Golden or Graying?
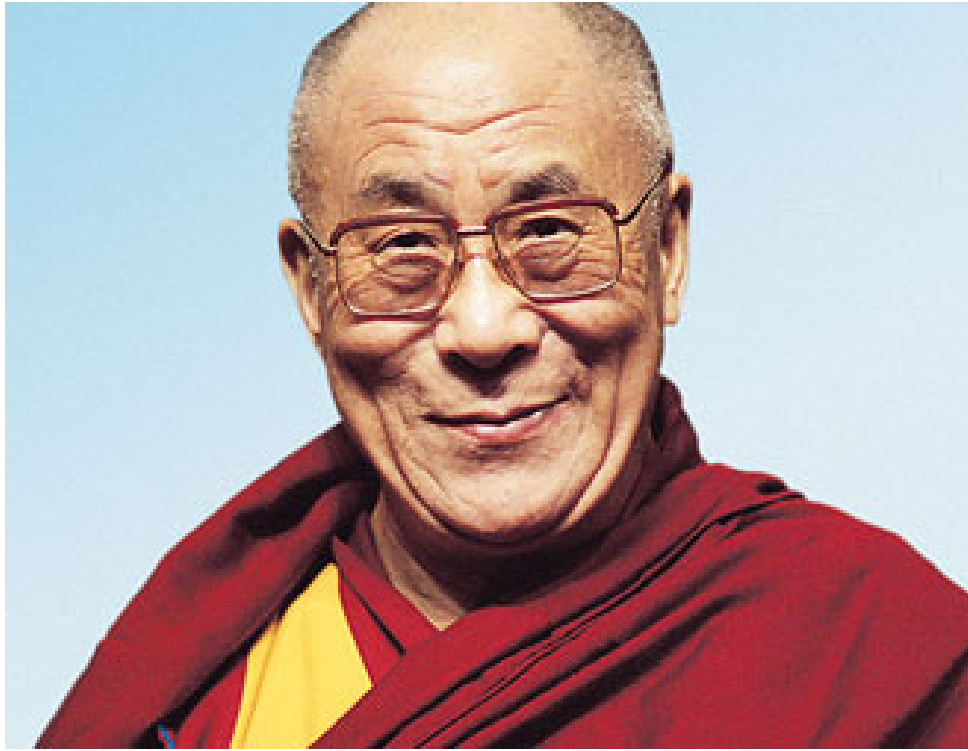## Economic decisions and cognitive aging

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with Jie Gao, Zeynep Enkavi, Lisa Zaval, Elke Weber, Eric Johnson
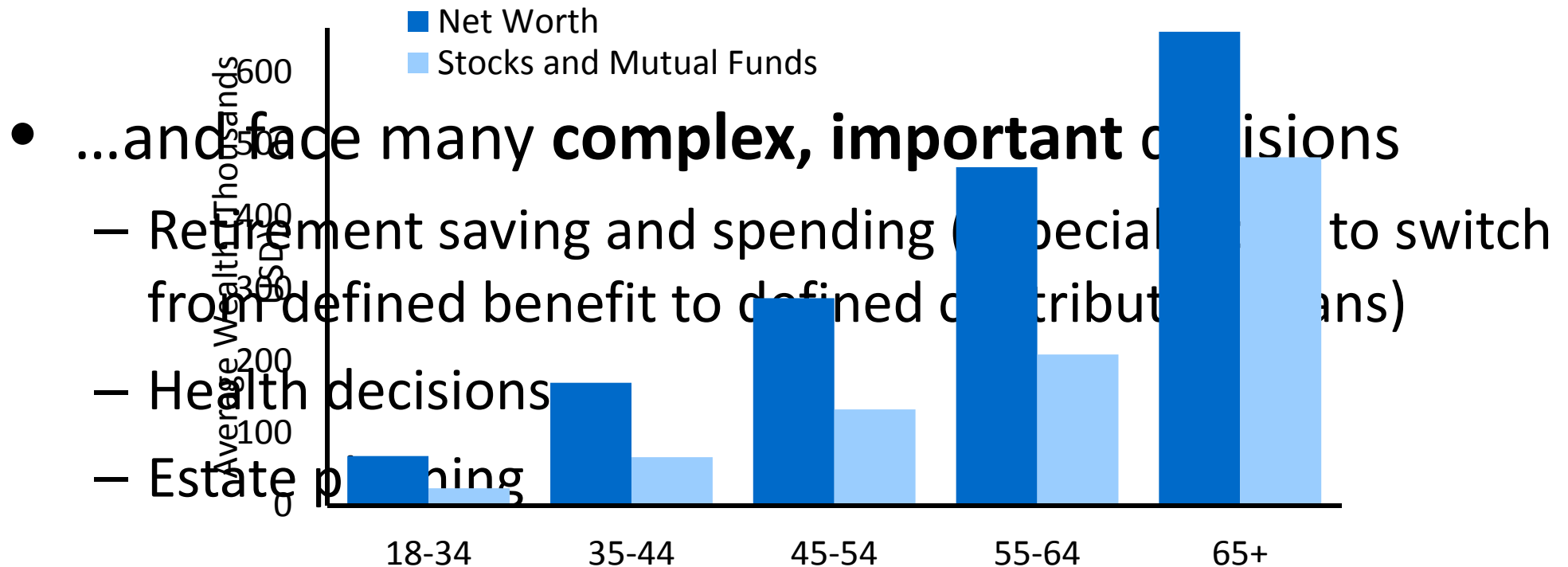Center for Decision Sciences, Columbia University

