

Future Discounting: Risk-taking, Inequality and Homicide

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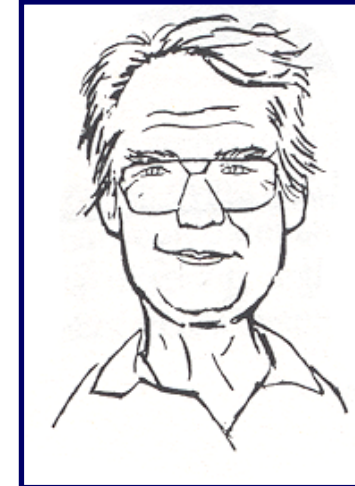


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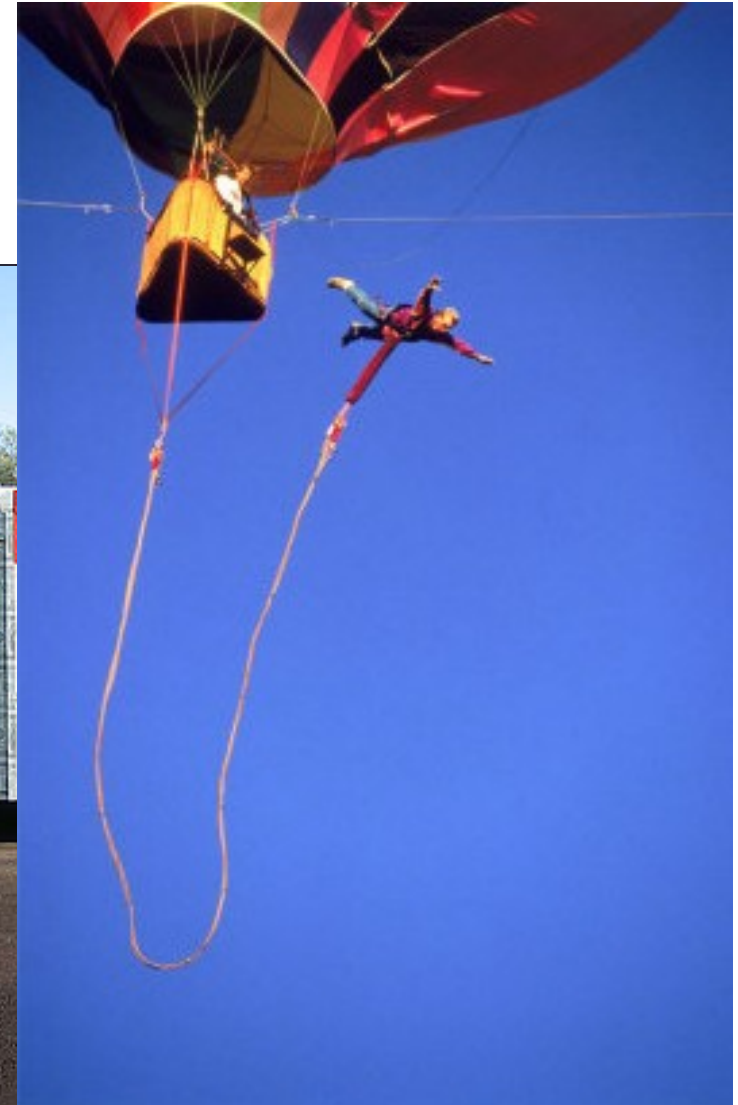
Roadmap

everyone "discounts the future"

sex differential discounting

facultative discounting

lethal violence as discounting



Goods are worth more sooner than later because ...

1 ... the longer one waits to collect them, the greater the chance they will be lost altogether.

2 ... all else equal, natural selection favours reproducing sooner rather than later.

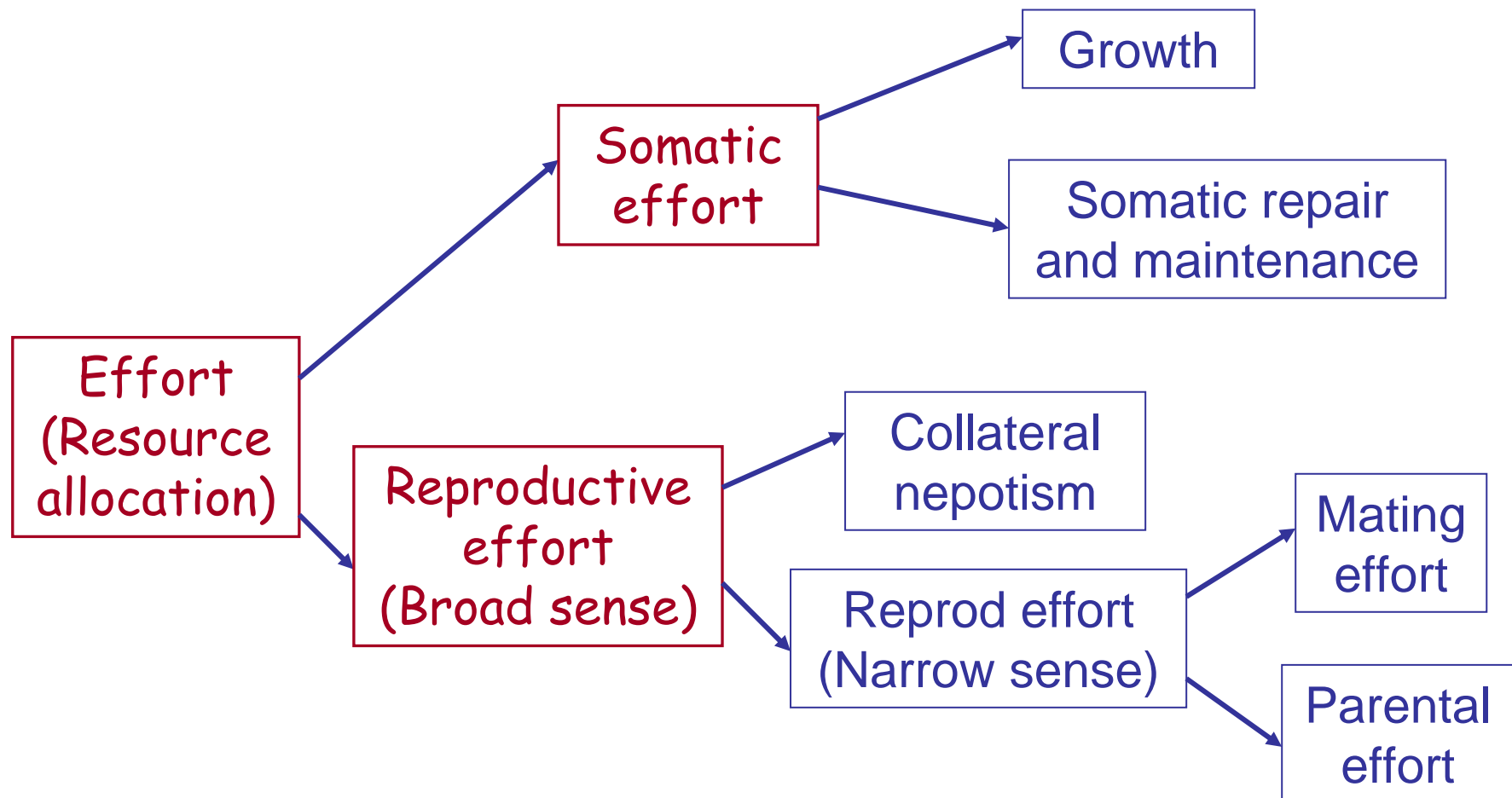
Evolved psychologies and physiologies
therefore "discount the future",
valuing imminent reproductive opportunities
over otherwise equivalent later opportunities.

Trade-offs in Life History Evolution & Reproductive Decisions

Current *versus* future reproduction.

Reproduction *versus* survival.

Reproduction *versus* growth.



Reproductive Effort - Somatic Effort Trade-off

High levels of *external mortality* select for increased early reproductive effort, and hence *against* somatic investment in thwarting senescence

e.g. Mainland Virginia opossum populations have predators.
Island populations don't.

So mainland opossums suffer higher external mortality, and (presumably as a result), they

breed earlier

have larger litters

senesce more rapidly

Austad (1993) *J Zoology* 229 : 695-708



Sex differences in discounting the future?

Hypothesis

Men discount the future more than women.

Rationale

In ancestral environments, men suffered higher external mortality (were less likely than women to live to see the future), apparently because male fitness variance exceeds female fitness variance and competition is more extreme among men than among women.

Men senesce more rapidly than women, which can be interpreted as physiological discounting of the future.

Sex Differences in Trading Off Financial Gain against a Health Hazard ?

