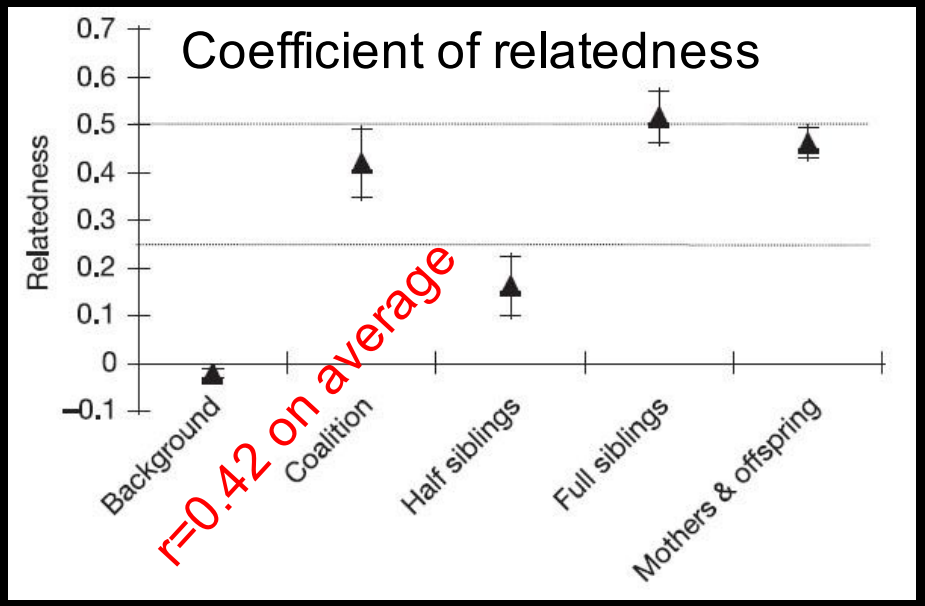
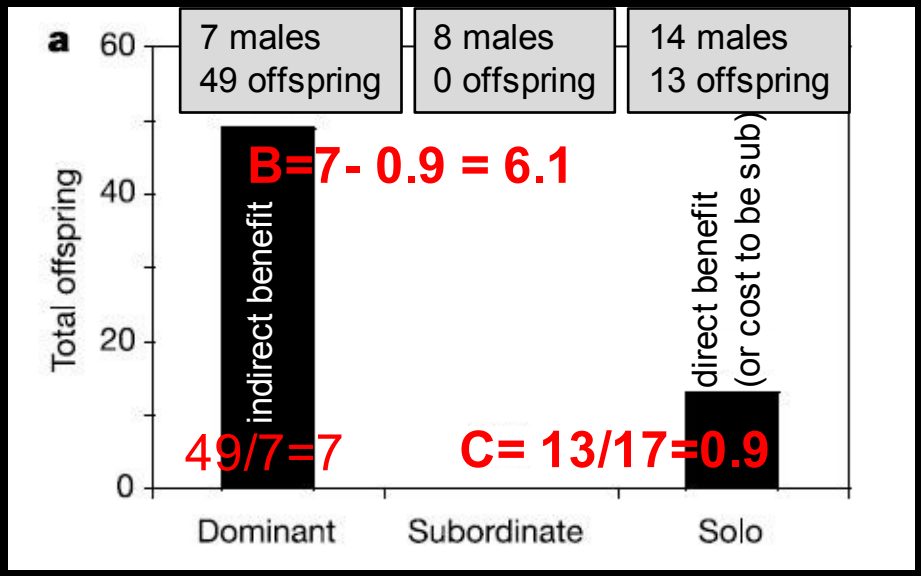




rB>C (0.42)(6.1) > 0.9

2.56 > 0.9

Kin selection and cooperative courtship in wild turkeys

Alan H. Krakauer

Nature **434**, 69–72 (03 March 2005) | Download Citation

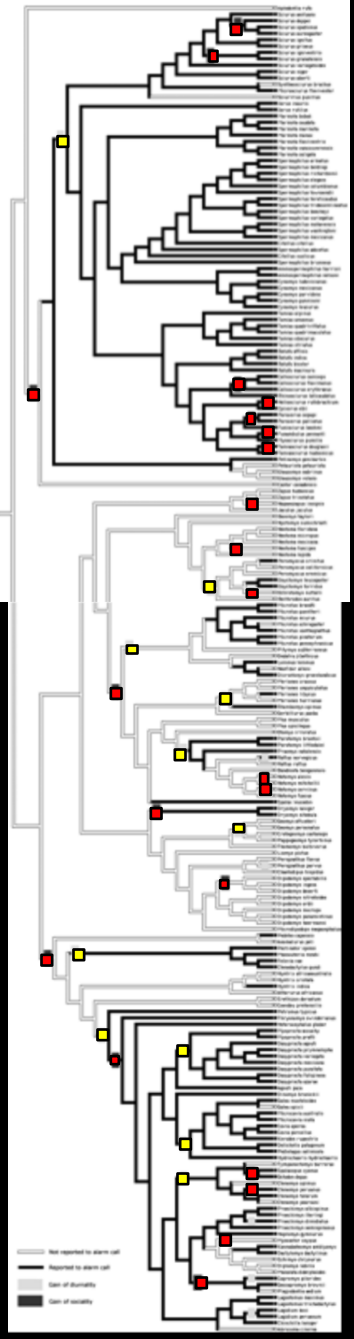
Table 1 **Calculation of Hamilton's rule, $rB - C < 0$**

Variable	Description	Calculation	Value*
r	Coefficient of relatedness	Mean pairwise relatedness of subordinates to their dominant display partner	0.42
B†	Benefit to dominant	(No. of offspring per dominant male) – (no. of offspring per solo male)	6.1 (9.0)
C†	Cost to subordinate	(No. of offspring per solo male)– (no. of offspring per subordinate male)	0.9 (2.3)
	Net benefit†	$rB - C$	+1.7 (1.5)

Dominant, solo and subordinate refer to dominant coalition males, solitary non-cooperating males and subordinate male helpers, respectively.
*Values in parentheses exclude non-reproducing males from mean fitness calculations.
†In units of offspring per male.

