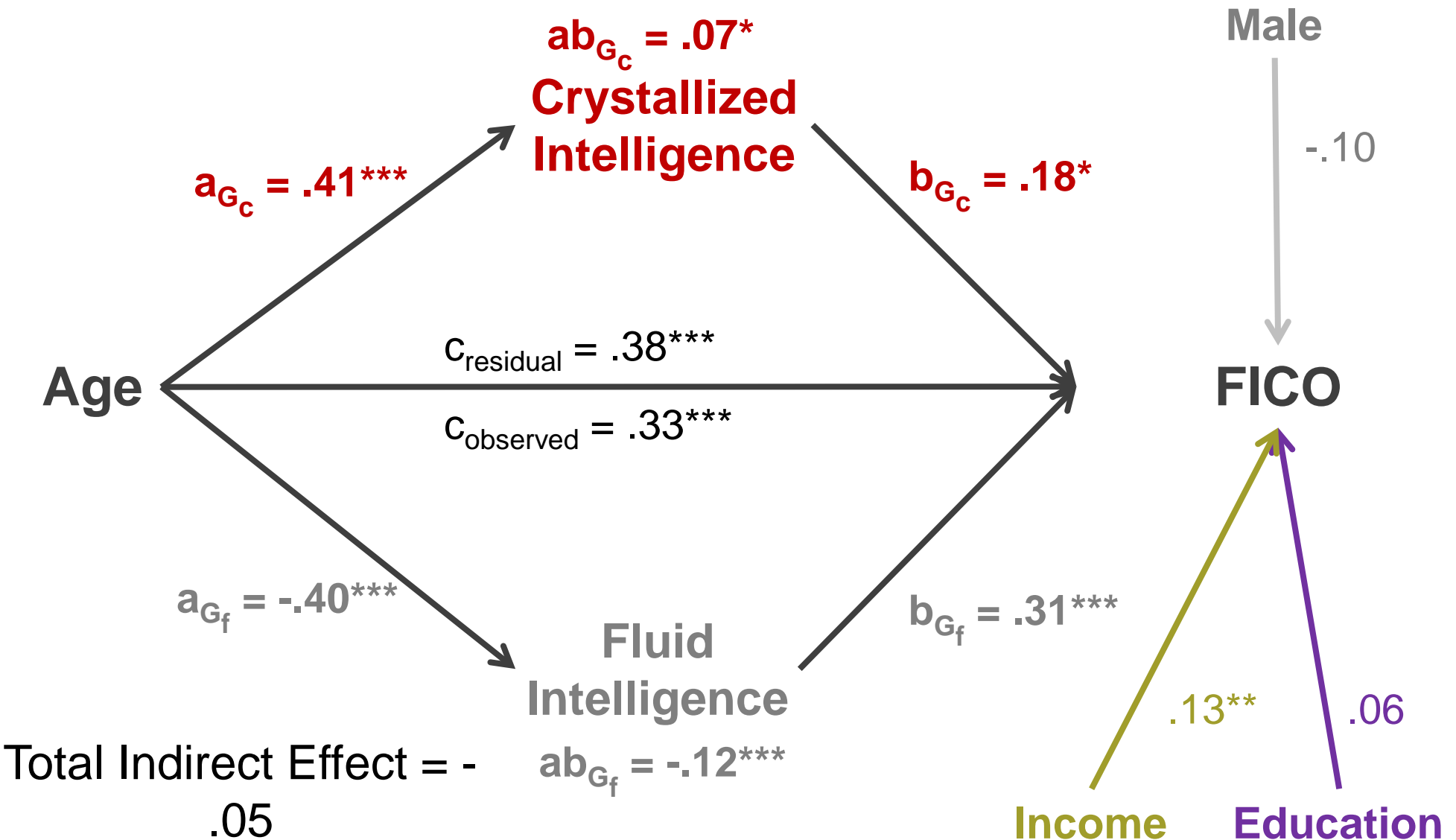
New Results (Note....Preliminary)

- Anonymous credit reports from a major credit reporting firm
 - 338 total data fields
 - Two pulls: February 2009 & January 2012 ($r = .80$)
 - Mean FICO score increased by 13pts ($p < .001$)
- Matches for 456/632 (72%) original participants!
 - 245/332 full data points (74%)
 - 231/332 in both time periods
 - Higher match rate for old (136/163 → 83%) than young (100/173 → 58%)