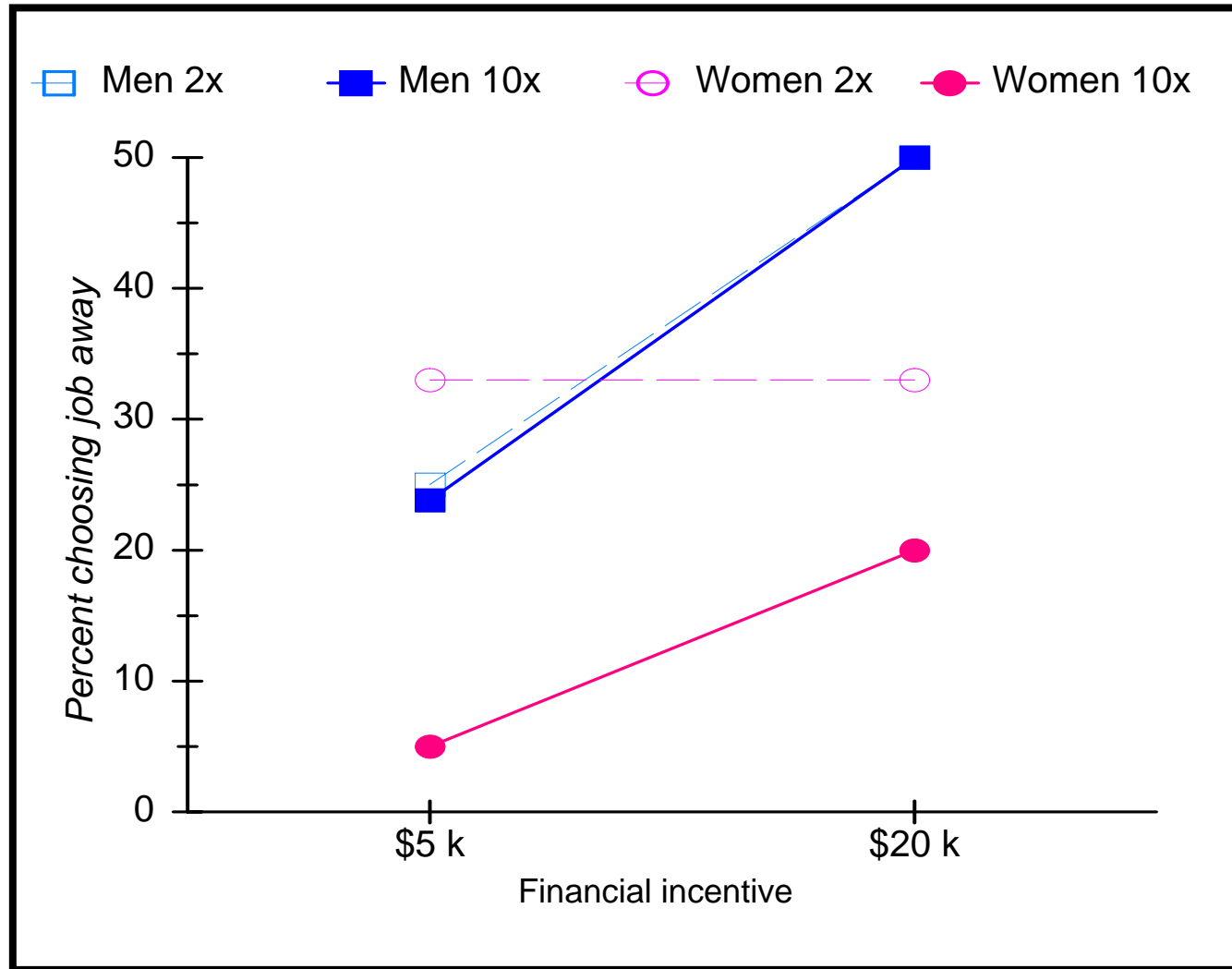
Undergraduate subjects were offered a hypothetical choice between two jobs. One paid better but also required moving to a city with worse air.



The financial incentive was either \$5000 or \$20,000.

The air quality disincentive was described as either a 2-fold or a 10-fold increase in rates of respiratory illness.

Elevated health hazards reduced the appeal of a better-paying job for women, but men were oblivious.

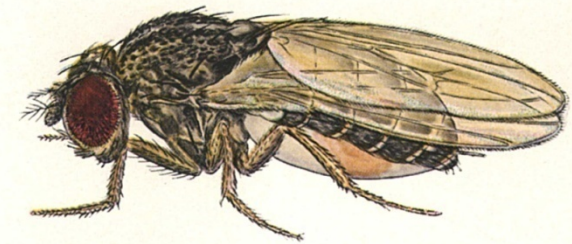
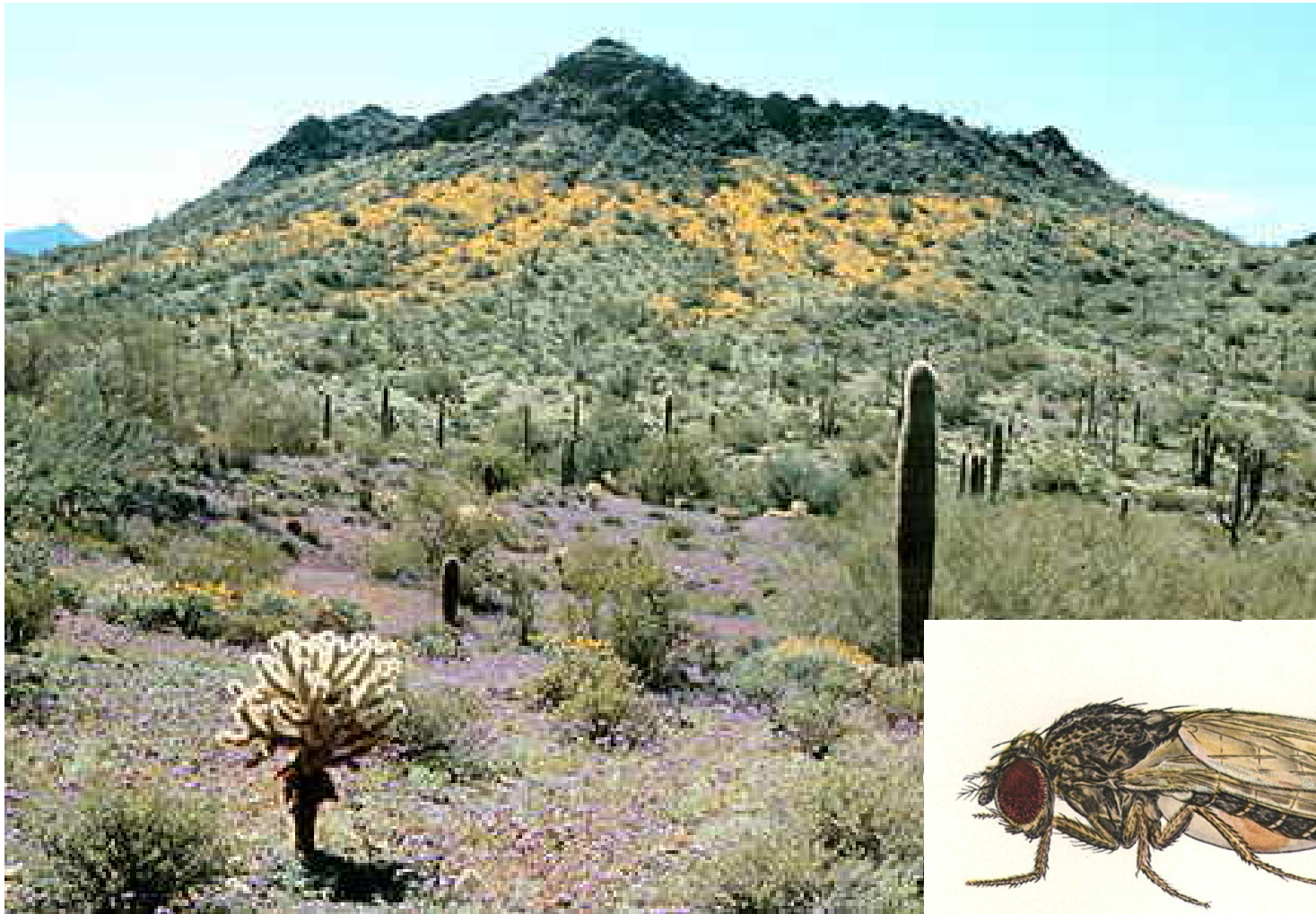


Facultative Discounting ?

Making optimal trade-offs between present and future efforts requires facultative responses.

Evolved psychologies and physiologies
"discount the future"

... especially in response to cues that are
predictive of a short or uncertain future



Sonoran desert flies infected with parasitic mites that reduce their expected lifespan court sooner and more prolongedly.

Polak & Starmer (1998) *Proc Roy Soc London (B)* 265: 2197-2201



Honey bees take on the colony's more dangerous jobs as their wings wear, and also in response to infections that reduce their expected lifespan.

Woyciechowski & Kozłowski (1998)
Apidologie 29: 191–205

Quantification of Future Discounting



Would you rather have \$ 10 now or a year from now ?

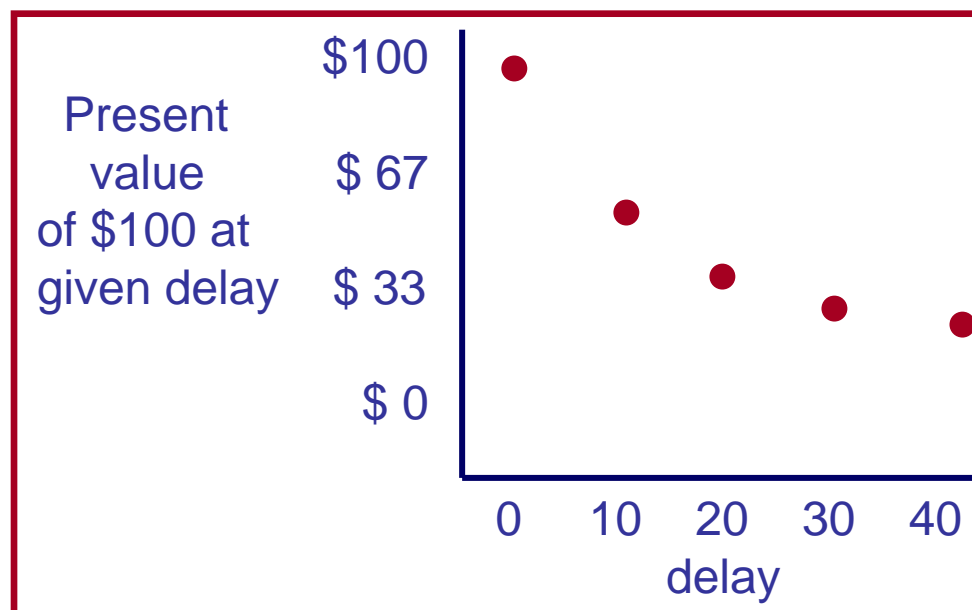
What about \$ 10 now versus \$ 10.01 in a year ?