Calling
Not calling

sociality
diurnality



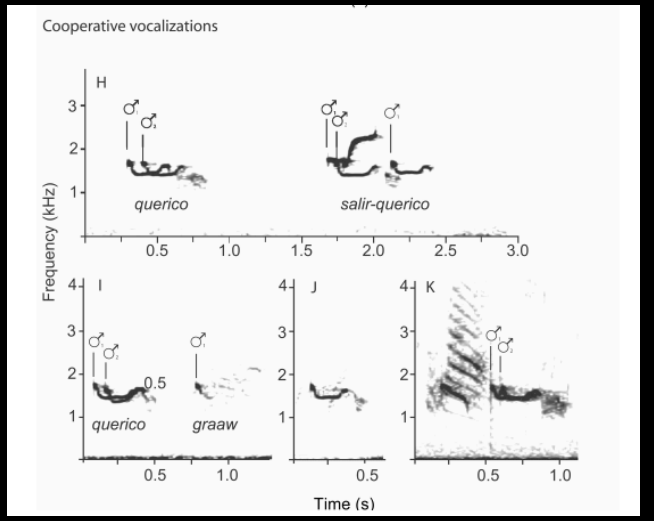
"If calling evolved to have a conspecific alarming function then we would expect that the evolution of sociality would precede the evolution of calling"

"If calling evolved to be directed toward predators, we assumed that individuals would do so when they were relatively safe (not in the dark where it is difficult to assess predation risk)… and evolution of diurnality would precede the evolution of calling"

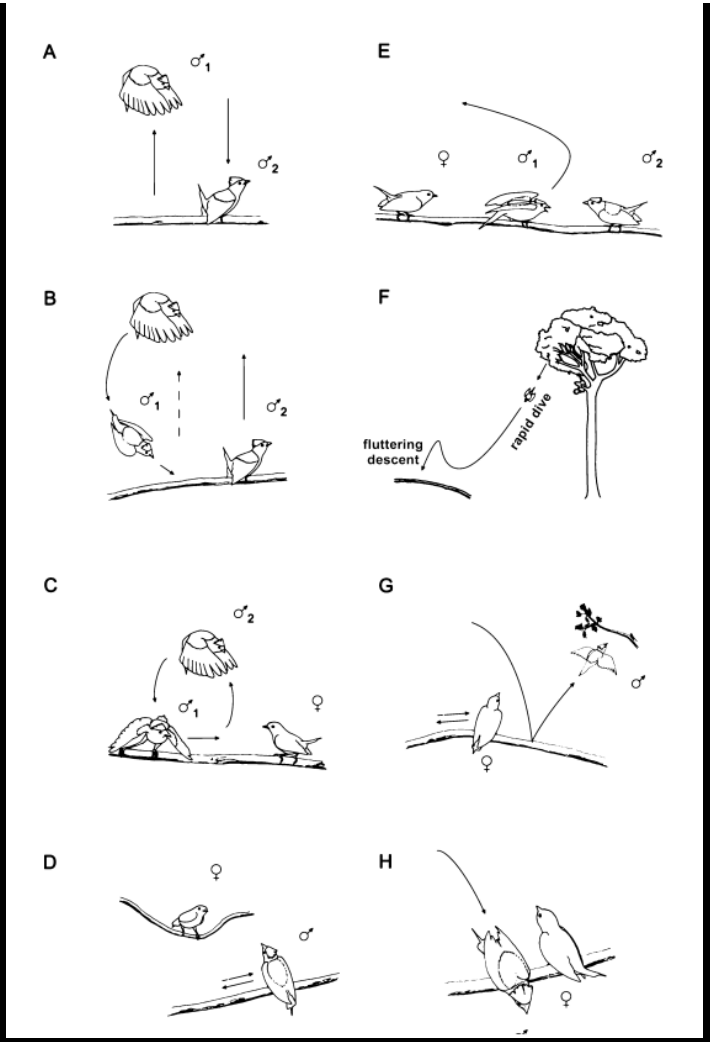
Consider Alternate Hypotheses

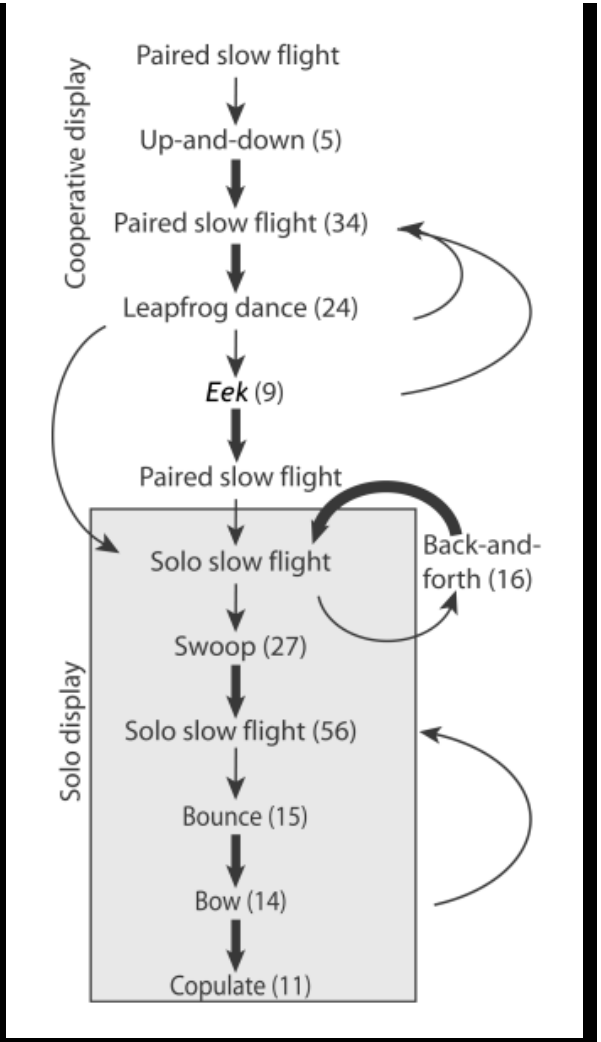
The answer to a phylogenetic question may differ from the answer to a question about Adaptive Value.

Shelly and Blumstein 2005 marmot calls


Cooperative vocalizations
H
querico
salir-querico
Frequency (kHz)
I
J
K
querico
graaw
Time (s)


The DuVal Lab
Florida State University
hoto © C. Vanderbilt





Provide three alternative hypotheses that could explain this behavior could evolve through Natural Selection.

DuVal E.H. (2007) The Auk 124 (4): 1168-1185.

Figure A. Duet pair of male lance tail manakins. Alpha-beta partners display

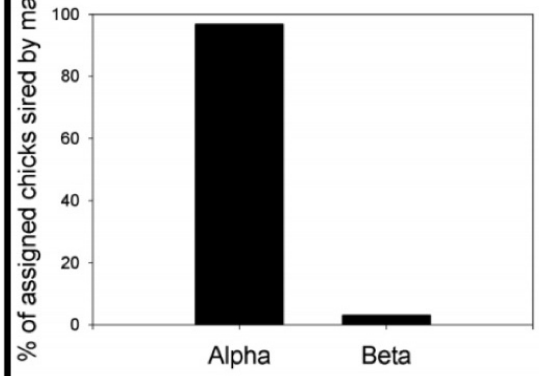


Figure. C Genetic test quantified the reproductive success males in different status classes. Of 63 chicks for which paternity could be assigned, all but two (97%) were sired by alpha males.

Direct Benefit?
Selfish

DuVal E.H. (2007) The Auk 124 (4): 1168-1185.