Credit Report Fields

Scoring Models	Second Lien/CLTV Indicators	Short-Term Prepayment Indicators	General Delinquency Attributes
1 Vantage: Vantage Score	1 LI56: Number of First Mortgages	1 LI90: Potential Mortgage Inquiries, 1 Month	1 LI41: % Accts Always Satisfactory
2 BCN09M: Beacon 09 Mortgage	2 LI62: Number of CESs	2 LI1: Total Inquiries in Past 12 Months	2 LI40: % Past Due Revolving Accts
3 BCN09: Beacon 09 (FICO)	3 LI63: Number of HELOCs	3 <u>Mortinq</u> : Mortgage Inquiry Past 30 Days	3 LI55: % Accts Ever 60+ DPD
4 BNI: Bankruptcy Navigator Index	4 LI57: Current Balance All First Mortgages	4 LI214: # of Mortgage Inquiries, 6 Months	4 LI52: # of Accts Ever 60+ DPD
5 BCN50: Beacon 5.0 (FICO)	5 LI59: Current Balance Largest First Mortgage	Long-Term Prepayment Indicators	5 LI14: # of 30 DPDs In 6Mths Revolving Accts
6 PIM: Personal Income Model 3.0	6 LI66: Current Balance CESs	1 LI94: Current Address Date/Home Tenure	6 LI17: # of 60 DPDs In 12Mths All Accts
Owner Occupancy	7 LI67: Current Balance HELOCs	2 LI95: Number of Addresses	7 LI50: % Accts 60DPD in 6Mths/ <u>Dflt</u> in 24
1 <u>ZIPCode</u> : Consumer Zip Code	8 LI58: Original Balance Largest First Mortgage	3 LI101: # of known Foreclosures	8 LI20: # of All Accts 6Mths Satisfactory
2 LI56: Number of First Mortgages	9 LI68: Original Balance CESs	4 LI96: Current Bankruptcy Status	9 LI21: # of All Accts in 3Mths Worst 30 DPDs
3 LI93: Address Type Code	10 LI69: Original Balance HELOCs (Credit Limit)	5 LI97: Date (<u>Mos</u> Since) Last Bankruptcy Start	10 LI22: # of All Accts in 3Mths Worst 60 DPD
4 LI94: Current Address Date/Home Tenure	11 LI60: Date Opened Largest First Mortgage	6 LI99: Last Bankruptcy Type	11 LI25: # of All Accts in 3Mths Worst 90 DPD
5 LI95: Number of Addresses	12 LI64: Date Opened Newest CES	Aggregate Payment Status	12 LI27: # of All Accts in 3Mths Worst 120+ DPD
Mortgage Adjustments	13 LI65: Date Opened Newest HELOC	1 LI31: Worst Status Last 3Mths Mortgage	13 LI43: # of All Accts 60+DPD in 3/ <u>Dflt</u> in 24
1 LI96: Current Bankruptcy Status	14 LI110: Original Balance Largest CES	2 LI105: Worst Status All First Mortgages	14 LI42: % <u>Revolving</u> Accts 3Mths Satisfactory
2 LI101: # of known Foreclosures	15 LI113: Current Balance Largest CES	3 LI30: Worst Status Last 3Mths Auto	15 LI47: % <u>Revolving</u> Accts 60DPD in 3/ <u>Dflt</u> in 24
3 LI125: # of Transferred/Sold First Mortgages	16 LI115: Current Balance Largest HELOC	Utilization	16 LI51: % <u>Revolving</u> Accts 60DPD in 6/ <u>Dflt</u> in 24