What about \$ 10 now versus \$ 20 in a year ?

Ask enough such questions, and you can estimate a personal discount function.

Its typical form:

$$\text{Present value} = \frac{\text{amount}}{1 + (k * \text{delay})}$$



Be a Winner!

You will have the chance to win money.

You will choose between getting money right away or more money later.

For example, do you want:

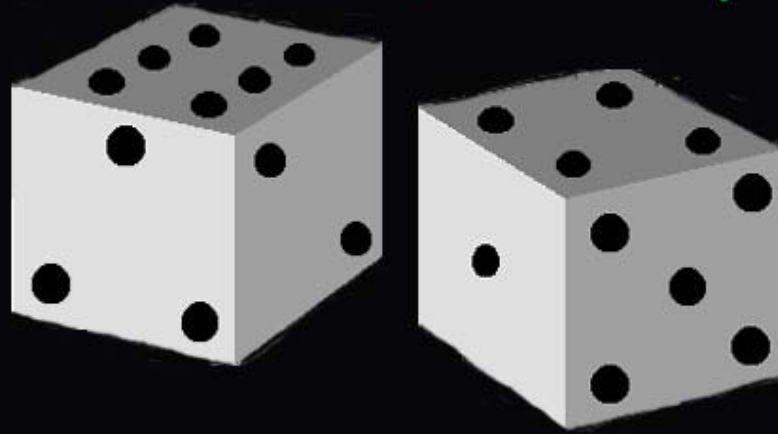
19 dollars tomorrow

or

25 dollars in 53 days?

next

When you are done, roll a pair of dice.



If you roll "snake eyes" (double 1s)
you will get one of the choices you made.

next

*Which option would you rather have?
Click on your choice.*

\$49 tomorrow

or

\$60 in 89 days

*Which option would you rather have?
Click on your choice.*

\$27 tomorrow

or

\$50 in 21 days

An illustrative set of options, ordered by k

\$ tomorrow	Future \$	Delay (days)	Discount parameter k
54	55	117	.0002
47	50	160	.0004
54	60	111	.0010
49	60	89	.0025
34	50	30	.0157
27	50	21	.0406
25	60	14	.1000
20	55	7	.2500

$$\text{Present value} = \frac{\text{amount}}{1 + (k * \text{delay})}$$

A perfectly consistent set of choices

\$ tomorrow	Future \$	Delay (days)	Discount parameter k
54	55	117	.0002
47	50	160	.0004
54	60	111	.0010
49	60	89	.0025
34	50	30	.0157
27	50	21	.0406
25	60	14	.1000
20	55	7	.2500

Interest rate

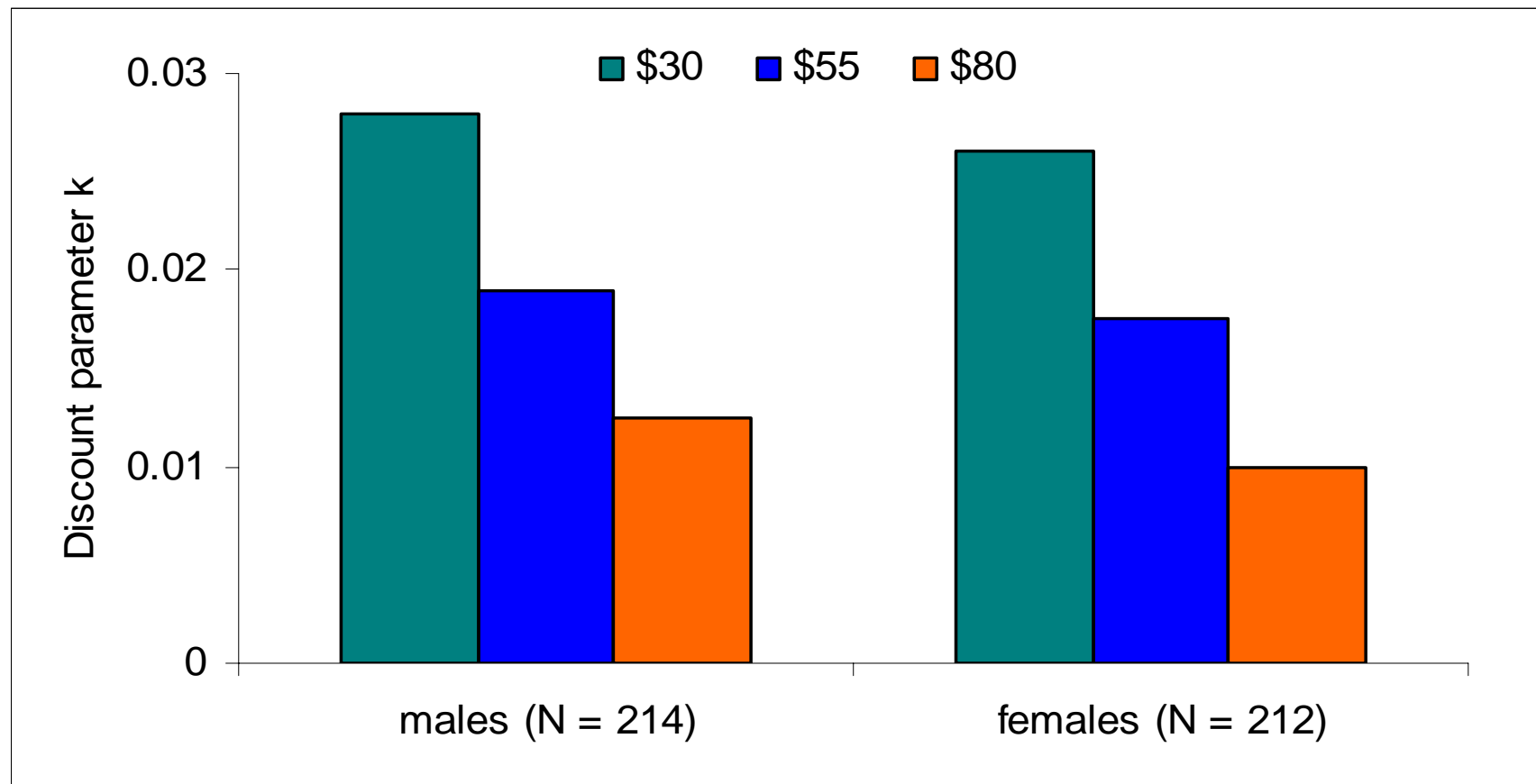
42 %

130 %

k is estimated as the square root of $(.0010 * .0025) = .0016$

Studies using this choice methodology find that ...

- men discount more than women
- poorer people discount more than richer
- addicts discount more than non-addicts
- small sums are discounted more than larger sums



People discount the future differently according to context & circumstance.

e.g. Not only do heroin addicts discount more than other people; they discount even more when they need a fix, and they discount more when the currency is drugs than when it's cash.

Can we change measured discount rates experimentally?

Hypothesis: A mating opportunity mindset will inspire men to be more impatient for \$\$ rewards.

Protocol:

1. Discount parameter estimated (9 pairs of monetary choices)
2. Pictures of opposite-sex persons rated for appeal (7-point scale)
Between-groups variable: all 12 pix were either attractive or unattractive (pre-rated).
3. Discount parameter re-estimated after seeing pictures (9 pairs of monetary choices)
4. Dice rolled: snake-eyes wins \$\$ value of one randomly drawn choice. Post-dated cheque written.

Pictures were taken from "hotornot.com" where photos had been rated by hundreds of visitors on a scale of 10 = "hot" to 1 = "not". We selected attractive people (rated 9 - 10) and unattractive people (rated 4 - 5).