Consumer Financial Protection Bureau
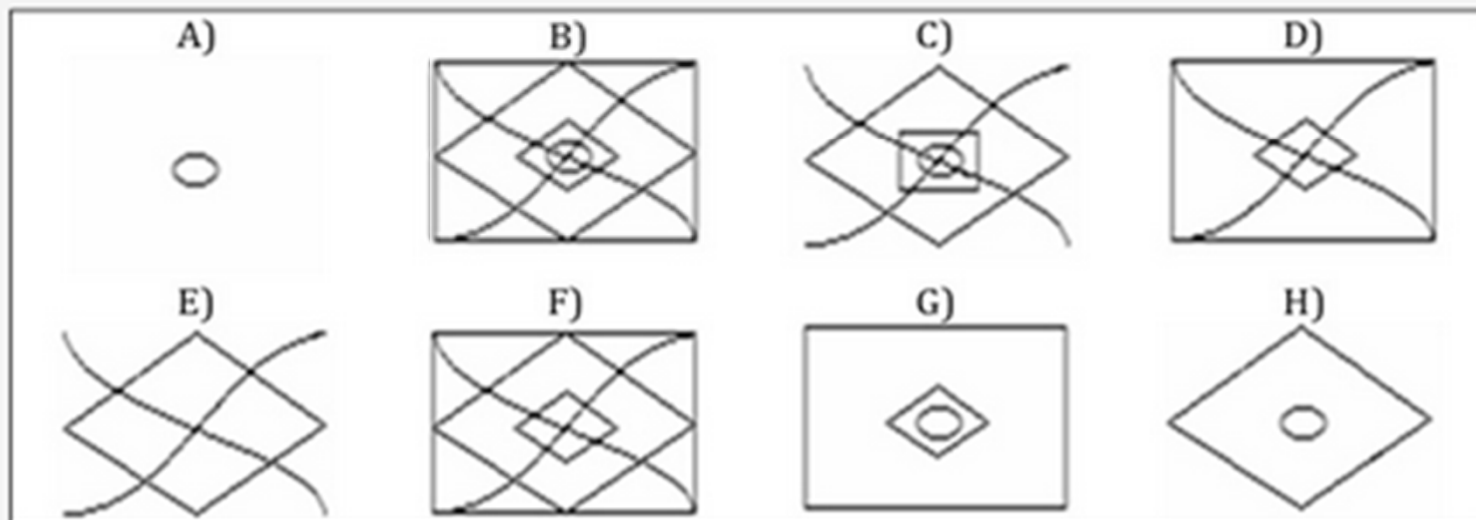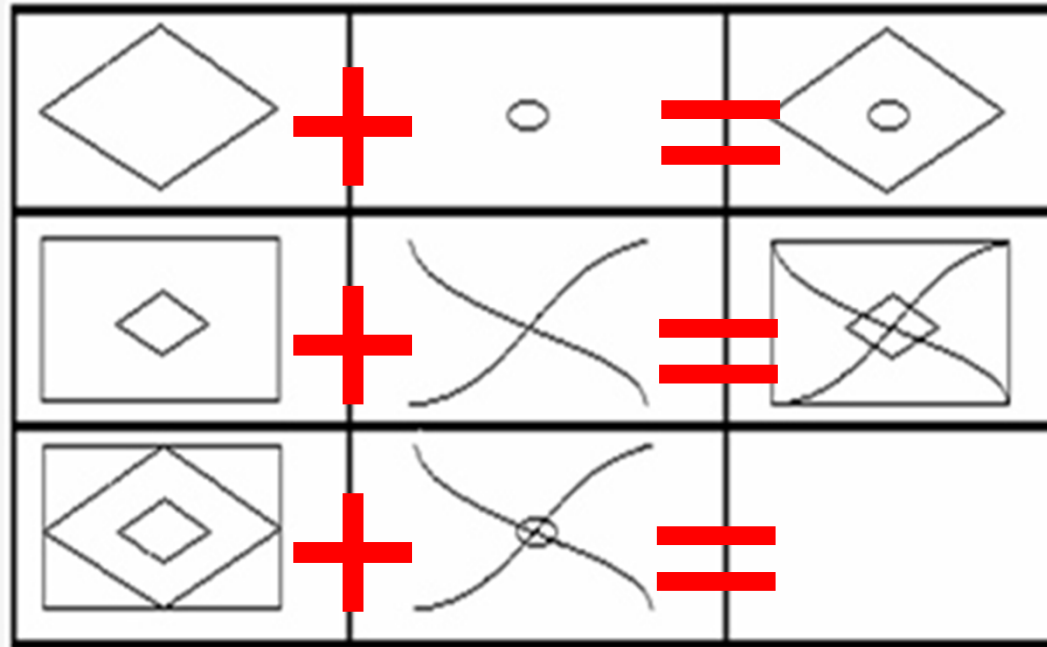2015 Research Conference, Washington, D.C.

Aging: Golden or Graying?