Figure A. Duet pair of male lance tail manakins. Alpha-beta partners display

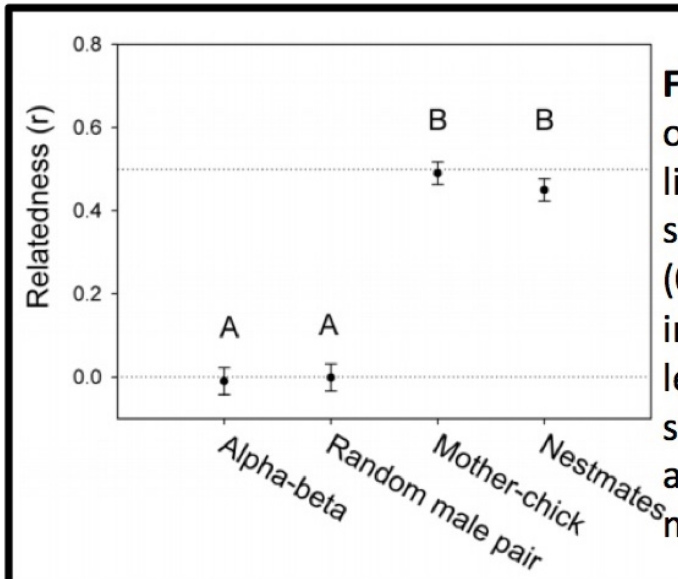


Figure. B Mean relatedness values of observed alpha-beta partners. Dotted lines indicate expected average r for full siblings or parent-offspring comparisons (0.5) and unrelated individuals (0). Bars indicate standard errors. Common letters denote groups that are not statistically different in relatedness but are significantly different from groups marked by different letters

Indirect Benefit?
Selfish

DuVal E.H. (2007) The Auk 124 (4): 1168-1185.

Figure A. Duet pair of male lance tail manakins. Alpha-beta partners display

	Year 2 alpha	Year 2 non-alpha
Year 1 beta	15	35
Year 1 non-dancing male	5	145

Table 1. Table indicating year 2 number of year 1 beta and non-dancing males that had transitioned to dancing alpha males with territory.

Delayed Benefit Selfish

Duval (2013) Journal of Animal Ecology, 82, 884–893

Cooperation

(reciprocity)

Selfish Herd

Mutualism

Prisoner's Dilemma

	Cooperate	Defect
Cooperate	**Reward** You both keep quiet You both get -2 years	**Sucker** You keep quiet Partner gives you up You get -10 years
Defect	**Temptation** You defect give up your partner Your partner is quiet You get out free 0	**Punishment** You both give up the other. And both get Charged major crime You both get -8 years

T>R>P>S
(T+S)/2<R

-2 years for the minor crime
-8 years for the major crime

http://bio150.chass.utoronto.ca/pdgame/index.html

W.D. Hamilton

The Evolution of Cooperation

Robert Axelrod; William D. Hamilton

Science, New Series, Vol. 211, No. 4489. (Mar. 27, 1981)

Political Science

Robert Axelrod

Prisoner's Dilemma

	Cooperate	Defect
Cooperate	R 2	S 0
Defect	T 3	P 1

T>R>P>S
(T+S)/2<R

http://bio150.chass.utoronto.ca/pdgame/index.html

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The Evolution of Cooperation

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http://sites.sinauer.com/animalcommunication2e/chapter13.01.html

Political Science

Robert Axelrod

ALTERNATE: Alternate between C and D, starting with a C.

ALWAYS COOPERATE: always play C, (Also known as sucker).

ALWAYS DEFECT: always play D. (Also known as cheat).

GRUDGER: Start with C & continue C until partner plays D. Then D til the end.

RANDOM: The player chooses either C or D with equal probability.

TIT FOR TAT: Start with C & play whatever partner did in the previous move

NAÏVE PROBER: Start with C and then play whatever its partner plays previously. However, randomly play D.

TIT FOR TWO TATS: Start with 2 Cs. If partner plays 2 Ds then D, otherwise C.

TWO TITS FOR TAT: Starts with C, if partner plays D then D for 2 moves. Otherwise C

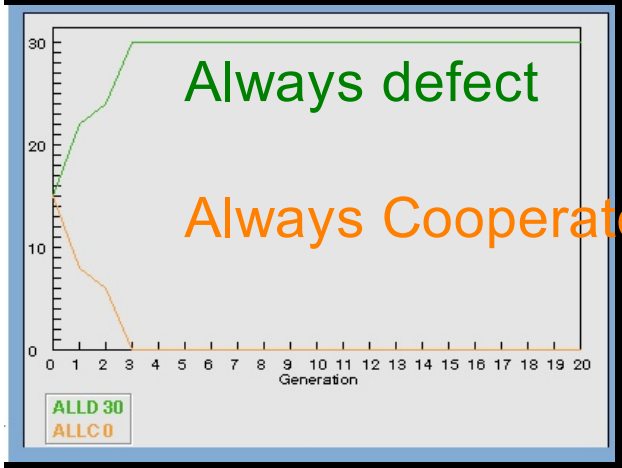
REMOURSEFUL PROBER: Start with C and play whatever partner played previously. However, randomly play D, allow one free hit if partner's D was in response to the random D

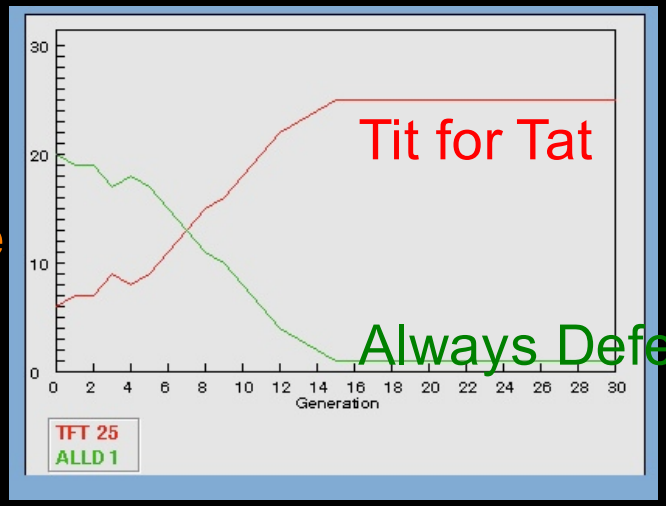
Strategies for Prisoner's Dilemma

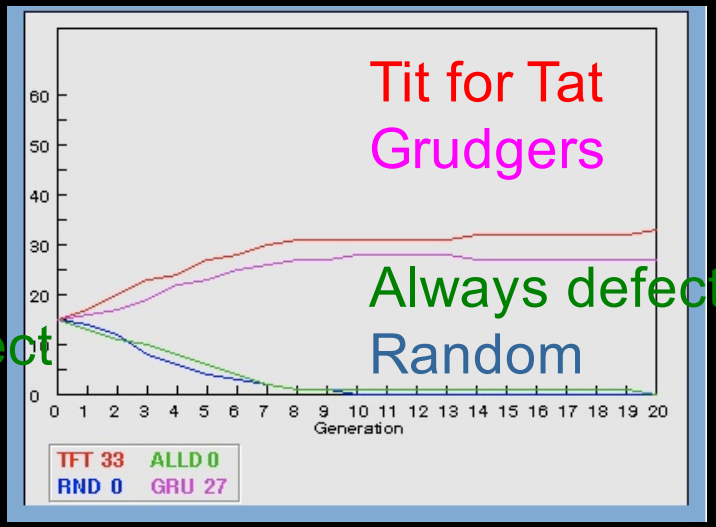
	Cooperate	Defect
Cooperate	R 2	S 0
Defect	T 3	P 1