Unappealing

1

2

3

4

5

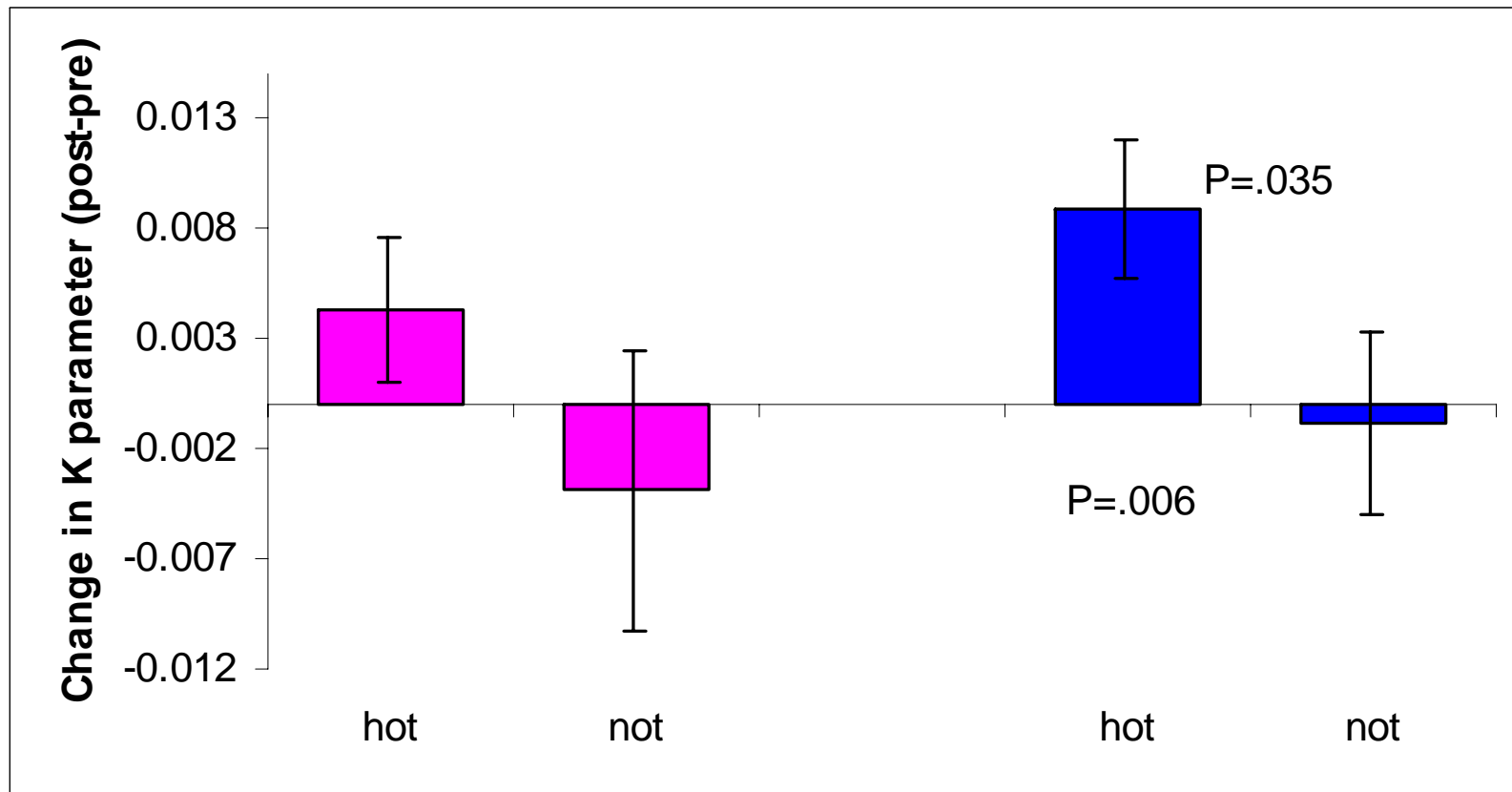
6

7

Very Appealing

Change in Discounting

Discount rates of **men** who viewed "hot" women increased.
Discount rates of **women**, and of **men** who viewed "not hot" women, were not significantly affected.



There were no such effects of appealing vs unappealing cars or food.

Homicide as an assay of future discounting ?

Most killers and their victims are unrelated men, especially where homicide rates are high.

The primary context in which men kill other men is *social competition* :

- a status challenge.
- a public insult, “dissing”, failure to show deference.
- rivalry over a woman.

And if not such an altercation, the motive is usually robbery, hence *material competition*.



Knife fight - José Francisco Borges

What factors promote reckless disregard for one's future in competitive contexts?

Reckless disregard for the future in competitive contexts increases when ...

1. competitors have relatively little to lose.

Rates at which men killed unrelated men in relation to the killer's age and employment status

Detroit 1972

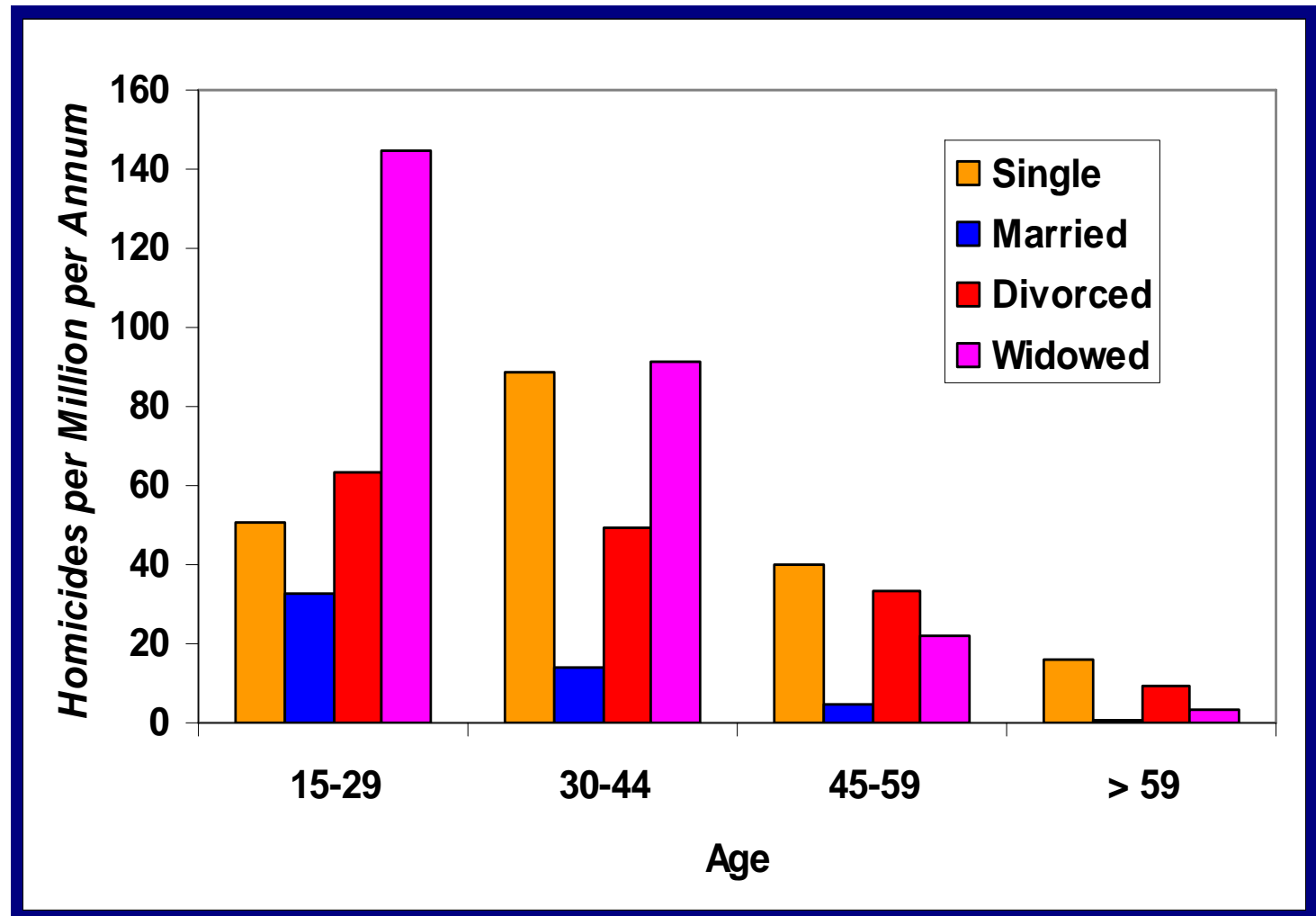


Reckless disregard for the future in competitive contexts increases when ...

1. competitors have relatively little to lose.

Rates at which men killed unrelated men in relation to the killer's age & marital status.

Canada
1974-1990

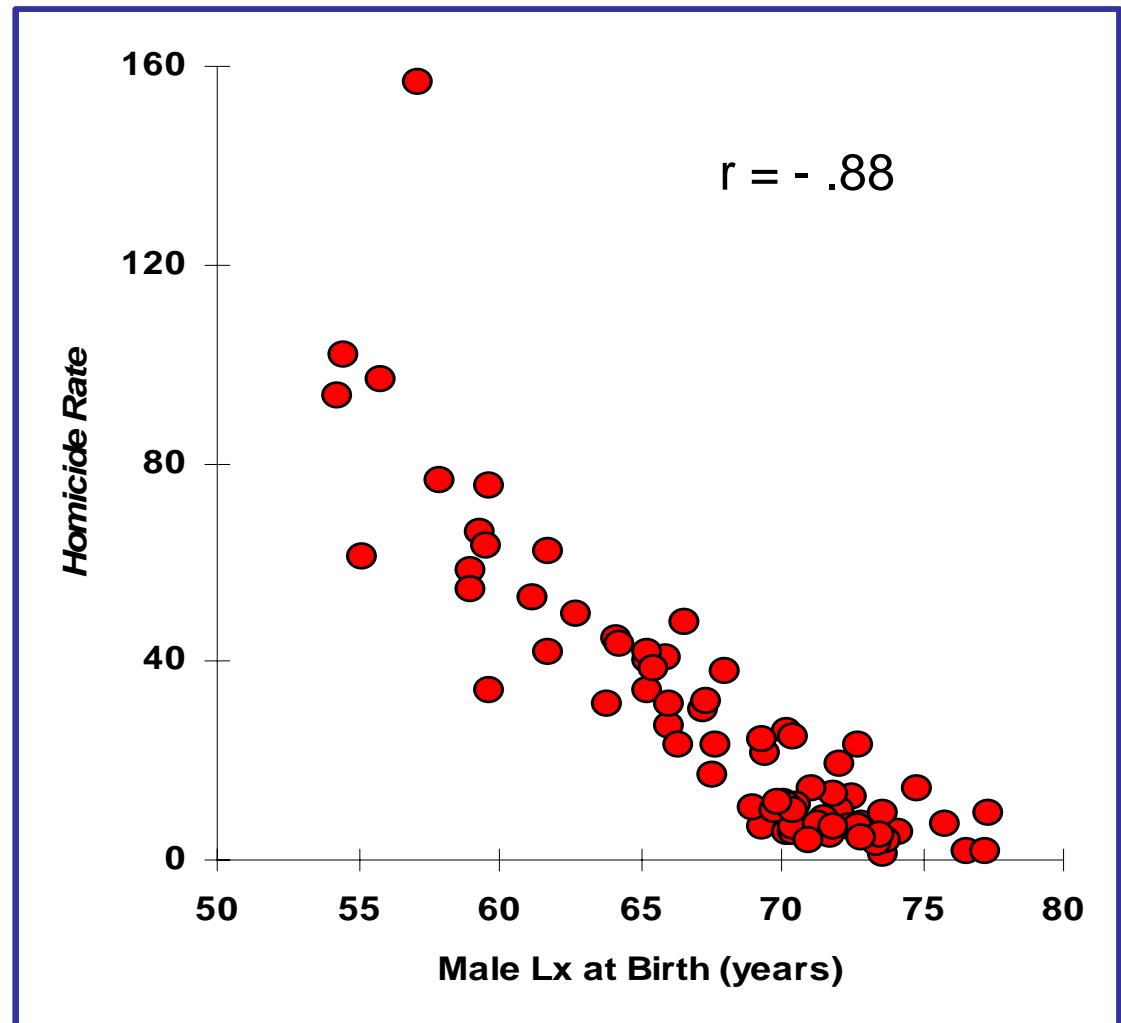


Reckless disregard for the future in competitive contexts increases when ...