Older adults make large financial decisions

- Number of people 65+ worldwide will double by 2035

- Older adults control a lot of wealth…
  - 43% of total U.S. household wealth, 47% of stocks
  - $2 trillion annual expenditures

- …and face many **complex, important** decisions
  - Retirement saving and spending (especially with the switch from defined benefit to defined contribution plans)
  - Health decisions
  - Estate planning

Net Worth
Stocks and Mutual Funds

Average Wealth Thousands of USD

600
400
300
200
100
0

18-34   35-44   45-54   55-64   65+

Pop quiz

Bad news: Graying is a fact of life
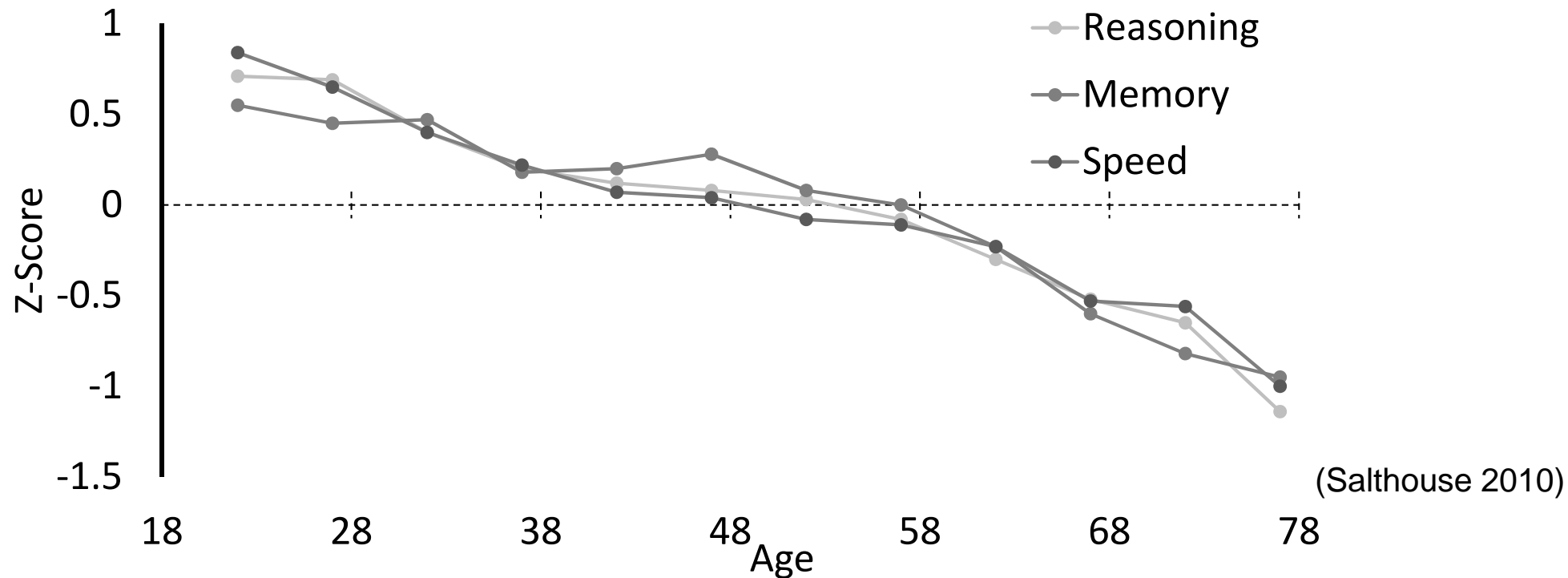
(Salthouse 2010)

Fluid Intelligence (G_f) → processing speed & efficiency, abstract reasoning, working memory, attention, etc.

Two types of intelligence

Crystallized Intelligence (G_c) → accumulated knowledge, experience, and expertise; i.e., "intellectual capital"

Fluid Intelligence (G_f) → processing speed & efficiency, abstract reasoning, working memory, attention, etc.

G$_c$ usually measured by vocabulary and knowledge

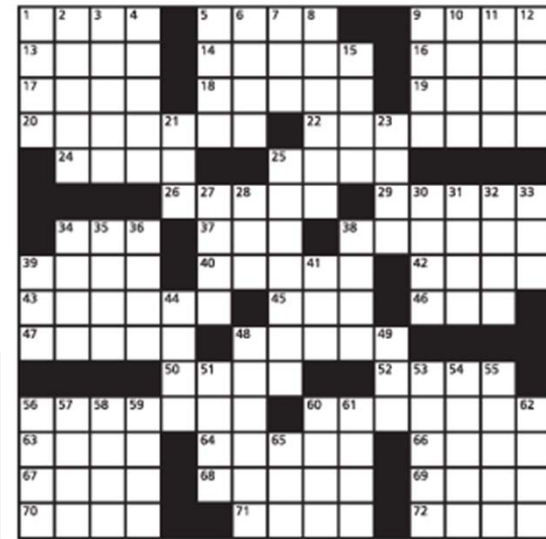How many months are there in a year?