4 LI126: # of Transferred/Sold CESs	17 LI102: Status Largest First Mortgage	1 LI76: Current Balance Revolving Accts	17 LI19: # of Install Accts 3Mths Satisfactory
5 LI127: # of Transferred/Sold HELOCs	18 LI106: Status Largest CES	2 LI77: Credit Limit Revolving Accts	18 LI23: # of Install Accts 3Mths Worst 60 DPD
Back- and Front-End Debt-to-Income	19 LI108: Status Largest HELOC	3 LI67: Current Balance HELOCs	19 LI29: # of Install Accts 6Mths Worst 60 DPD
1 LI91: Monthly Payment on All Accts	20 LI104: Original <u>Bal</u> 2 nd Largest First Mortgage	4 LI69: Original Balance HELOCs (Credit Limit)	20 LI48: # of Install Accts 60DPD in 6/ <u>Dflt</u> in 24
2 LI61: Monthly Payment All First Mortgages	21 LI112: Current <u>Bal</u> 2 nd Largest First Mortgage	5 LI72: % Utilization All Revolving	21 LI54: # of Install Accts Ever 60+ DPD
3 LI83: Monthly Payment Install Accts	22 LI111: Original <u>Bal</u> 2 nd Largest CES	6 LI71: % Utilization All HELOCs	22 LI49: # of Install Accts 90DPD in 6/ <u>Dflt</u> in 24
4 LI82: Monthly Payment CESs	23 LI114: Current <u>Bal</u> 2 nd Largest CES	7 LI33: # of Revolving Accts >=50% Utilization	23 LI44: # of Install Accts 90+DPD in 3/ <u>Dflt</u> in 24
5 LI75: Monthly Payment Revolving Accts	24 LI116: Current <u>Bal</u> 2 nd Largest HELOC	8 LI34: # of Bankcard Accts >=75% Utilization	24 LI15: # of 30 DPDs In 24Mths Retail Accts
6 LI73: Monthly Payment HELOCs	25 LI103: Status 2 nd Largest First Mortgage	9 LI32: # of Retail Accts >=50% Utilization	25 LI16: # of 60 DPDs In 12Mths Retail Accts
7 LI92: Monthly Payment on Other Accts	26 LI107: Status 2 nd Largest CES	10 LI35: # of <u>Dept</u> Store Accts >=75% Utilization	26 LI18: # of 90 DPDs In 24Mths Retail Accts
8 LI74: Monthly Payment Cards	27 LI109: Status 2 nd Largest HELOC	11 LI36: # of Install Accts >=75% Utilization	27 LI24: # of Retail Accts in 3Mths Worst 60 DPD
Tax Lien Indicators	28 New Piggy: Piggyback Indicator V2.0	12 LI39: % Balance Mortgage Accts	28 LI26: # of Retail Accts in 3Mths Worst 90 DPD
1 LI121: Current Balance Active Tax Liens	Borrower Age	13 LI70: % Balance to High Credit CESs	29 LI28: # of Retail Accts in 3Mths Worst 120+
2 LI122: Current Balance Inactive Tax Liens	1 LI2: Age Oldest Acct	Accounts in Collection	30 LI45: # of Retail Accts 60DPD in 3/ <u>Dflt</u> in 24
3 LI119: Date (Age) Newest Active Tax Lien	2 LI7: Age Newest Install Acct	1 LI300: Current Balance in 3rd Party Collections	31 LI46: # of Retail Accts 90DPD in 3/ <u>Dflt</u> in 24
4 LI120: Date (Age) Newest Inactive Tax Lien	3 LI5: Age Oldest Revolving Acct	2 LI317: # of Third Party Collection Accts	32 LI10: # of Retail Accts Past Due