1. competitors have relatively little to lose.
2. the future is uncertain.

Homicides per 100,000 persons per annum in 77 Chicago neighbourhoods (1988-1993) as a function of life expectancy (Lx).

(Effect of homicide removed from Lx calculation)



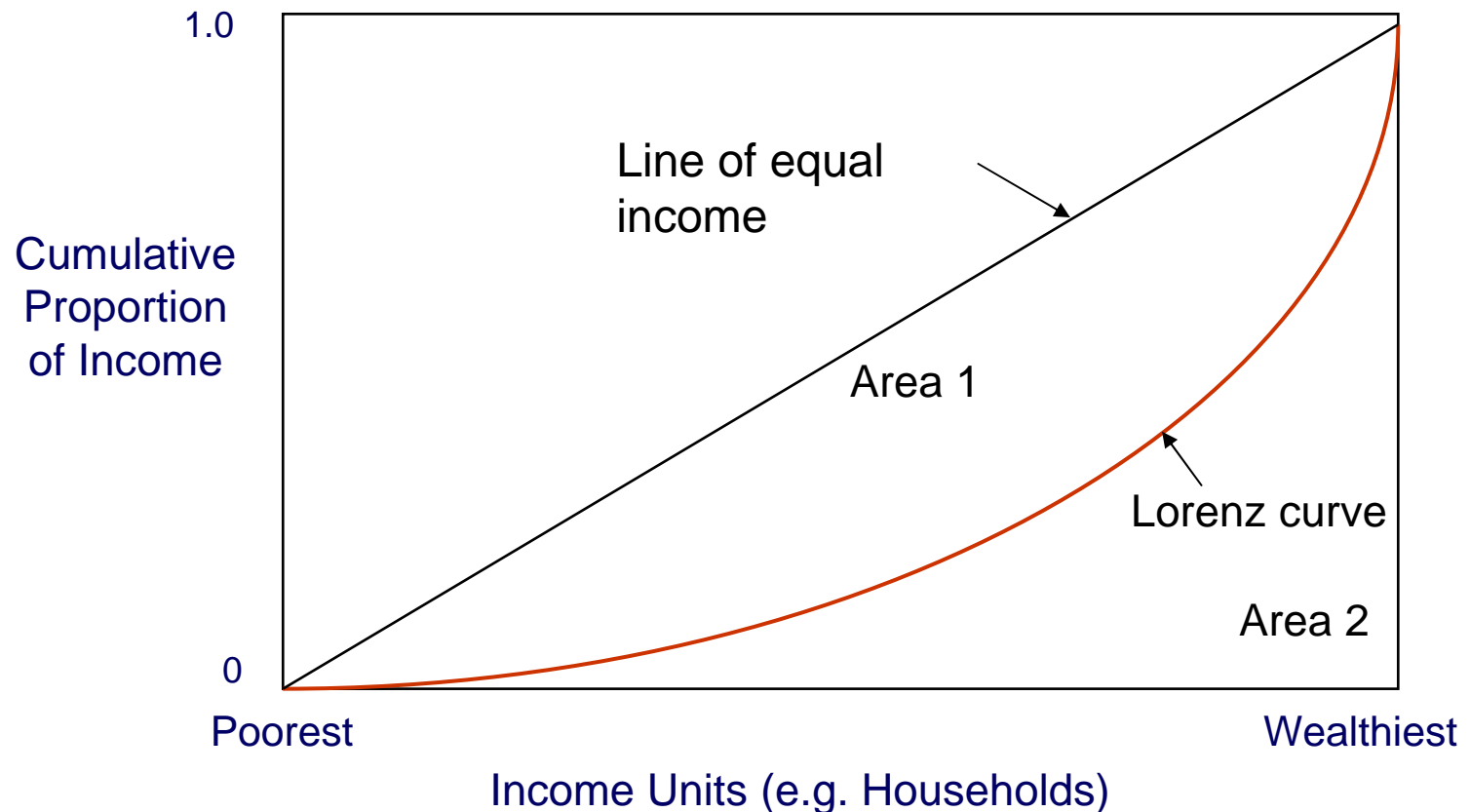
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3. winners take all.

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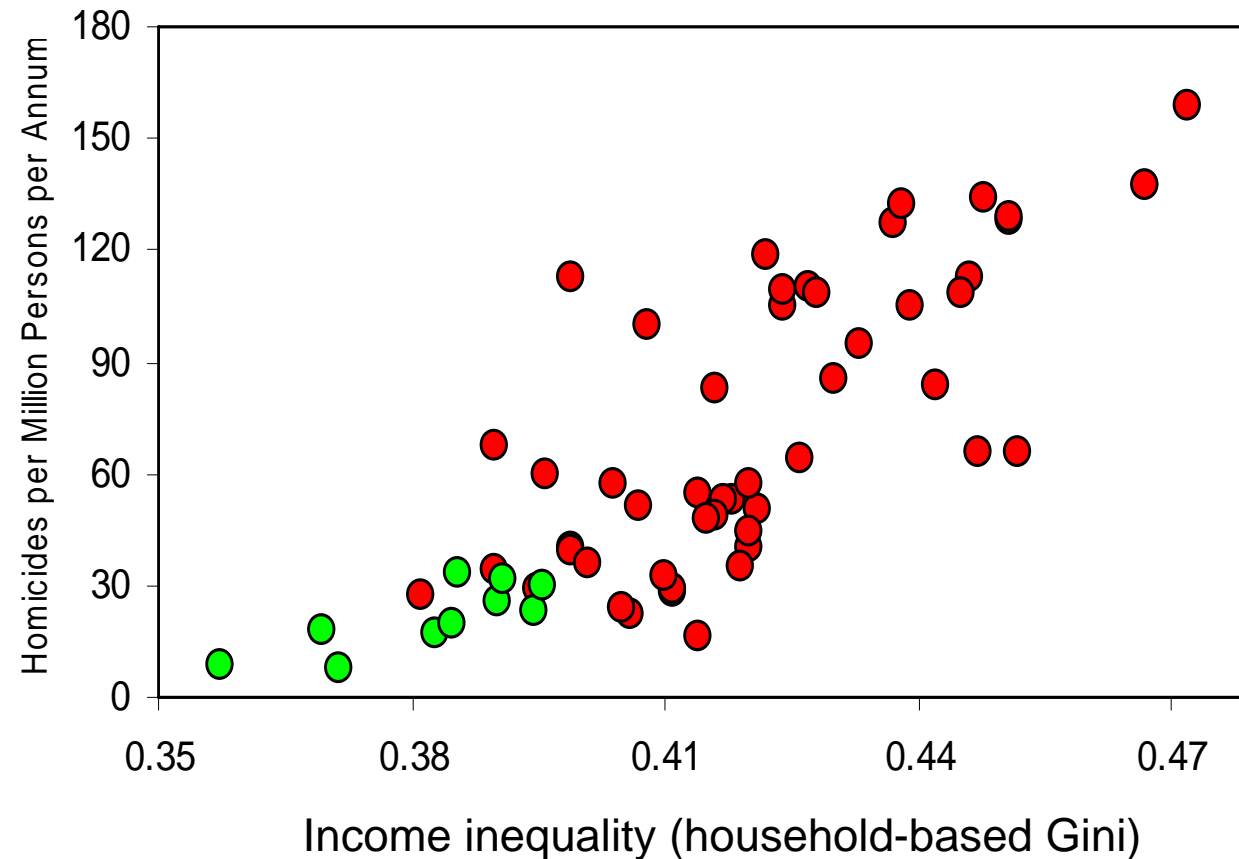
Gini coefficient of income inequality = $\text{Area 1} / (\text{Area 1} + \text{Area 2})$