Who was Catherine the Great?
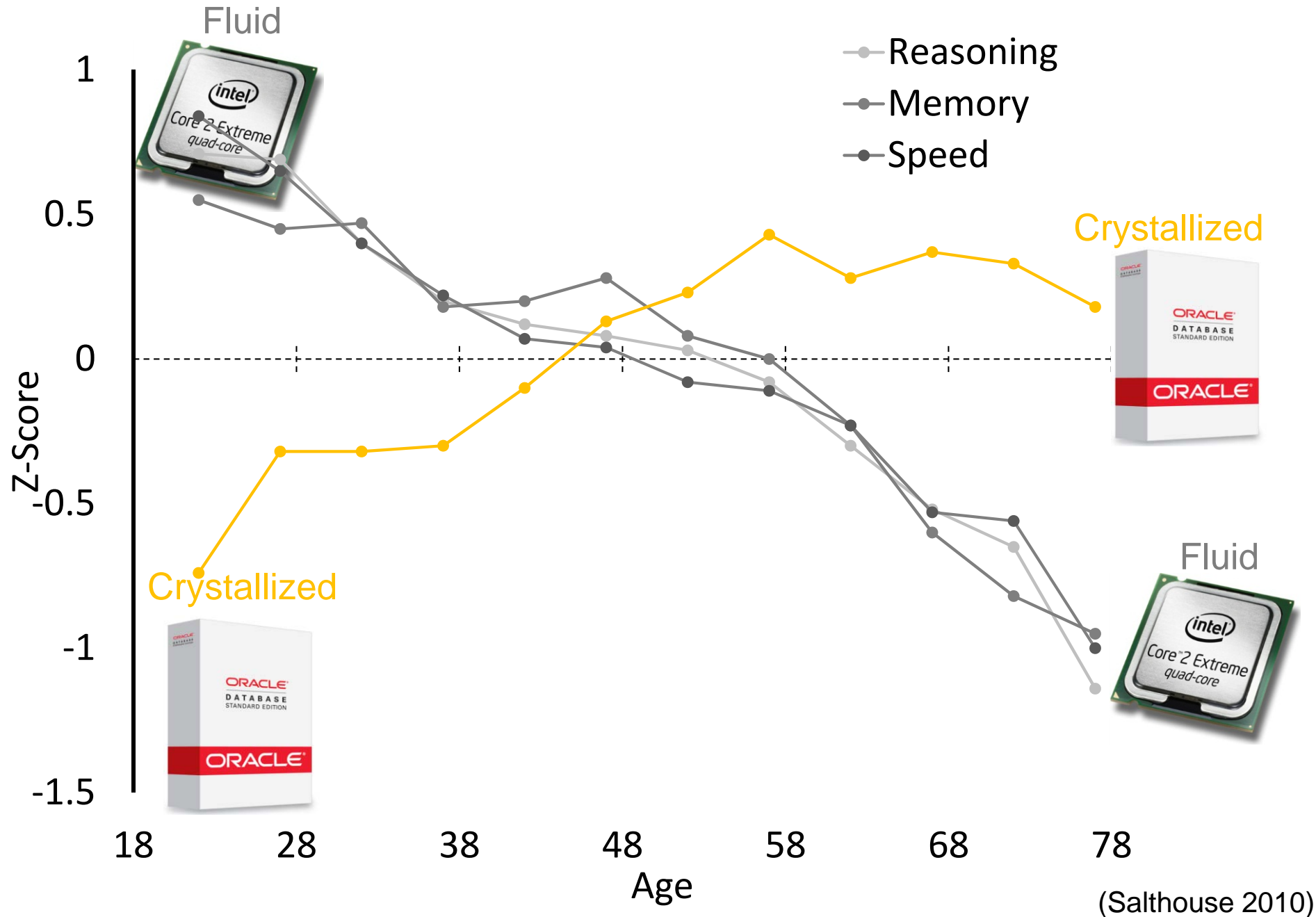
7. CORPULENT
Select the word most nearly the opposite in meaning.

- ◎ sallow
- ◎ affiliated
- ◎ emaciated
- ◎ entrepreneur
- ◎ anemic

Intelligence patterns over the life span

(Salthouse 2010)

Complementary Capabilities framework
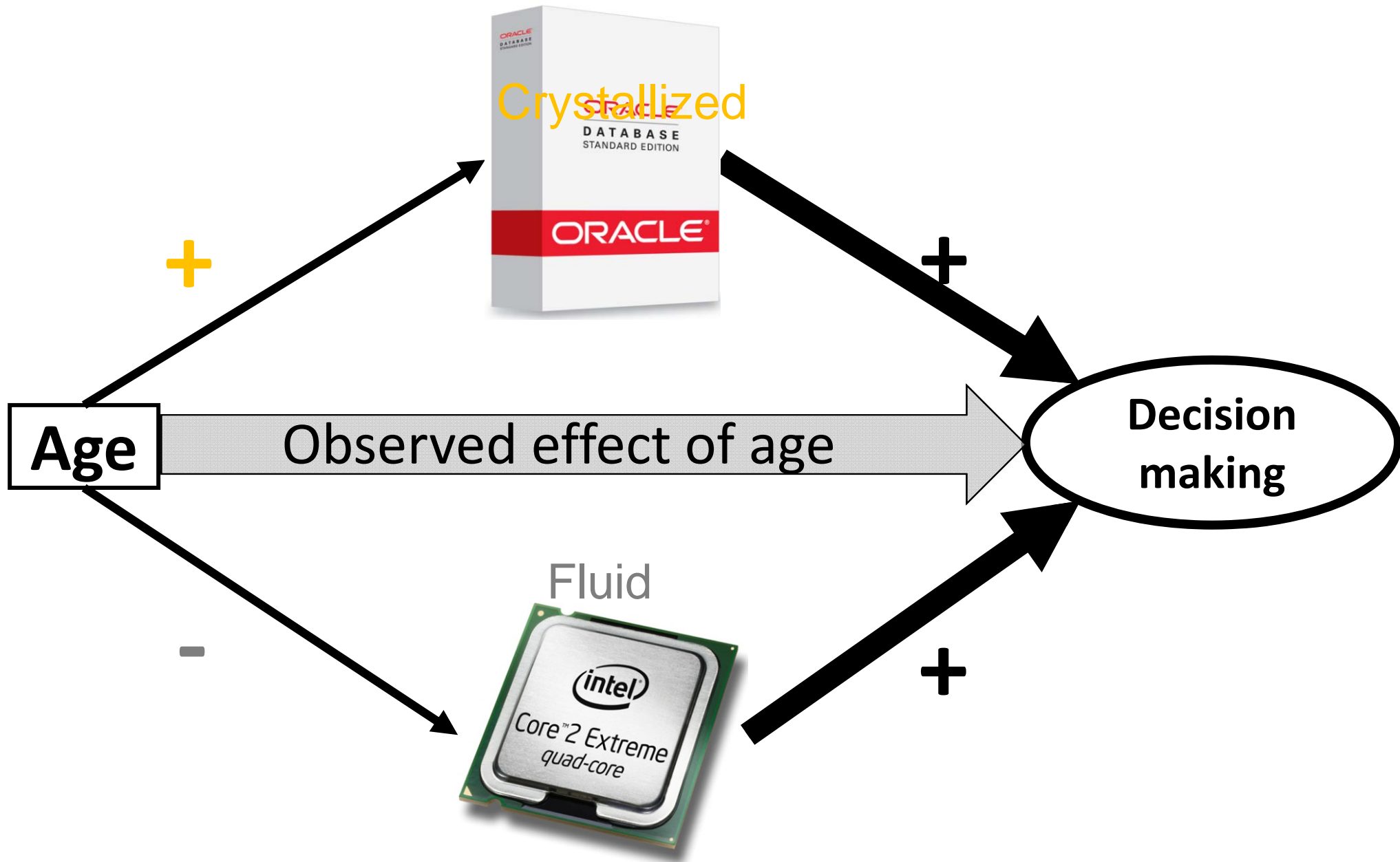
Structural Equation Model: Discounting