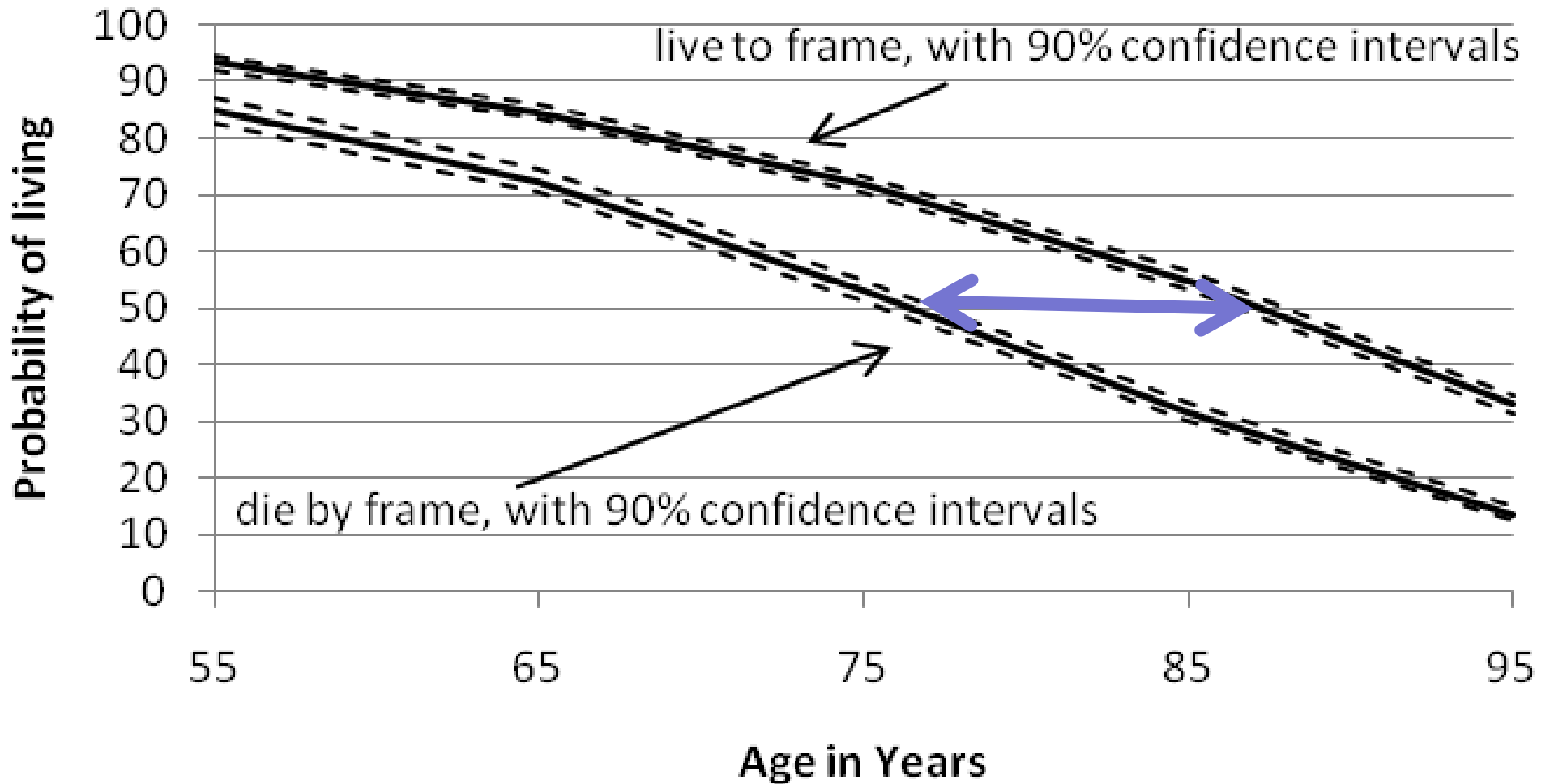
FICO Mediation



Predicting how long you will live (Payne et al, 2012)

- Fundamental Assumption of Economics Models.
- Can be asked two ways:
 - What is the probability that you will live to be age 85 or older?
 - What is the probability that you will die by age 85 or younger?
- These should be the related $p(\text{alive at 85}) = 1 - p(\text{die by 85})$
- Are they influenced by how we ask?

Study 1 (n=1444)



- How to accommodate elders?
 - Financial Education can help Crystallized Intelligence.
 - But Not Fluid Intelligence. This is a challenge
 - Better Choice Architecture.
 - Lessons from Medicare Part D
 - Should there be ‘dozens of options?’
 - Can People Opt-In to a supported environment
- Next Steps: Actual Behavior...Credit Reports of participants.

- Choice Architecture in general, no-action defaults, specifically
- Applications
 - Decumulation
 - Annuitization
 - What are the behavioral barriers?
 - How do people estimate longevity?
 - Claiming Age for Social Security
 - Design of Health Care Exchanges.

Thanks!

- National Institute of Aging for funding
- Society of Judgment and Decision Making meeting participants
- Columbia's Cognitive Neuroscience Seminar participants
- Preferences-as-Memories Lab members:
Kirstin Appelt, Dan Bartels, Isaac Dinner, Bernd Figner, Dave Hardisty, Maria Konnikova, Jing Qian, Eric Schoenberg, Katherine Thompson, Liza Zaval
- Special thanks to Jon Westfall for technical assistance
- Mark Heitman for SEM assistance
- Tim Salthouse and Yaakov Stern for feedback

Appendix

How does crystallized intelligence compensate?