Pick your favorite color and play that strategy against a neighbor for 10 rounds

ESS depends upon participating strategies (the current social environment)



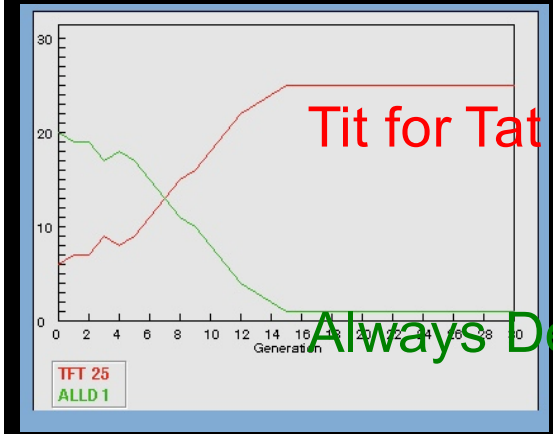




But both are stable

http://bio150.chass.utoronto.ca/pdgame/index.html
http://ncase.me/trust/

ESS depends upon participating strategies



	Cooperate	Defect
Cooperate	R 2	S 0
Defect	T 3	P 1

let p = proportion of TFT

$p(20)+(p-1)(9) = p(12)+(1-p)(10)$

$p20+p9-9 = p12+p10-10$

$p29-p22 = -10+9$

$p7 = 1$

$p = 1/7$ or 14%TFT

But both are stable

scores after 10 games

	TFT	All-D
TFT	20	9
All-D	12	10

"the knife's edge"

	Cooperate	Defect
Cooperate (groom)	**Reward** Takes me 2 hours To groom you But save me 8 hours Grooming myself **= +6**	**Sucker** Takes me 2 hours To groom you I still spend 8 hours Grooming myself **= -10**
Defect (flake out)	**Temptation** I don't waste 2 hours grooming you And I save 8 hours not grooming myself **= +8**	**Punishment** I don't waste 2 hour grooming you I still spend 8 hours grooming myself **= -8**

T > R > P > S & (T+S))/2<R

+8 > +6 > -8 > -10 & (+8+-10)/2 <+6

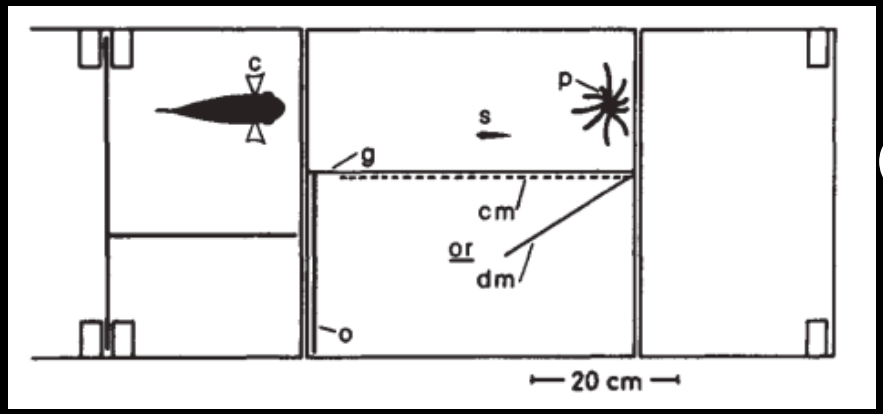
-1<+6

Cost Benefit in Nature?

	Cooperate	Defect
Cooperate	**Reward - fairly good** I get blood on my unlucky nights which saves me form starving. I have to give blood on my lucky nights which doesn't cost too much.	**Sucker- Very Bad** I pay the cost of saving your life on my good night. But on my bad night you don't feed me and I run the risk of starving.
Defect	**Temptation -Very Good** You save my life on my unlucky nights. but then I get the added benefit of not paying the slight cost of feeding you on my lucky nights.	**Punishment - fairly bad** I don't have to pay the slight costs of feeding you but I don't get the benefit of food when I desperately need it.

$T > R > P > S \quad \& \ (T+S))/2 < R$

Cost Benefit in Nature?



	Cooperate	Defect
Cooperate (move forward)	R	S
Defect (hang back)	T	P

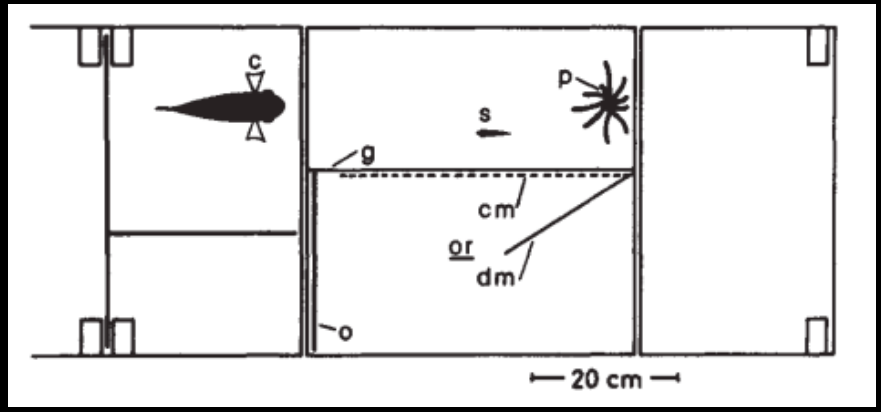
T>R a trailing fish learns attack distance w/o risk
R>P if both hang back they don't learn attack distance
P>S if leader gets to close it gets eaten if closer (S)

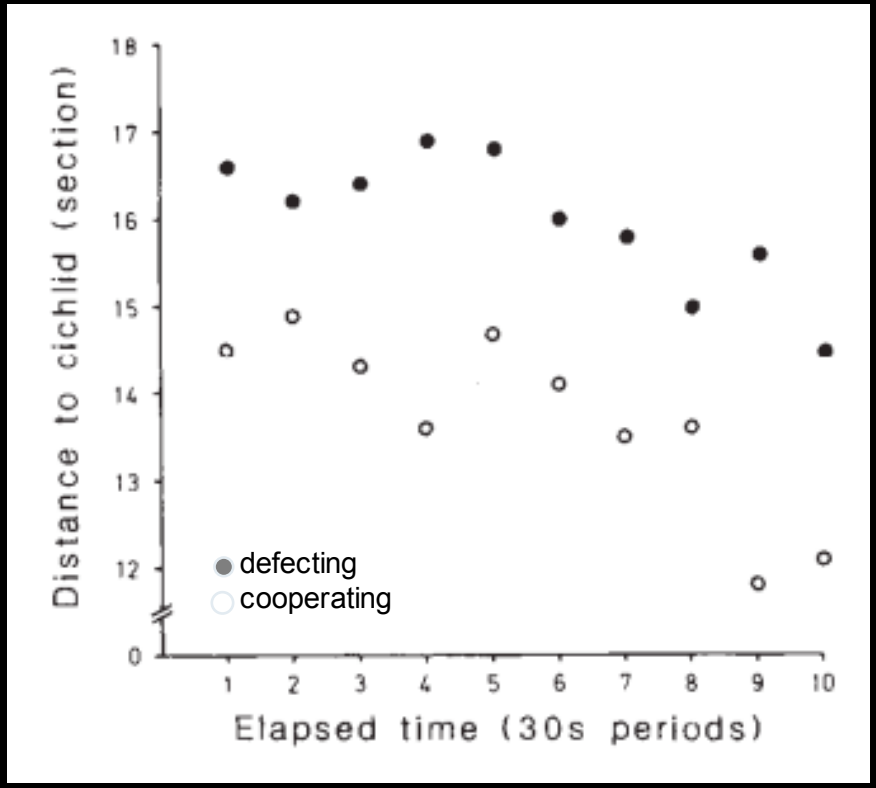
R> (S+T)/2 either cooperating fish can learn attack distance and risk is reduced by herd