Li, Baldassi, Johnson, Weber 2013 Psychology & Aging

Male

$a \times b_{G_c} = .08^{**}$
Crystallized Intelligence

.05

$.41^{***}$

$.20^{**}$

Patient Intertemporal Choices

Age

$c_{residual} = .08$

$c_{observed} = .08$

$-.40^{***}$

Fluid Intelligence

$.20^{**}$

$a \times b_{G_f} = -.08^{**}$

$.13^*$

.06

Income

Education
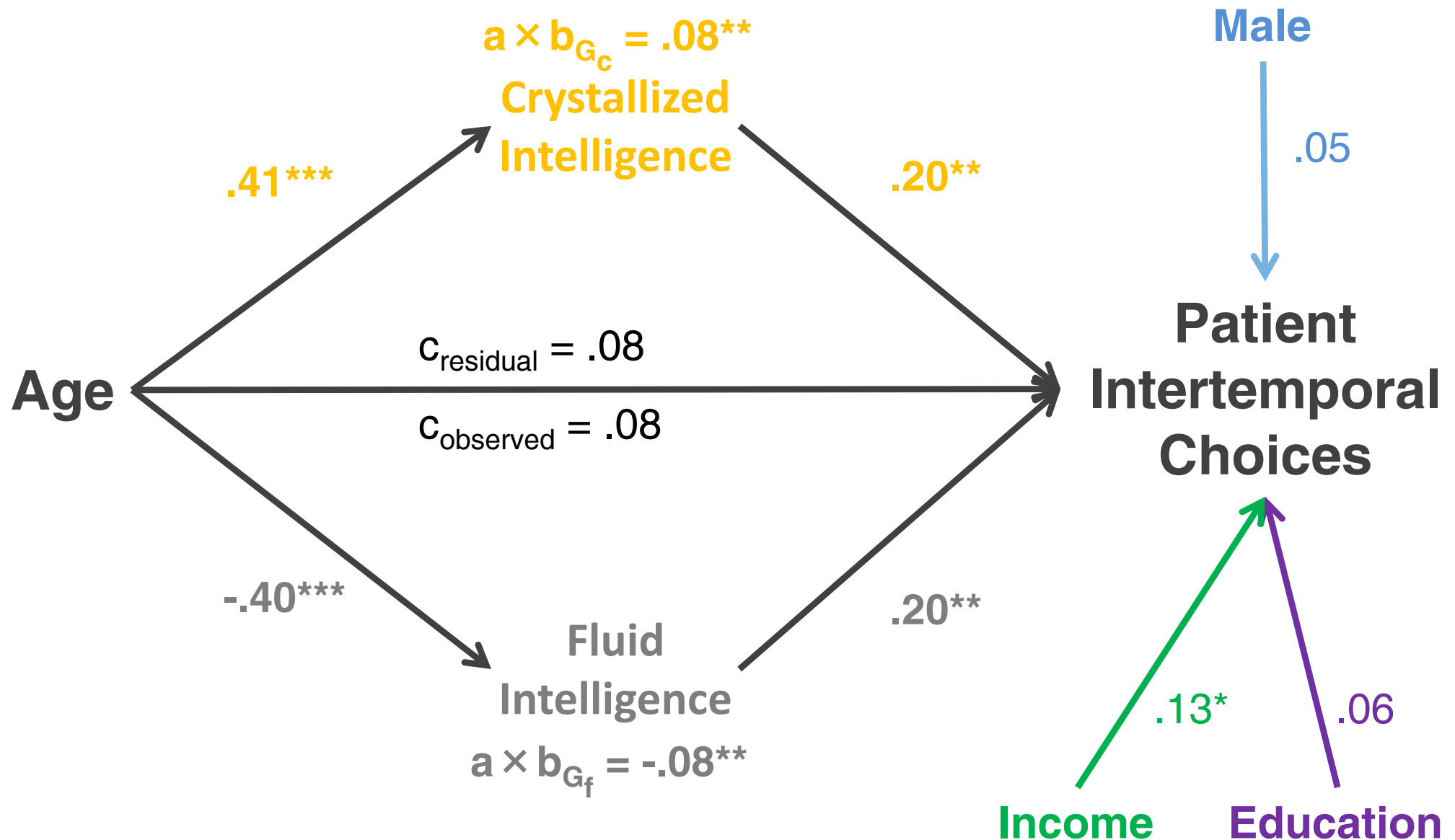
OK, what about "real" economic decisions?