- G_c predicts better financial and debt literacy, greater patience in temporal discounting
- Does general G_c stand in for more specific knowledge or experience?
- Or is it related to some other age-dependent variable?
 - Socioemotional Selectivity Theory (Carstensen, 2006)

Loss Aversion titrator

*Consider a one-time gamble based on the toss of a fair coin (the probability of heads equals the probability of tails, both being .5). If the coin turns up heads then you lose \$0.50, and if the coin turns up tails, you win \$6. Would you play this gamble? Consider the following similar gambles and record your choices.

		YES	NO
Heads	Tails		
Lose \$0.50	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$1.00	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$1.50	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$2.00	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$2.50	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$3.00	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$3.50	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$4.00	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$4.50	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$5.00	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$5.50	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$6.00	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$6.50	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>
Lose \$7.00	Gain \$6.00	<input checked="" type="radio"/>	<input type="radio"/>

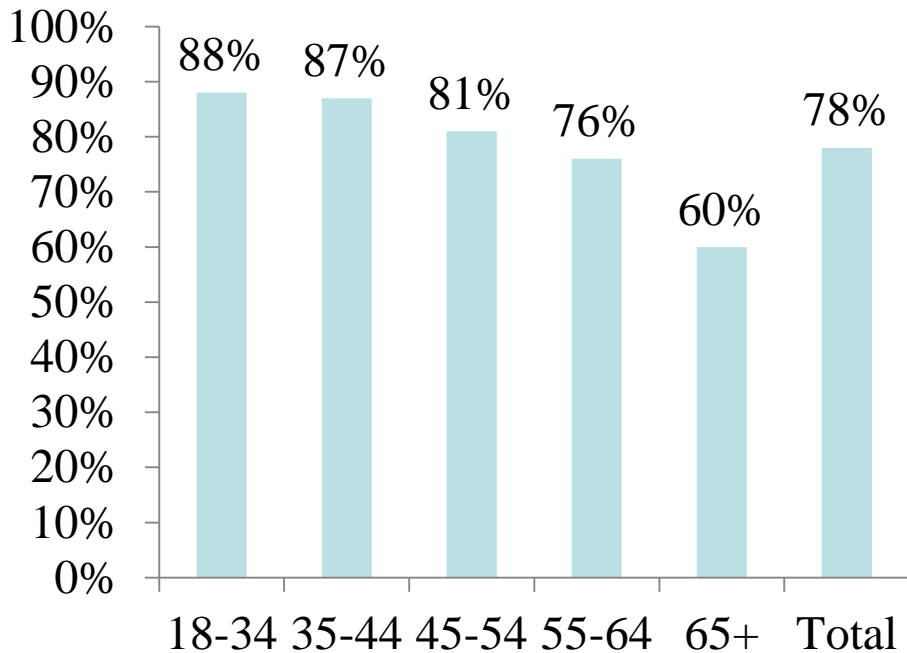
[Back](#)