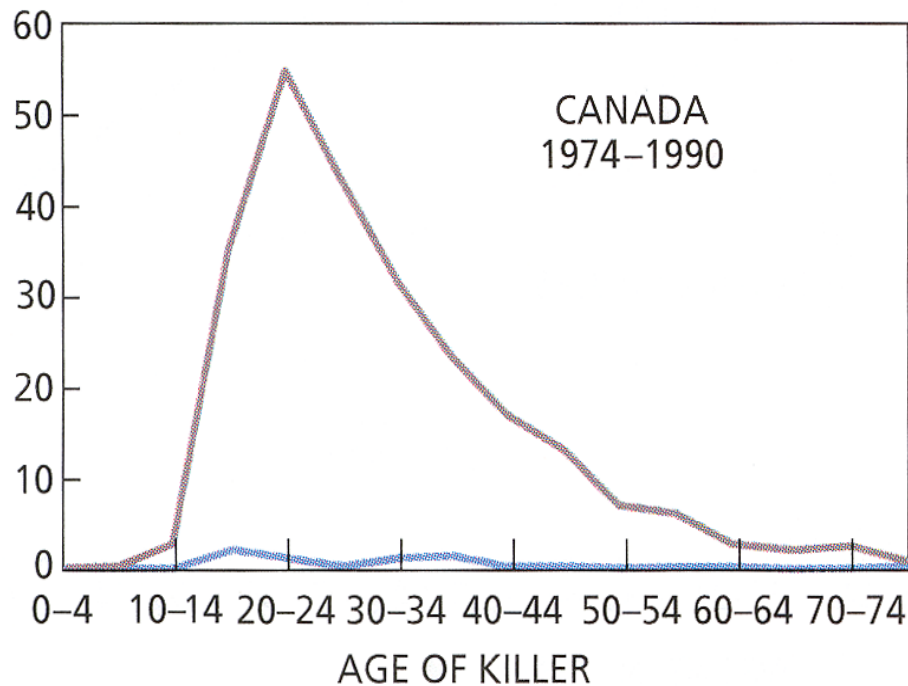
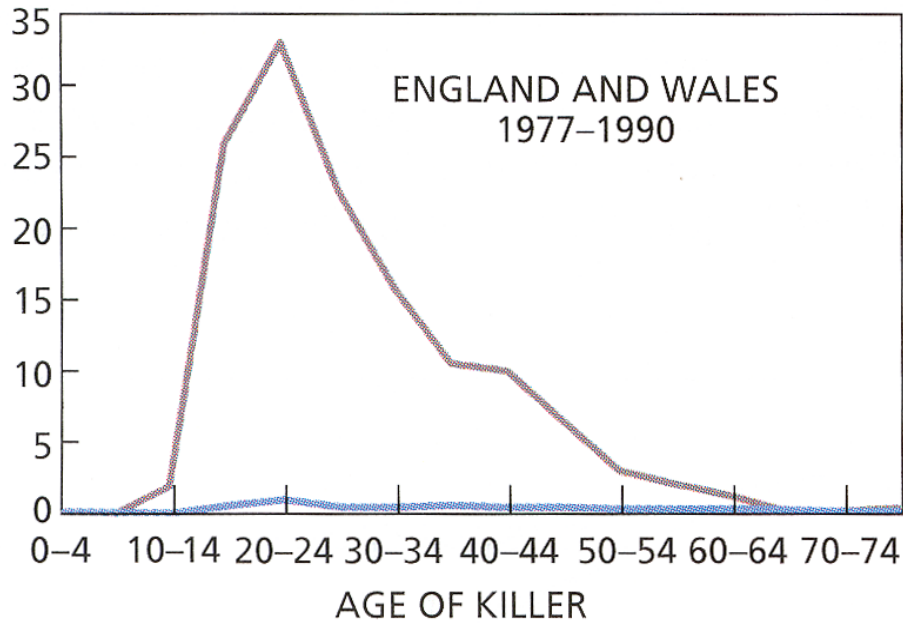


Reckless disregard for the future in competitive contexts increases when ...

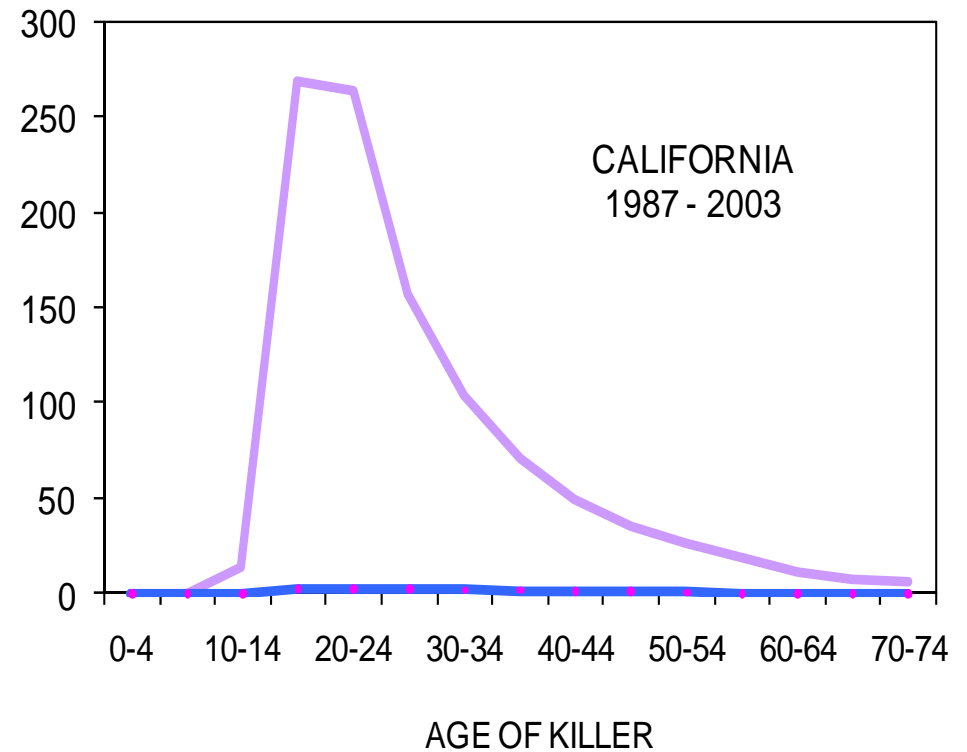
1. competitors have relatively little to lose.
2. the future is uncertain.
3. winners take all.

1990 homicide rates in US states (●) and Canadian provinces (●) as a function of Gini





Age-specific Rates of Killing
same-sex unrelated persons
(per million populace per year)



Are homicide rates “cultural”?

A popular theory accuses “American culture” of glorifying violence.

R Nisbett & D Cohen (1996) *Culture of honor*.

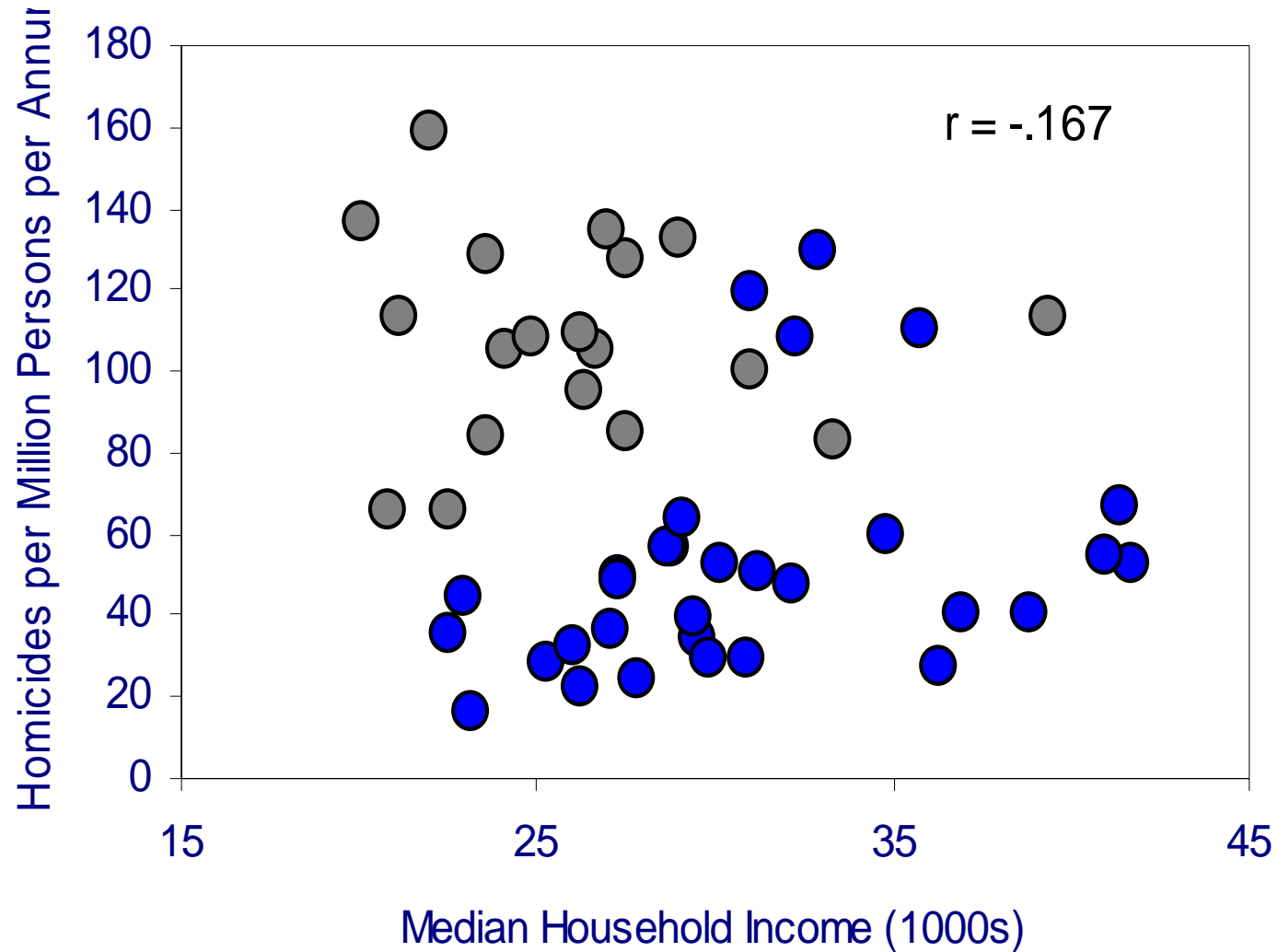
Homicide rates have long been higher in the US south than in the north. And besides killing at higher rates, southerners

- oppose gun control more.
- favour the death penalty more.
- are more supportive of military spending.
- are more lenient towards men who assault wives.
- exhibit a bigger testosterone surge in response to an insult.