- **Question:** *How does cognitive aging affect real-world economic decisions with age?*

- **One way to answer**: <u>Credit scores</u>
  - Standard measure of creditworthiness
  - Good scores can provide substantial benefits
    - Greater borrowing capabilities and lower interest rates
    - Landlords and employers use it to screen applicants
  - *Cumulative* measure of good financial decisions

- **Secondary question:** *What kind of G_c helps?*

Data

- 619 U.S. participants aged 18-82
  - ~2/3 from Center for Decision Sciences vLab pool
  - Rest were broader sample from market research firm
- Four waves of web-based data collection over 3 months
- **Credit reports** for 73% of respondents (complete N = 415)

Wave 1	Wave 2	Wave 3	Wave 4
Shipley Vocabulary	Antonym Vocabulary	WAIS Information	

Cognitive aging and credit scores

Li, Gao, Enkavi, Zaval, Weber, Johnson 2015 PNAS

.31***

Financial-domain Crystallized Intelligence ($G_{c\text{-}FL}$)

.25***

Main (total) effect of age: .20***

Age

Credit scores

Direct effect, controlling for G_f & $G_{c\text{-}FL}$: .16**

−.23***

Fluid Intelligence (G_f)

.12*
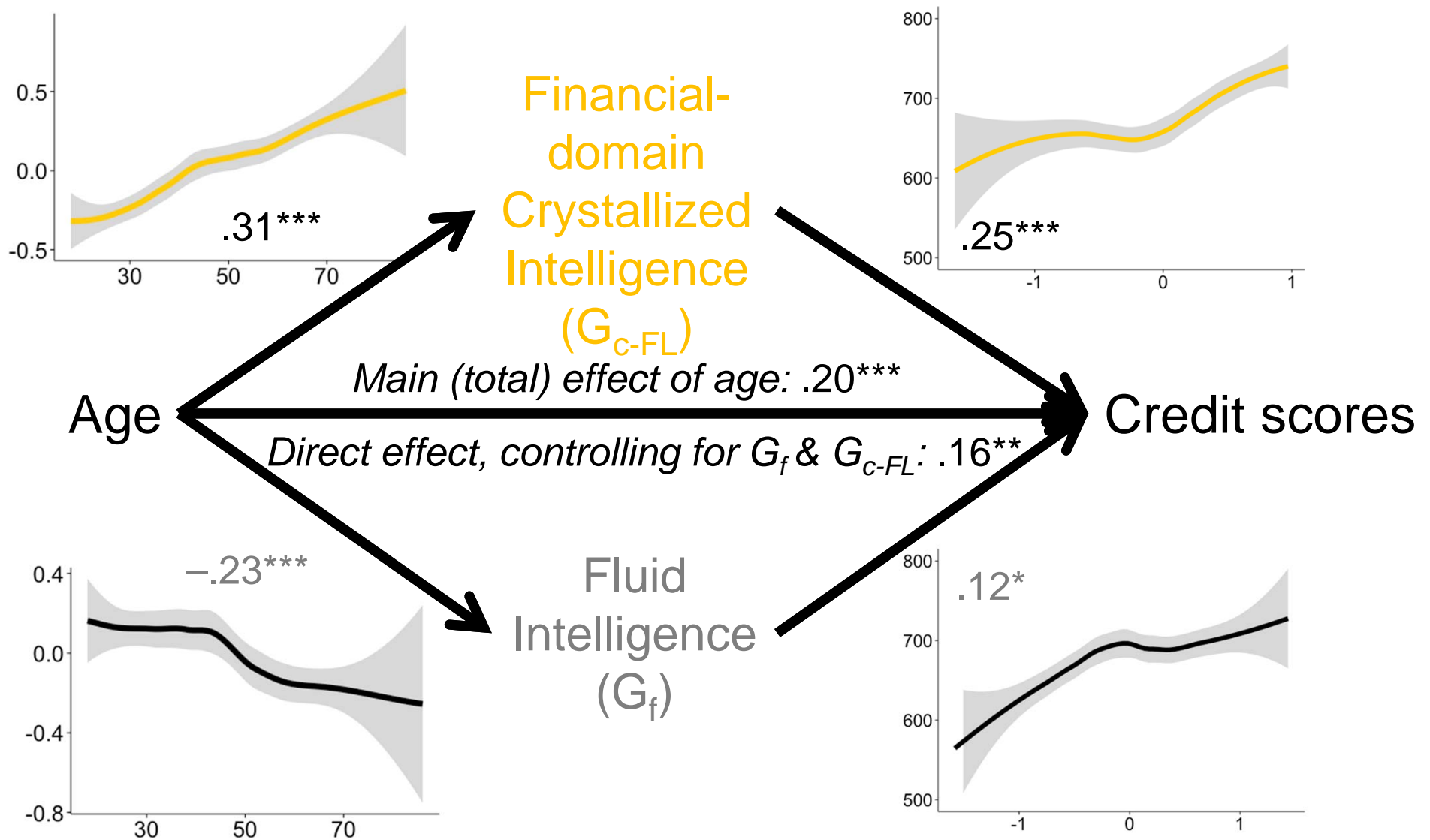
Numbers are standardized SEM coefficients. *** p < 0.001; ** p < 0.01; * p < 0.05