NATURE VOL. 325 29 JANUARY 1987

TIT FOR TAT in sticklebacks and the evolution of cooperation

Manfred Milinski





NATURE VOL. 325 29 JANUARY 1987

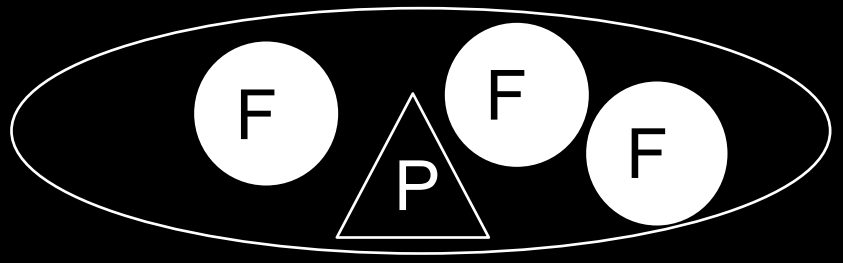
TIT FOR TAT in sticklebacks and the evolution of cooperation

Manfred Milinski

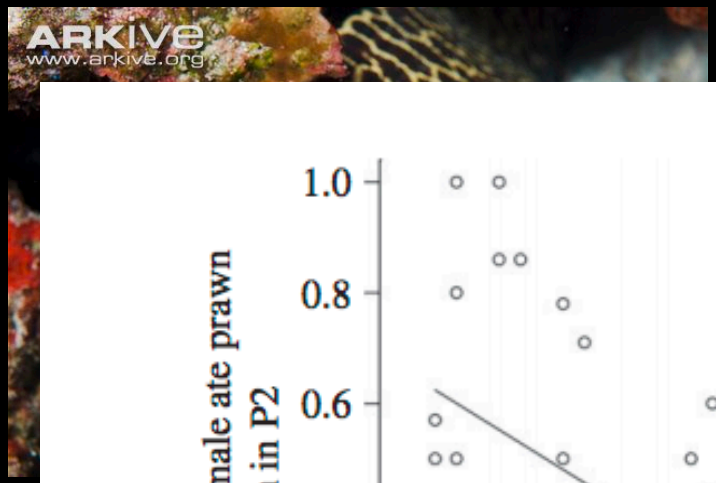
T>R>P>S ???
(T+S)/2<R

	Cooperate	Defect
Cooperate (eat only parasites)	R = feeding	S = no meal client leaves
Defect (bite the client)	T = big meal	P = ½ big Meal on avg.

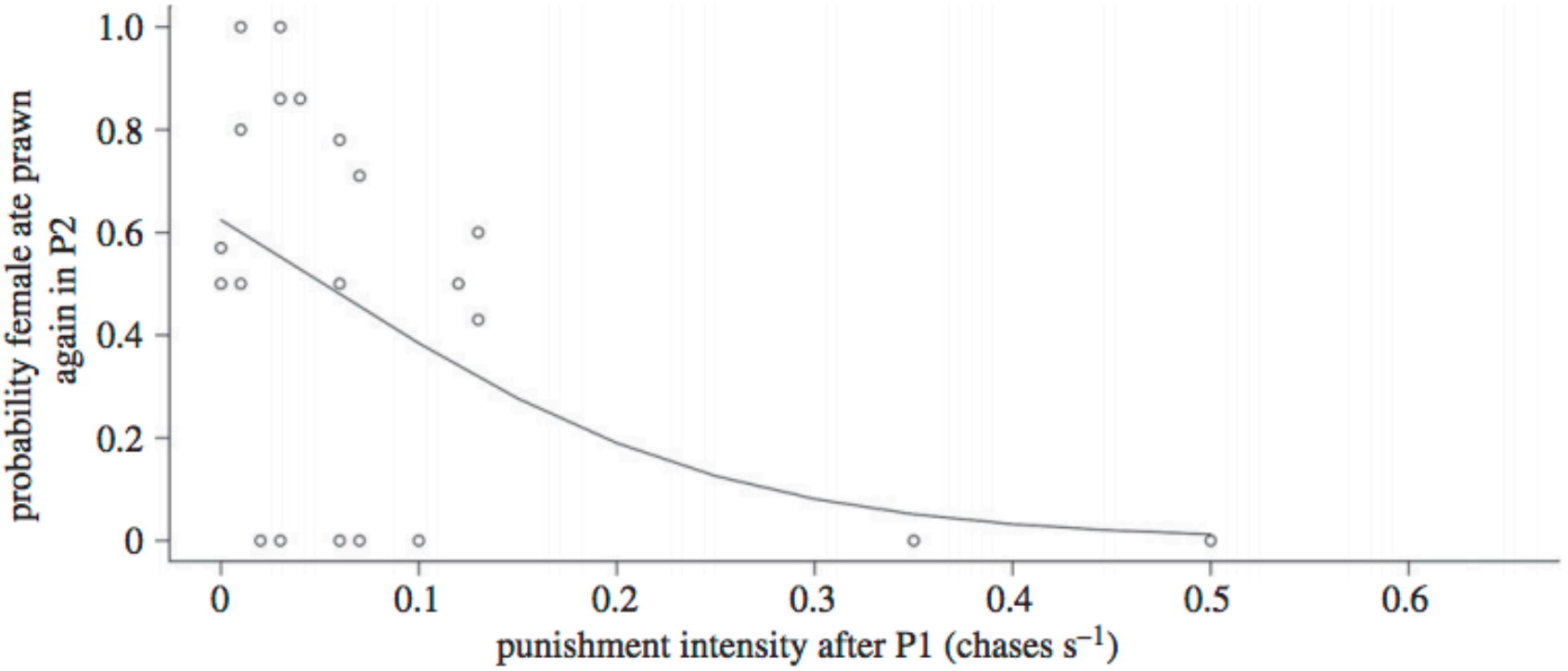
Payoff matrix is enforced by added cost of punishment within the “cooperating pair”



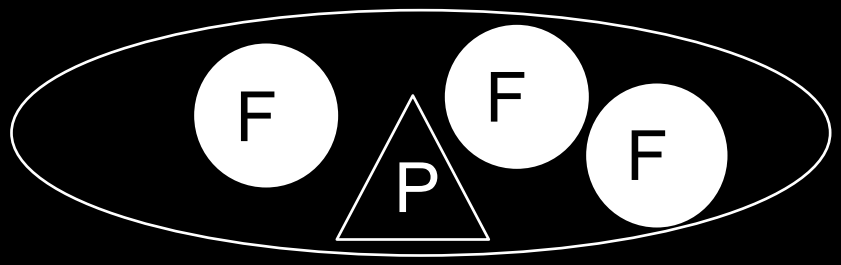
Raihani et al 2012 Proc. R. Soc. B 279:365-370