**More information on our sample, and drop out
(completion rates), screening procedures**

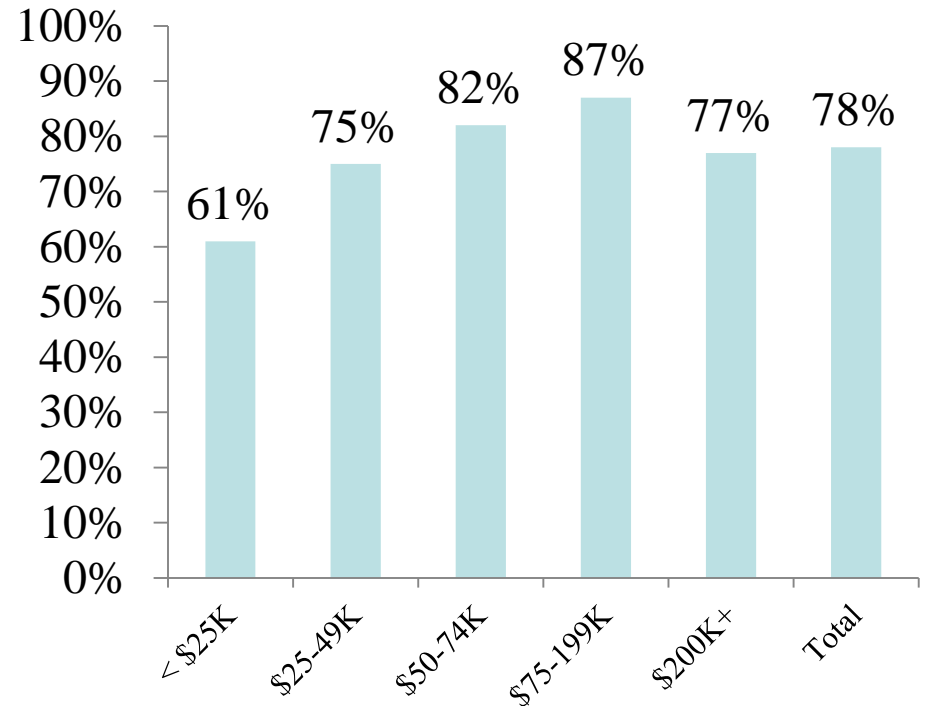
Internet Availability in the US

- > 80% of Americans have a computer at home, almost 92% of those have internet access

Dial up/High Speed Internet



Dial up/High Speed Internet



Internet Availability (Cont.)

Item	Have Access to Internet at Home, Work, or Elsewhere	Have Used the Internet in the last 30 days
% of Total Population	85%	71%
- Male	48% of those...	48% of those...
Age		
18 – 34	33%	36%
35 – 54	41%	43%
55+	26%	21%
Income		
< \$50,000	36%	31%
\$50,000 - \$74,999	21%	21%
\$75,000 - \$149,999	31%	34%
\$150,000+	12%	13%

MediaMark Research & Intelligence, 2008

[Back](#)

Comparison of Sample Characteristics with US population

Comparison of Sample Characteristics with US population					
Social Demographic		GRAD young (18-30)	US Comparison young	GRAD old (60-82)	US Comparison old
Gender ^a	Male	33%	51%	36%	44%
	Female	67%	49%	64%	56%
Education ^b	HS Degree or Less	33%	47%	26%	55%
	Some College/AA	12%	44%	15%	24%
	Bachelors Degree +	55%	9%	59%	23%
Race ^c	Caucasian	65%	61%	93%	78%
	African American	8%	14%	4%	8%
	Asian	15%	4%	0%	4%
	Hispanic	2%	18%	1%	8%
	American Indian/Alaskan	1%	1%	0%	1%
	Other	9%	2%	2%	1%

^{a b d} Data Set: 2009 American Community Survey 1-Year Estimates

(^a Young: 20-34, ^b Young: 18-24, ^d Young: 20-34, ^{a b d} Old: 60+)

^c US Census Monthly Estimates by Age, Sex, and Race—July 1, 2009; young = 18-30, old = 60-85

[Back](#)

Details on completion and drop out rates

Completion rates:

632 participants ($N_{\text{young}}=332$, $N_{\text{old}}=300$) completed the 1st wave
562 participants ($N_{\text{young}}=296$, $N_{\text{old}}=266$) completed the 2nd wave
516 participants ($N_{\text{young}}=274$, $N_{\text{old}}=242$) completed the 3rd wave
336 participants ($N_{\text{young}}=173$, $N_{\text{old}}=163$) completed the 4th wave

	All participants	Young	Old
Dropout: 1-2	70 (11.08%)	36 (10.84%)	34 (11.33%)
Dropout: 2-3	46 (8.19%)	22 (7.43 %)	24 (9.02%)
Dropout: 3-4	180 (34.88%)	101 (36.86%)	79 (32.64%)

Overall dropout rate was 46.84% ($N_{\text{young}}=159$ [47.9%], $N_{\text{old}}=137$ [45.7%])
- Low considering the length of time between waves (Musch & Reips, 2000)

IMPORTANT

- Dropout rates do not differ between young and old.
- No demographic, cognitive or decision-making variable predicts dropout

[Back](#)