Illustrative example

- Consider "Anne," a 44-year-old with a college degree who earns $50k and has average cognitive ability
  - We predict a 693 FICO score → good but not excellent
- What happens if we increase…
  - Fluid intelligence by one SD? ↑714 FICO score
  - Financial literacy by one SD? ↑740 FICO score
- If both increased, Anne's APR from 4.22% → 3.82%
  - Total savings on $300k loan: $24,879!
- If Anne instead loses one SD of each?
  - Just barely subprime: 5.41% APR, $77k extra interest

Robustness Checks

- What about domain-general crystallized intelligence (vocabulary and general knowledge)?
  - No effect of general G_c (when G_f is in the model)
- Is it because older adults have more financial experience?
  - Financial *experience* → no effect
  - Actual understanding and expertise required
- Could results be due to age differences in…?
  - Risk, time, and loss preferences → results hold
    - Time preference positively correlated to credit scores
  - Big Five personality traits → results hold
    - Extraversion and intellect negatively correlated to credit scores

One-shot decisions: Similar findings

Credit card repayment

1. A MasterCard account with a $100 balance and a 15% Annual Percentage Rate (APR)
2. A Visa account with a $1000 balance and a 10% APR

Now imagine that you have just received a **$1000** government stimulus rebate, and you have decided to use the entire rebate to repay debt.

How much would you repay on each account?

*Please press 'Next' when the 'Total' is green.

Total of all entries must equal 1000

MasterCard Account:	$ 0
Visa Account:	$ 0
Remaining:	$ 1000
Total:	$ 0

Amar et al 2011

Choosing health insurance

Imagine that in the average year, you see the doctor 5 times, average about $1000 of hospital bills, and plan to get $250 of prescription medications.

Health Plan	Monthly Premium	Doctor Visit Copay	Annual Deductible
A	$416	$31	$800
B	$573	$19	$700
C	$392	$18	$1600
D	$587	$29	$1500

Which policy would you like to purchase?

○ A
○ B
○ C
○ D

Johnson et al 2013

Summary

- Credit scores and other financial decisions positively related to G_f and domain-specific G_c
  - Domain-specific knowledge and expertise matter more than domain-general G_c and mere experience

- The effect of age on decision making depends on relative G_f and G_c demands of the task
  - $\rightarrow$Different aids for old and young

Implications for public policy

- Older decision-makers have expertise but lack processing power
  - New domains (e.g., tech) will be a challenge
  - Reduce need for fluid processing
    - Structuring and filtering the choice set
    - External decision aids (e.g., calculators)
    - Setting good defaults
- Young adults need help as well!
  - Provide knowledge and relevant experience
    - Retirement accumulation: 401(k) and IRA savings
    - Small decisions with big long-term consequences: Sunscreen, healthy eating, exercise, flossing

Closing thoughts

"The other big secret is that we're good at lifelong learning. Warren (Buffett) is better in his seventies and eighties, in many ways, than he was when he was younger. If you keep learning all the time, you have a wonderful advantage."
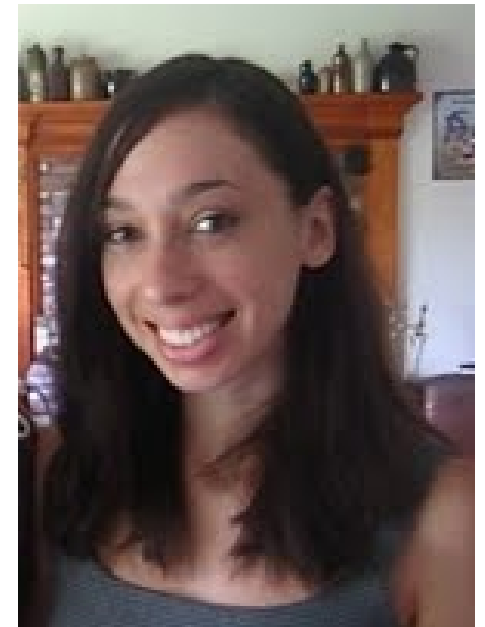

Charlie Munger

Fortune Interview

November 18, 2013

Thanks!

Sample Demographics

Variable		Young 18-30	Middle-Younger 31-45	Middle-Older 46-60	Old 61+
N	Wave 1-3	146	181	151	141
	Wave 1-4	96	147	121	114
	Have FICO	81	92	120	124
Age	Wave 1-3	24.5	38.3	54.0	67.5
	Wave1-4	24.3	38.6	53.9	67.9
	Have FICO	24.6	38.0	54.5	67.8
Gender (female)	Wave 1-3	68.3%	50%	70.2%	55.7%
	Wave 1-4	66.3%	47.9%	70.2%	56.6%
	Have FICO	74.1%	62.6%	70%	59.3%
Married	Wave 1-3	17.9%	66.9%	56.3%	51.4%
	Wave 1-4	18.9%	68.8%	57.0%	49.6%
	Have FICO	21.0%	60.4%	57.5%	50.4%
Have 1 or more Children	Wave 1-3	15.2%	78.1%	74.2%	77.9%
	Wave 1-4	15.8%	76.4%	75.2%	77.0%
	Have FICO	12.3%	76.9%	74.2%	78.9%
Income (median)	Wave 1-3	$40,000	$70,000	$60,000	$50,000
	Wave 1-4	$30,000	$70,000	$60,000	$50,000
	Have FICO	$40,000	$60,000	$60,000	$50,000
Income (mean)	Wave 1-3	$47,448	$77,472	$61,152	$60,750
	Wave 1-4	$46,158	$76,146	$62,686	$54,646
	Have FICO	$47,160	$65,220	$63,750	$61,626
Education (at least some college)	Wave 1-3	82.9%	86.7%	84.1%	90.1%
	Wave 1-4	82.3%	85.7%	82.6%	88.6%
	Have FICO	90.1%	88.0%	85.0%	91.1%
Race (Caucasian)	Wave 1-3	65.5%	77.0%	87.4%	92.9%
	Wave 1-4	57.9%	79.9%	86.8%	94.7%
	Have FICO	71.6%	75.8%	88.3%	93.5%