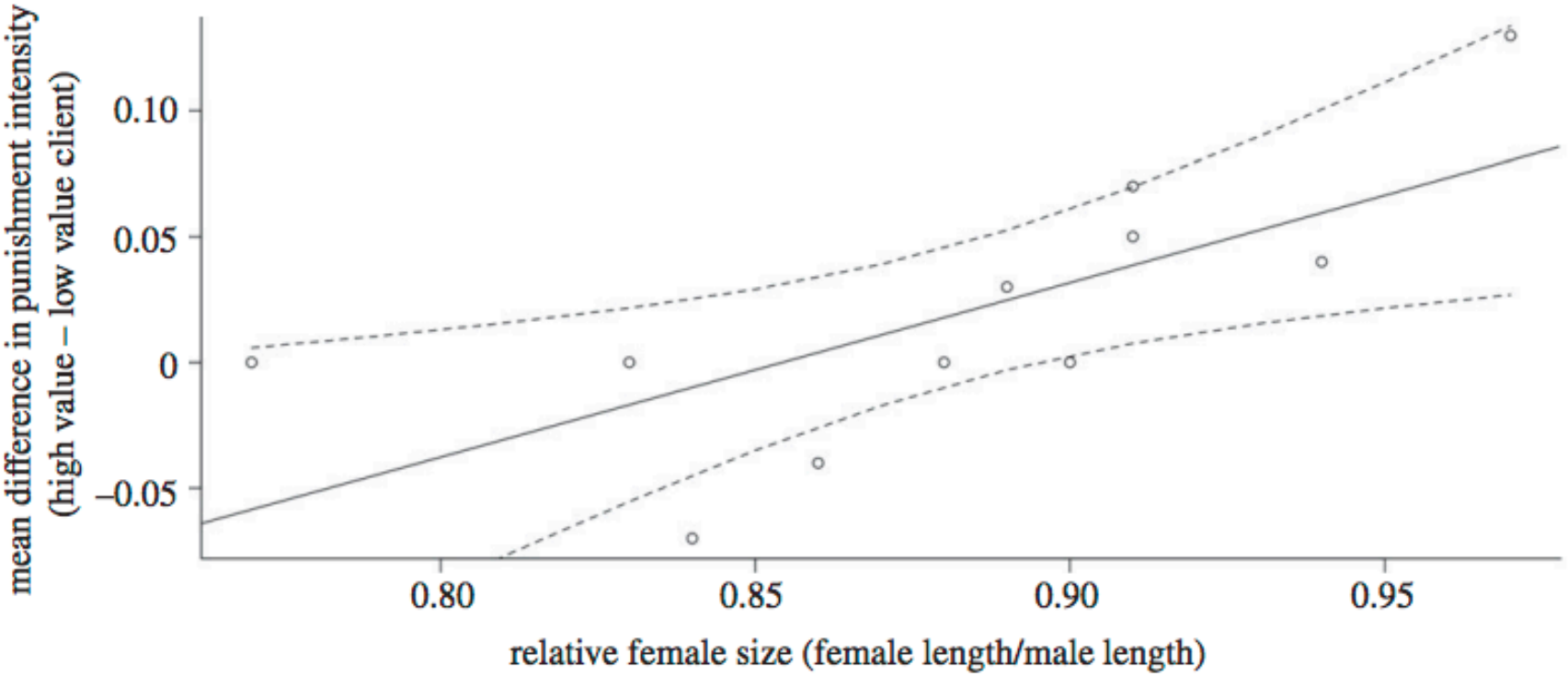
Cooperate | Defect



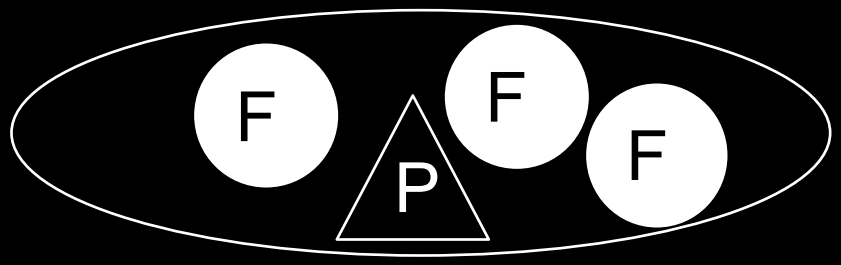
Payoff matrix is enforced by added cost of punishment within the “cooperating pair”



Raihani et al 2012 Proc. R. Soc. B 279:365-370



Payoff matrix is enforced by added cost of punishment within the “cooperating pair”



Raihani et al 2012 Proc. R. Soc. B 279:365-370

Subconscious Bias another form of Anthropomorphism

Ethograms should be:

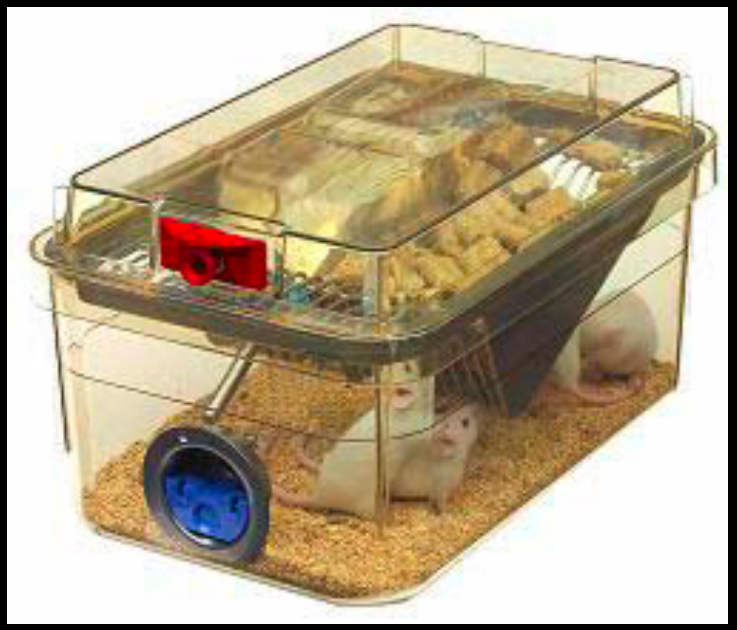
- Objective
- Quantifiable
- Devoid of Intent
- Devoid of anthropomorphism

Described by:

- Structure
- Spatial orientation
- Consequence (automated)

Units of behavior?

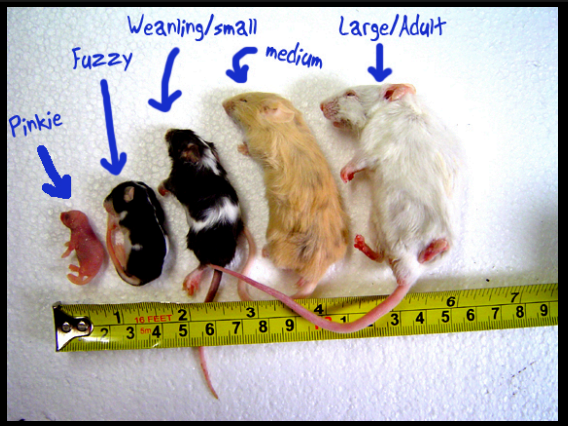
Mice as research subjects



The “value” attached to the life or welfare of an animal is a social construct.