More information on the measurement model for the cognitive variables

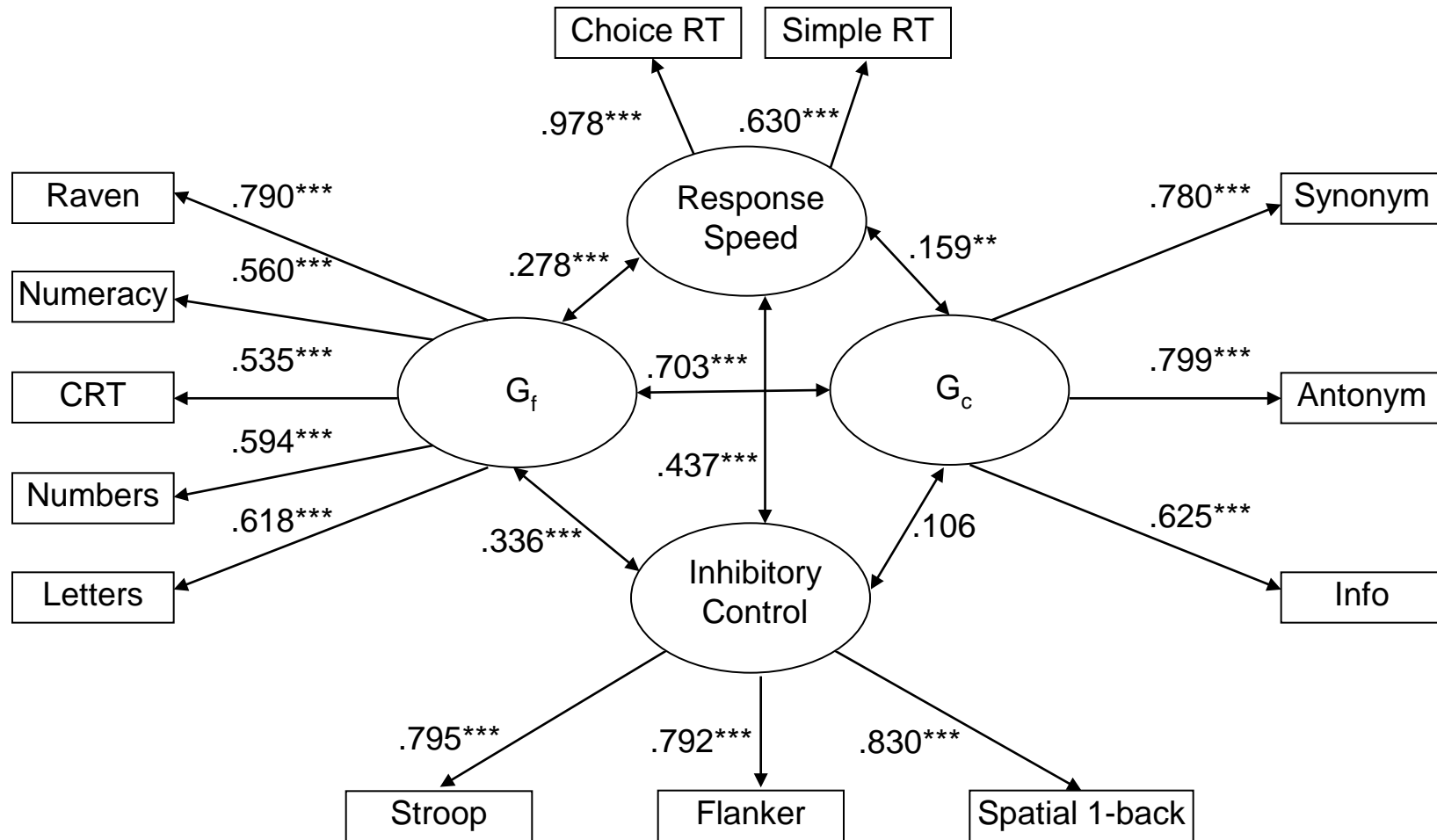
Model fits

- Measurement Models:
 - Cognitive Competencies
 - Decision-making Performance
- Overall SEM (structural equation model) combining cognitive and decision-making factors

[Back](#)

Measure of fit	Cognitive Factors	Decision-making Factors	Overall SEM	Overall SEM w/ Demographic Controls
χ^2 Test of Model Fit	117.2	141.7	566.8	601.0
Degrees of Freedom	40	95	347	410
χ^2 /df	2.93	1.49	1.63	1.47
RMSEA (Root Mean Square Error Of Approximation)	0.08	0.04	0.04	0.04
CFI (Comparative Fit Index)	0.94	0.95	0.90	0.91
TLI (Tucker Lewis Index)	0.92	0.93	0.88	0.89

Measurement model (Cognitive measures)



Anchoring (bad factor structure)