Raw statistics

		Mean				Standard Deviation			
		Young	Medium Young	Medium Old	Old	Young	Medium Young	Medium Old	Old
	Credit Score	677.26	664.35	700.61	737.81	89.61	117.2	109.83	95.84
G_f	Raven	8.31	7.50	6.30	5.60	3.58	4.43	2.95	2.79
	Numeracy/CRT	4.56	4.58	3.75	4.19	2.03	2.53	1.89	2.17
	Letter Set	10.42	10.35	10.09	9.93	3.05	3.40	2.33	2.49
G_c	Synonym	6.30	6.66	6.93	8.09	2.89	2.93	2.60	2.31
	Antonym	6.54	6.63	7.05	8.05	2.65	2.75	2.57	2.15
	WAIS Information	19.13	18.09	18.99	21.26	5.03	5.71	4.72	4.14
	Financial experience (FS)	-0.47	-0.01	0.17	0.36	0.46	0.48	0.50	0.40
	G_{c-FL} (FS)	-0.27	-0.09	0.06	0.28	0.58	0.62	0.55	0.50
Economic Preference	Discount Factor	0.65	0.53	0.64	0.72	0.65	0.63	0.61	0.56
	Present Bias	0.44	0.32	0.55	0.60	0.70	0.82	0.65	0.58
	Loss aversion	-0.03	0.12	-0.15	-0.08	0.55	0.64	0.56	0.56
	Probability distortion	-0.08	-0.12	-0.01	-0.04	0.25	0.31	0.25	0.26
	Risk aversion	0.43	0.49	0.21	0.31	0.45	0.57	0.44	0.45
Big Five Personality	Intellect	46.33	44.67	43.91	45.17	5.89	8.41	7.36	7.64
	Emotion Stability	39.31	37.32	34.42	33.28	9.02	11.55	9.40	9.43
	Extraversion	43.12	41.89	40.98	40.25	6.94	7.90	6.16	7.33
	Agreeableness	42.05	41.14	40.6	40.22	6.10	7.03	4.77	6.09

Financial Literacy measure
(Fernandes et al 2014)

1	Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy: *Answer Options: (1) more than today with the money in this account (2) exactly the same as today with the money in this account **(3) less than today with the money in this account** (4) Do not know*
2	Do you think that the following statement is true or false? "Bonds are normally riskier than stocks." *(1) true **(2) false** (3) do not know*
3	Considering a long time period (for example 10 or 20 years), which asset described below normally gives the highest return? *(1) saving accounts **(2) stocks** (3) bonds (4) do not know*
4	Normally, which asset described below displays the highest fluctuations over time? *(1) saving accounts **(2) stocks** (3) bonds (4) do not know*
5	When an investor spreads his money among different assets, does the risk of losing a lot of money: *(1) increase **(2) decrease** (3) stay the same (4) do not know*
6	Do you think that the following statement is true or false? "If you were to invest $1000 in a stock mutual fund, it would be possible to have less than $1000 when you withdraw your money." ***(1) true** (2) false (3) do not know*
7	Do you think that the following statement is true or false? "A stock mutual fund combines the money of many investors to buy a variety of stocks." ***(1) true** (2) false (3) do not know*
8	Do you think that the following statement is true or false? "After age 70 1/2, you have to withdraw at least some money from your 401(k) plan or IRA." ***(1) true** (2) false (3) it depends on the type of IRA and/or 401(k) plan (4) do not know*
9	Do you think that the following statement is true or false? "A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less." ***(1) true** (2) false (3) do not know*
10	Suppose you had $100 in a savings account and the interest rate is 20% per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total? ***(1) more than $200** (2) exactly $200 (3) less than $200 (4) do not know*
11	Which of the following statements is correct? *(1) Once one invests in a mutual fund, one cannot withdraw the money in the first year **(2) Mutual funds can invest in several assets, for example invest in both stocks and bonds** (3) Mutual funds pay a guaranteed rate of return which depends on their past performance (4) none of the above (5) do not know*
12	Which of the following statements is correct? If somebody buys a bond of firm B: *(1) He owns a part of firm B **(2) He has lent money to firm B** (3) He is liable for firm B's debts (4) none of the above (5) do not know*
13	Suppose you owe $3,000 on your credit card. You pay a minimum payment of $30 each month. At an Annual Percentage Rate of 12% (or 1% per month), how many years would it take to eliminate your credit card debt if you made no additional new charges? *(1) Less than 5 years (2) Between 5 and 10 years (3) Between 10 and 15 years **(4) never** (5) do not know*