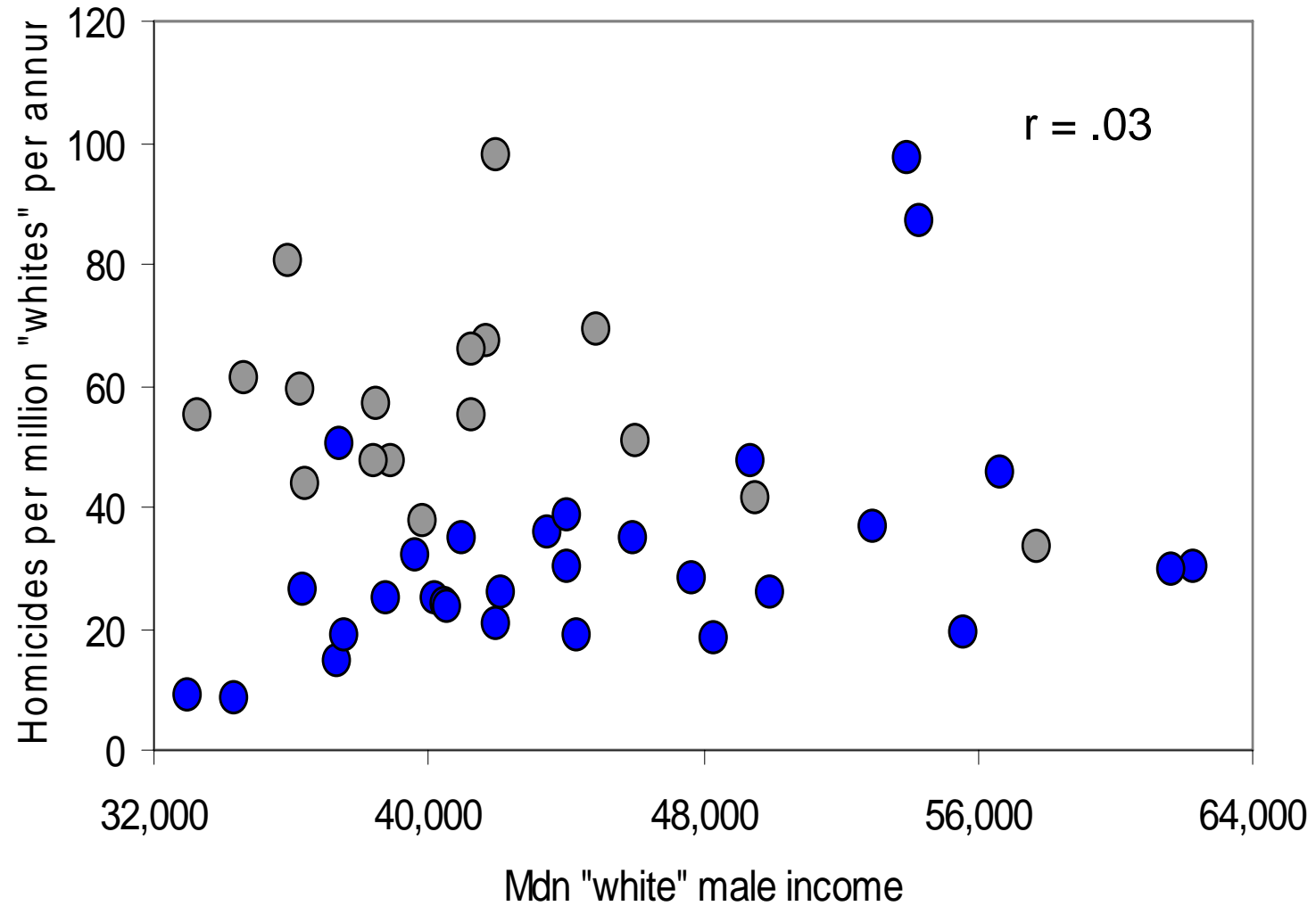
In other words, southerners possess (and transmit) attitudes and values that legitimate and encourage violence, especially violence in defence of personal and family honour.

Nisbett & Cohen argue that the explanation is strictly historical and that there is no current economic rationale for these north / south differences.

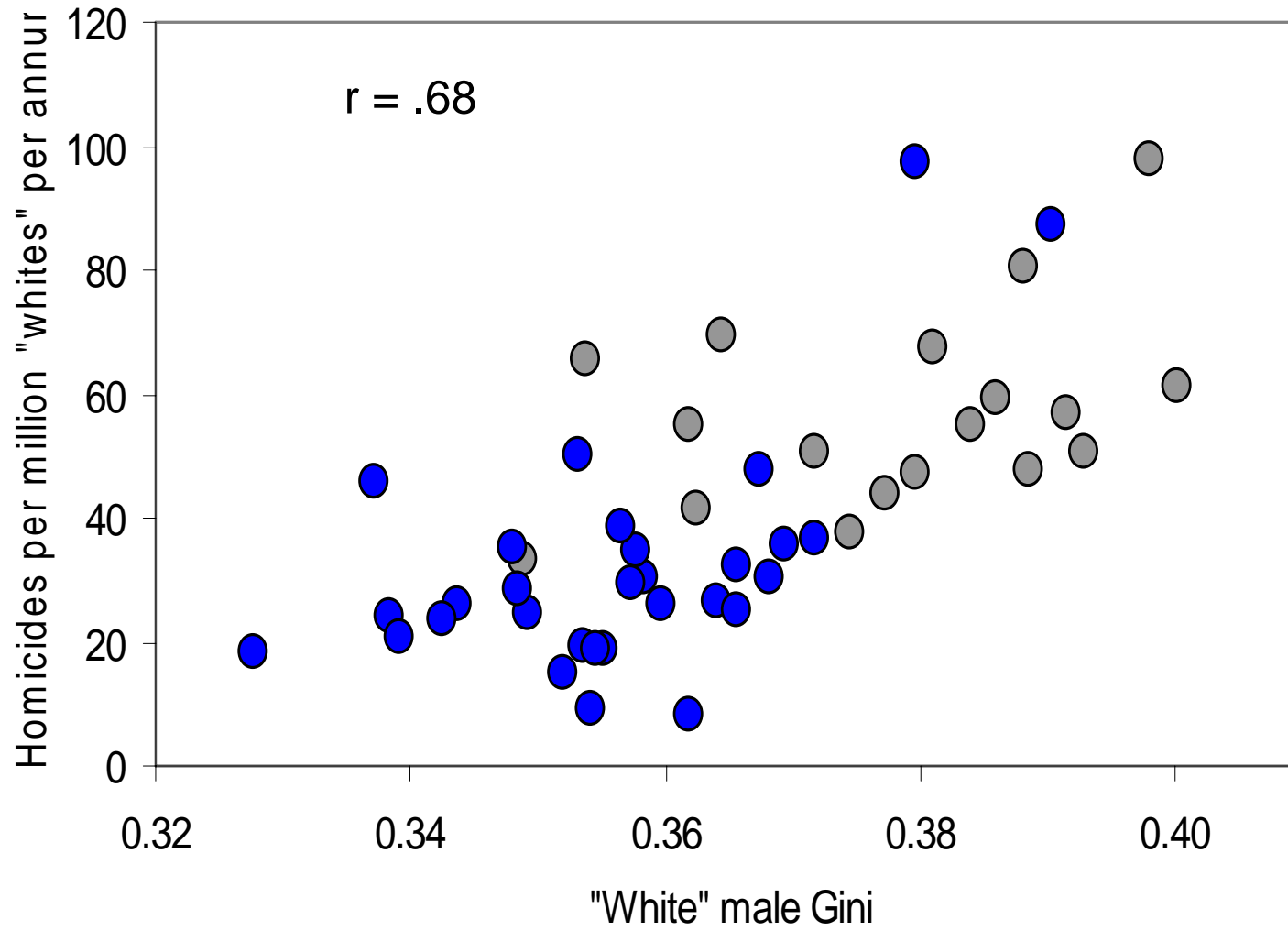
Variability in homicide rates among US states is indeed unrelated to income (1990 data) ...



"White" men's income does not predict their homicide rates across US states ...



but income inequality does ... and the "southern" effect disappears



In conclusion...

All creatures necessarily make present-future trade-offs.

But how *much* ought one to discount the future?