Mice as pests

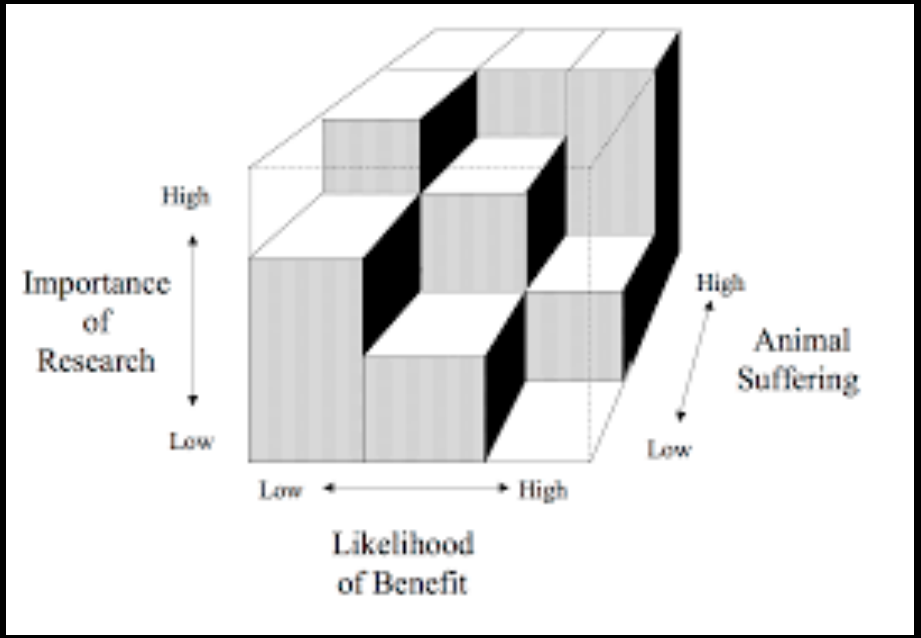
Mice as food



How worth while is the research?

What is the probability of success and benefit from the research?

How much suffering will the experiment cause to the animal?



There was confusing in lecture (my fault) because I hadn't carefully read the last line

"The solid part of the cube represents work that would be deemed unacceptable"

Ethical Considerations

IACUC CENTRAL

IACUC.org is now **IACUC Central**, a comprehensive repository for all things IACUC. IACUC Central is a valuable resource for institutional animal care and use committee members and staff. Updated quarterly, IACUC Central organizes information into pages containing links to governmental agencies, databases, examples of institutional websites, training resources, and more.

Adaptive Cost Gauging

International Animal Care and Use Committee

Refinement:
- use of non-invasive methods
- short term manipulations
- improved husbandry

Replacement:
- use of non-animal models

Reduction:
- use fewer animals
  - -more focused
  - -model organisms
    - > resources
    - < variability

What choices do you have to make to design an experiment?
(regardless of hypothesis)

How do you choose an organism to study?