Optimal discounting depends on

one's sex

one's life stage

cues of present & future returns on efforts

... and cues of longevity

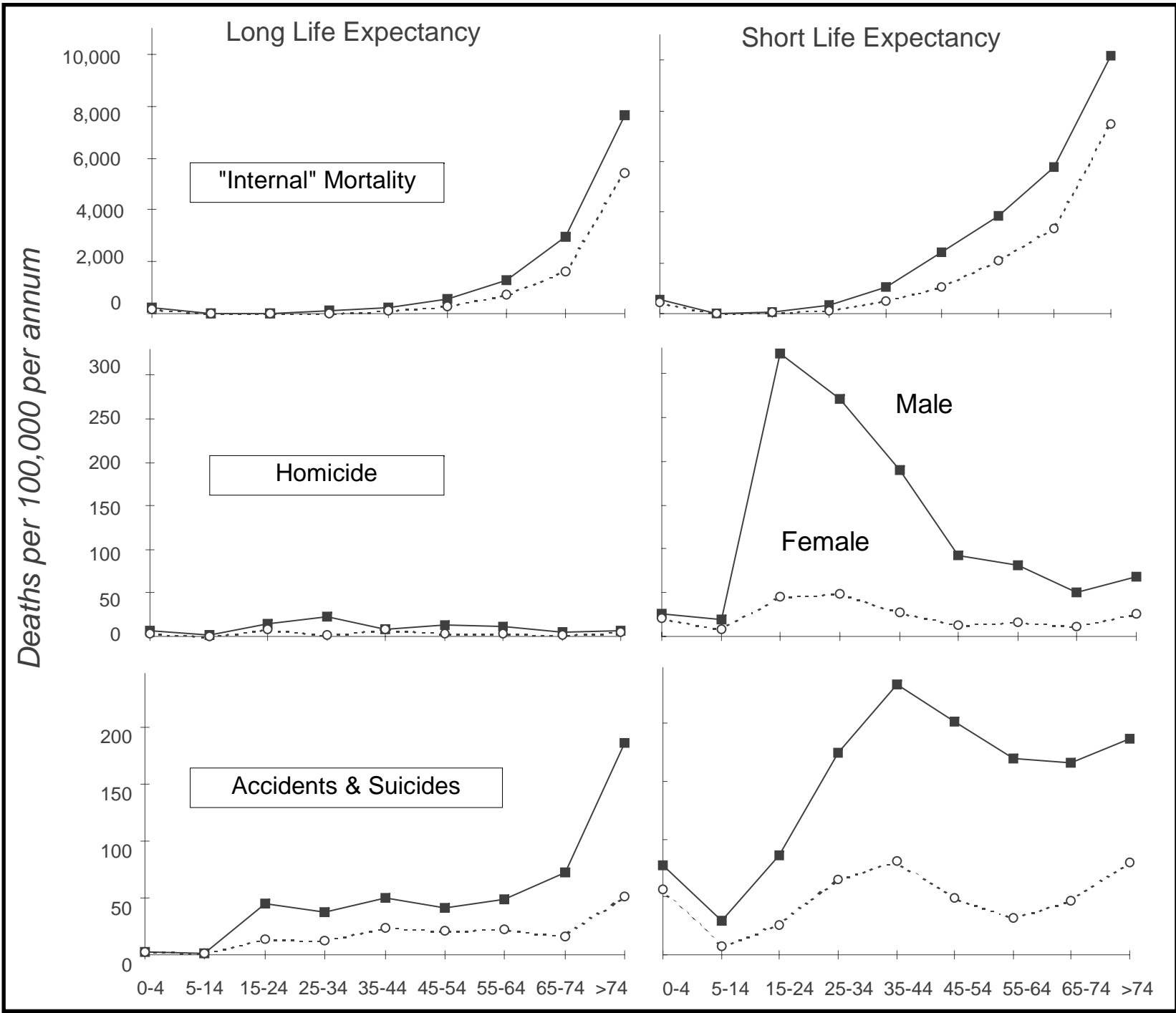
An evolutionary adaptationist perspective helps predict & explain who discounts how much, where and when.

A challenge :

To use our evolutionary models to help us discover the adaptations that effectuate present-future trade-offs.

Life is Uncertain
Eat Dessert First





“Rational discounting” = exponential discounting

$$V = A * e^{-kD}$$

- (1) It devalues the future as if the chance of an intervening disaster were constant per unit time.
- (2) It maintains ordered preferences. (An exponential discounter who prefers future A over future B continues to do so as both futures draw closer.)

Reality = hyperbolic discounting

$$V = A / (1 + kD)$$

- (1) It devalues the future as if disasters are more likely sooner than later.
- (2) It causes preference reversals : a hyperbolic discounter may prefer future B to future A when both are far off, then switch preferences as they draw nearer.

A discounting problem for a starling in a 2-key Skinner box :

Which would you rather have ?

- A. one food pellet after a 6-second delay.
- B. three pellets after a 12-second delay.



The starling prefers option B.

Next problem :

Which would you rather have ?

- A. one pellet after a 1-second delay.
- B. three pellets after a 7-second delay.

The starling switches to a preference for option A.

Starlings, too, exhibit hyperbolic discounting with resultant reversals of preference as the future draws nearer.

Notice what we're asking the starling to do :

To choose now (make a present commitment) between two alternative future payoffs, *neither of which requires him to do anything in the interim.*

Is this a real-world problem ?

In the real world, animals make choices between *alternative courses of action.* (To forage here or there. To engage in activity A or B.)

And the choices have expected payoff rates.

So could the starling be treating delay as time invested in pursuit of the reward, and maximizing rate of return ?

- A. one pellet after a 6-second delay.
- B. three pellets after a 12-second delay.

Option A returns 0.17 pellets per second “invested” (delay).
The preferred option B delivers 0.25 pellets per second.

- A. one pellet after a 1-second delay.
- B. three pellets after a 7-second delay.

Option B returns 0.43 pellets per second “invested” (delay).
The preferred option A delivers 1.00 pellet per second.

Prediction : Preference should switch at 3 seconds versus 9 seconds.

Result : The birds do indeed switch where the return rates are equal.

Bateson & Kacelnik (1996) *Behavioral Ecology* 7 : 341-352

In this case, “irrational” hyperbolic discounting is interpretable as a byproduct of mental processes whose function is to prefer activities that provide the best rates of return.

The lesson is ecological validity. Evolved decision-making machinery is not a general-purpose “rational choice” device.



Broadbar moths assess oviposition sites more hastily and oviposit at higher rates when starved or injured.

Javoiš & Tammaru (2004) *Animal Behaviour* 68 : 249-255

Cues of an inauspicious future provide an adaptive rationale both to prefer smaller, earlier payoffs and to accept dangerous risks.

But are impatience and risk-taking actually correlated?

discounting parameter k and "sensation seeking"?

discounting parameter k and risky bets?

How is discounting instantiated in evolved attributes?

The idea that a personal discounting function provides input to diverse decision processes has intuitive and theoretical appeal.



Homicide rates vary greatly

Homicides per million persons per annum in various countries, 1996

Iceland	4	Canada	17
Ireland	6	Singapore	18
Japan	6	Australia	18
U.K.	9	New Zealand	20
Spain	9	Switzerland	27
Sweden	10	Finland	29
France	11	U.S.A.	94
Germany	11	Mexico	172
Netherlands	12	Brazil	190
China	14	Estonia	222
South Korea	16	Russia	306
Italy	17		

(source : UN Demographic Yearbook)

"AddHealth" : a Longitudinal Survey of U.S. Adolescents

Nationally representative sample (N = 4834) interviewed in 1995
at mean age 14.9 (range 10-19) and again a year later ...

Was poor health status at first interview
predictive of risk taking a year later ?

M. Raco, BSc thesis, McMaster 2008

"In general, how good is your health?"

Excellent

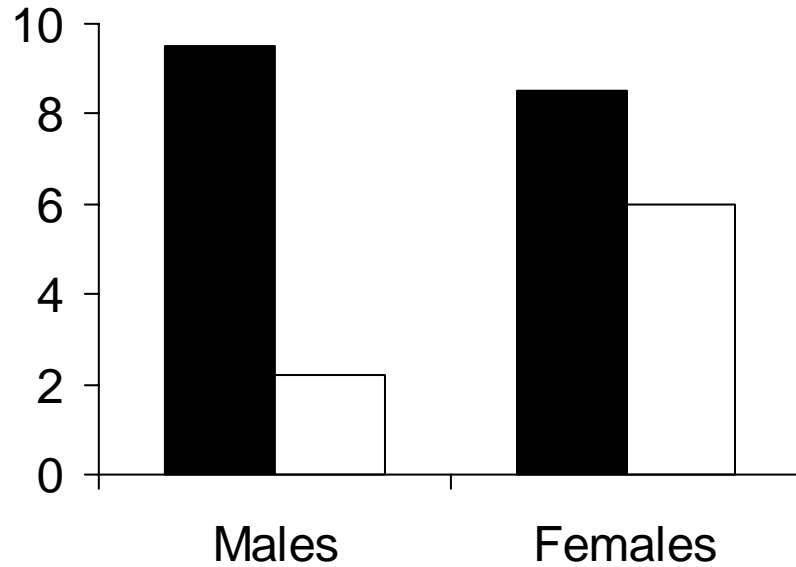
Very good

Good

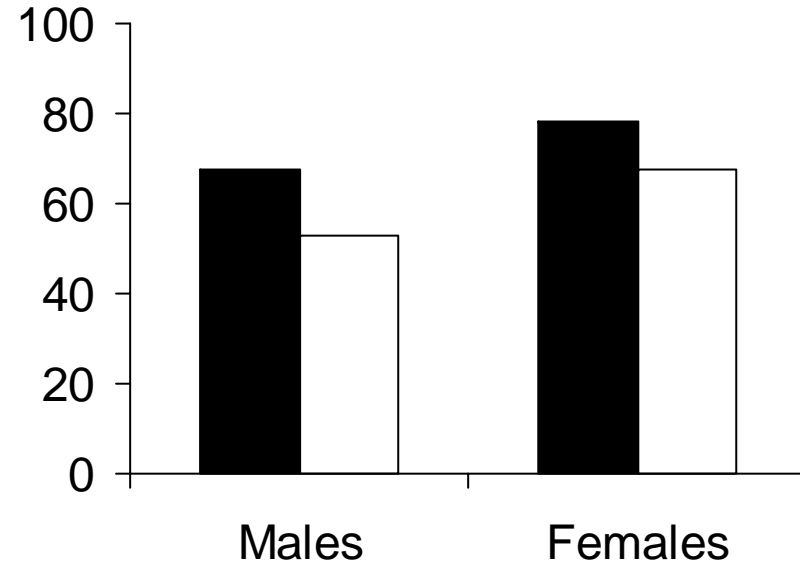
Fair

Poor

Percent who say they usually or always wear a bicycle helmet



Percent who say they usually or always wear a seatbelt in car



Good to excellent health
 Fair to poor health

	Beta	p	Beta	p
Household income	.155	.000	.132	.000
Age	-.127	.000	.002	.917
Health	.055	.006	.079	.000
Sex	.002	.912	.143	.000