Lab Based research

Pro

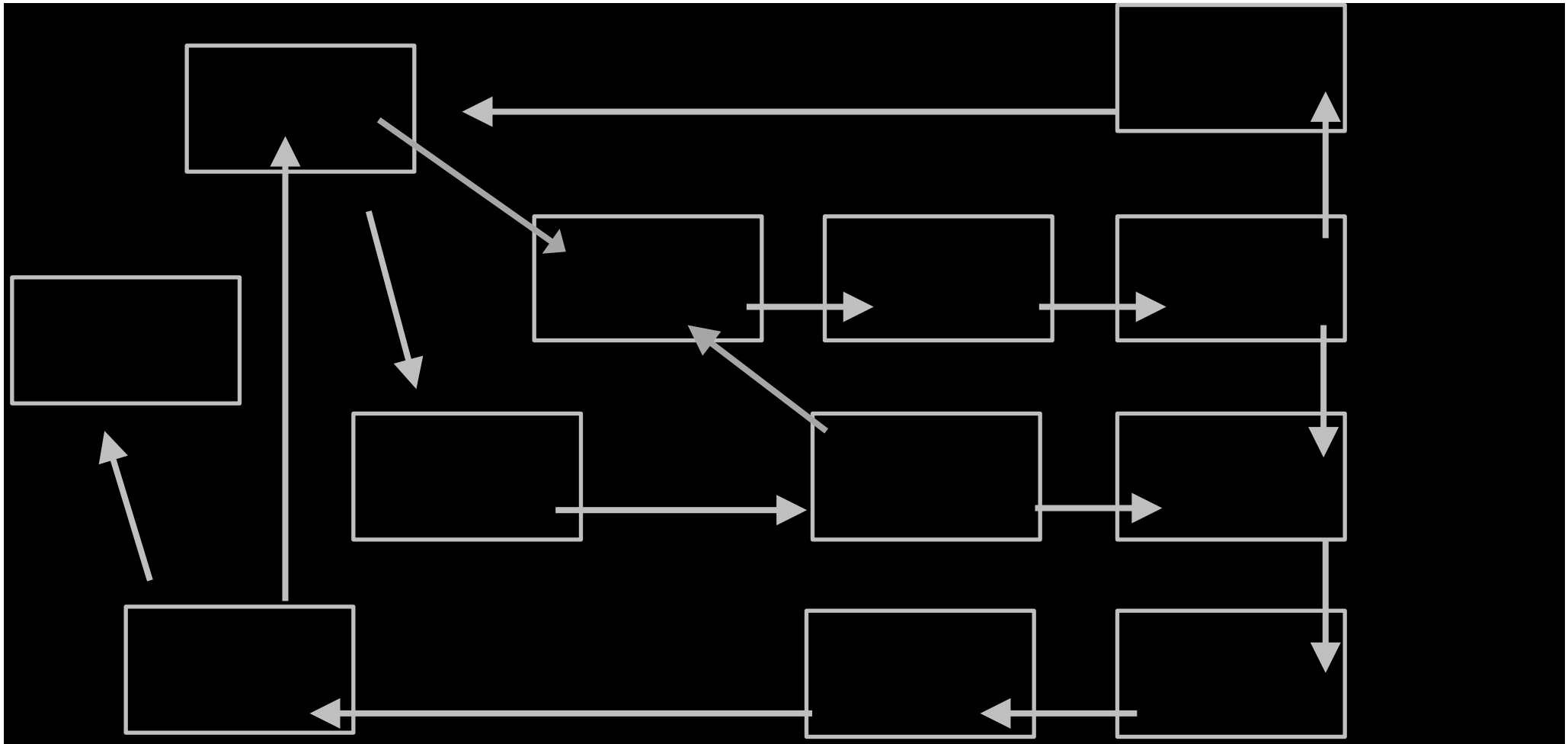
Con

Field Based research

Pro

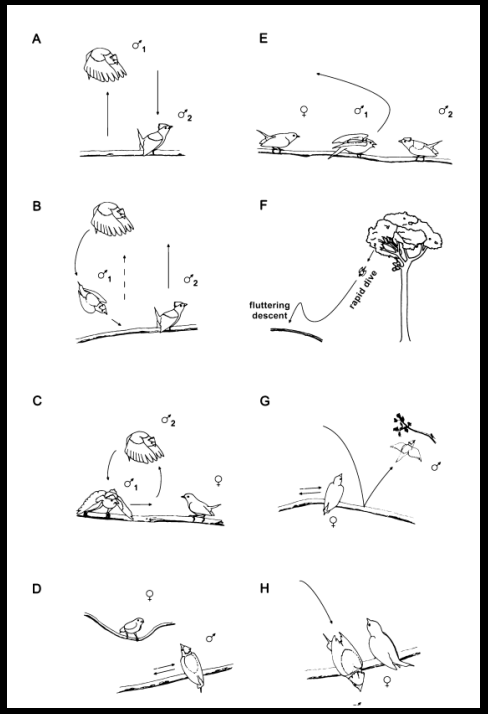
Con

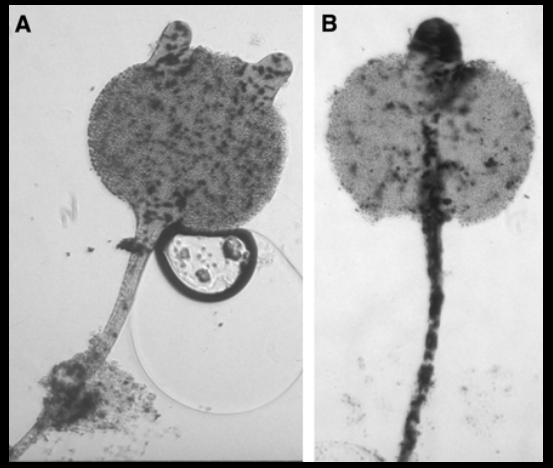
Experimental vs. observational

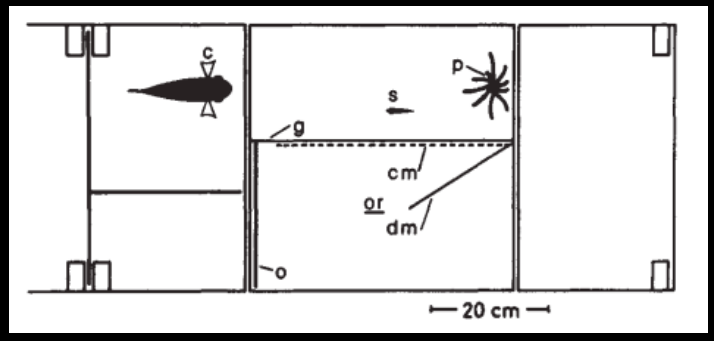


- Ask the question
- Make preliminary observations
- Identify the variables
- Choose a recording method
- Collect and analyze data
- Formulate a hypotheses

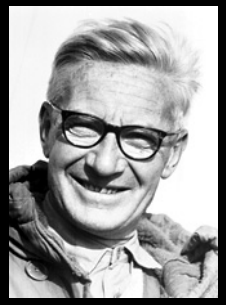
- Make predictions based on the hypothesis
- Design experiments to test the hypothesis
- Conduct the experimental tests
- Consider alternate hypotheses
- Share your findings





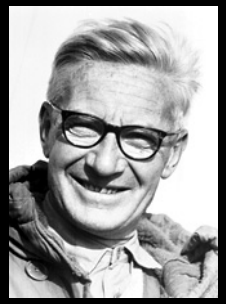


What do all of these instances of cooperation or apparent altruism have in common?



Timeframe of study

(Level) of question	**Snap shot:** An explanation of the current form of a behavior in terms of present-day	**Story:** An explanation of the current form of the behavior in terms of a sequence
Proximate (how): An explanation in terms of immediate factors, relevant and potentially measurable in current time.	**Mechanism** (a.k.a. causation) **Causal explanations in terms of what the behavior is and how the behavior is constructed. These explanations can include physical morphology, molecular mechanisms or other underlying biological factors** Aristotle: material cause	**Ontogeny** (a.k.a. development) **Developmental explanations for sequential changes across the lifespan of an individual. Often these explanations are concerned with the degree to which the behavior can be changed through learning.** Aristotle: formal cause
Ultimate (why) An explanation in terms of the process and forces of evolution.	**Adaptive Value** (a.k.a. function or survival value) **Functional explanations regarding the utility of the current form of the behavior with regard to increasing an organisms lifetime reproductive success.** Aristotle: final cause	**Phylogeny** (a.k.a. evolution) **Evolutionary explanations that describe the history of the behavior, such as which ancestor first possessed this trait, what was the antecedent to this behavior, and what selective pressures in the past have shaped this behavior.** Aristotle: efficient cause



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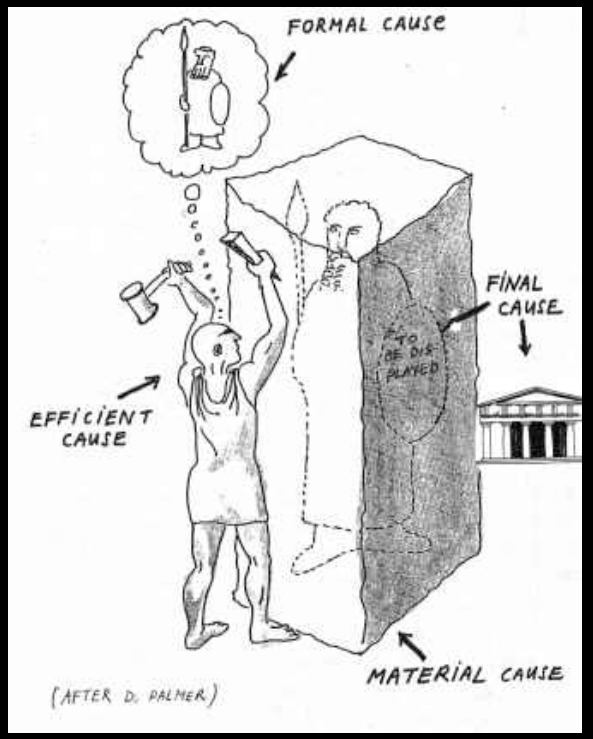

Aristotle's 4 Causes

1) **Efficient cause**: "is the trigger that starts a process moving" — x is what **produces** y
2) **Material cause**: "that from which," — x is what y is **[made] out of**.
3) **Final cause:** the goal or the purpose (**telos** in Greek) — x is what y **is for**
4) **Formal cause** "the essence of a thing" — x is what it is **to be** y.

WEBSTITES WITH MORE INFO IF YOU ARE CURIOUS
http://ishe.org/wp-content/uploads/2015/04/HEB_2013_28_4_3-11.pdf
http://www.willamette.edu/~sbasu/poli212/AristotleonCause.htm
http://www.uvm.edu/~jbailly/courses/Aristotle/notes/AristotleCausesNotes.html