

*“All generalisations are false
- including this one.”*

— Mark Twain

Generics in contrast

A theory and some experiments

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of Amsterdam

Sinn und Bedeutung, September 2019

THE PLAN

- A) A new theory for generics
- B) Testing the theory
- C) Discussing the results
- D) What now?

GENERIC SENTENCES

express →

GENERALISATIONS

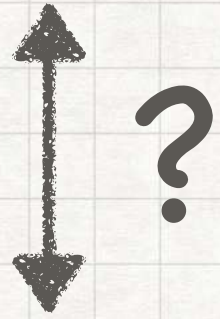


Coffee is stimulating!

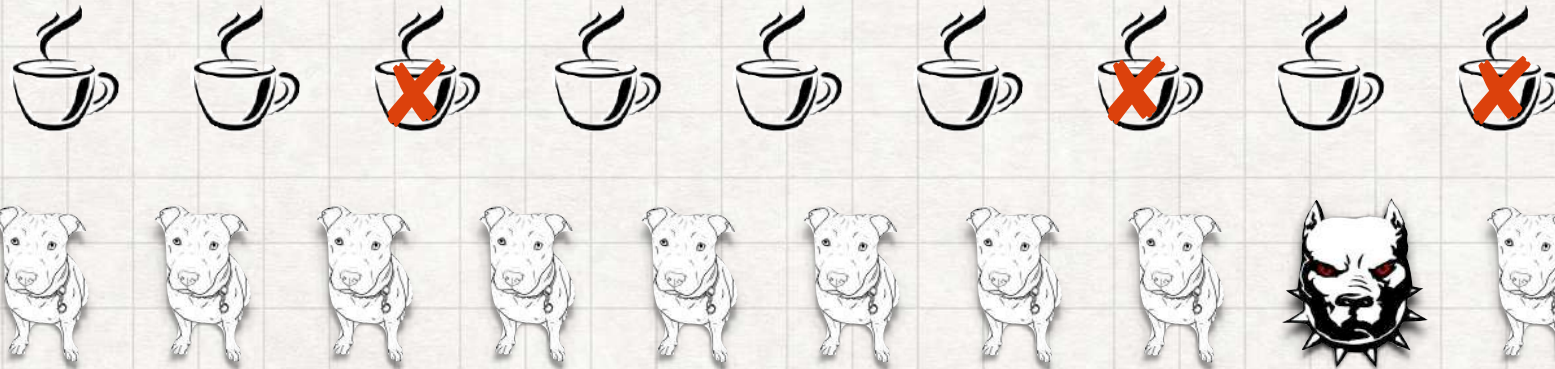
GENERIC SENTENCES

express

GENERALISATIONS



Reality/Observation



GENERIC SENTENCES

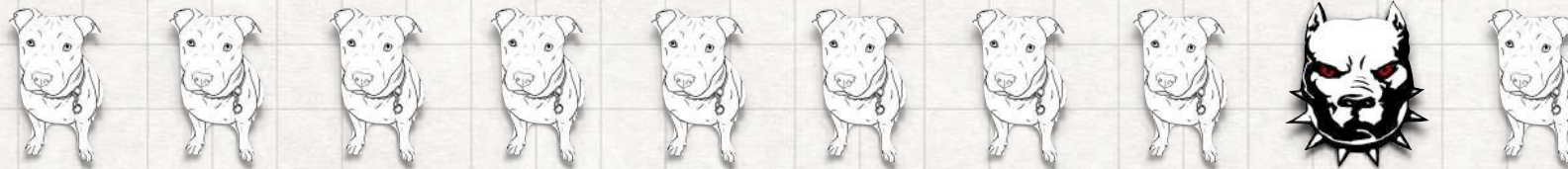
express

GENERALISATIONS



Meaning ?

Reality/Observation



GENERIC SENTENCES

express

GENERALISATIONS

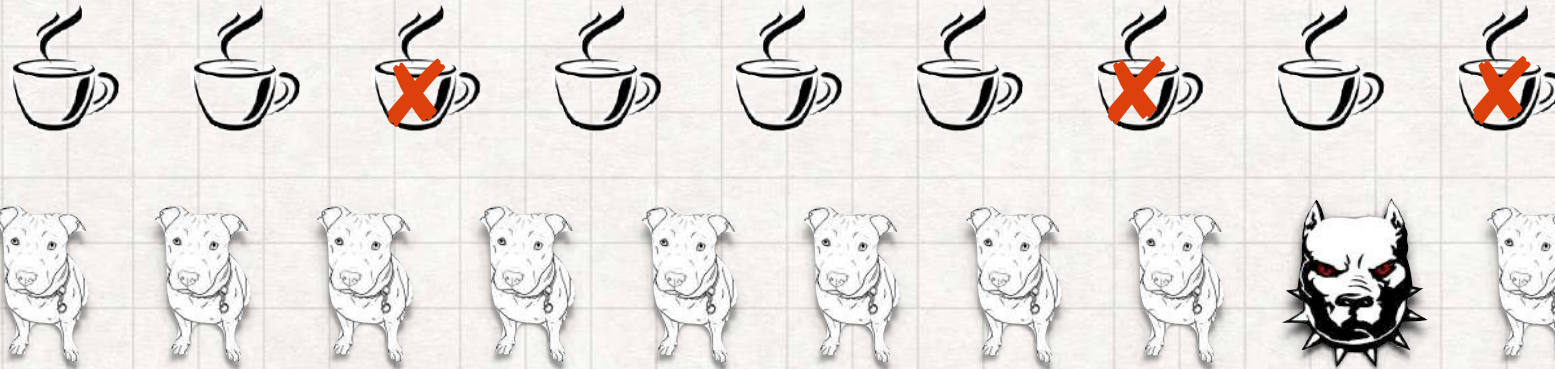


Meaning ?



Learning!

Reality/Observation



GENERIC SENTENCES

express

GENERALISATIONS



Coffee is stimulating!

Meaning ↔ Learning

Linguistics

FORMAL SEMANTICS

Theory & Methodology

Psychology

PSYCHOLOGY OF LEARNING

GENERIC SENTENCES

express

GENERALISATIONS



Coffee is stimulating!

Meaning ↔ Learning

Assertability of generic sentences

=

Strength of association

"Pit-bulls are dangerous."

of Pit-bulls with danger

GENERIC SENTENCES

express

GENERALISATIONS



Coffee is stimulating!

Meaning ↔ Learning

Contingency

$$\text{Ass}(G_are_f) = P(f|G) - P(f|Alt(G))$$

[Shanks 1995]

THE PROPOSAL

GENERIC SENTENCES

Assertability of generic sentences = Strength of association

$$\text{Ass}(G_are_f) = P(f|G) - P(f|Alt(G))$$

$$\text{Ass}(G_are_f) = \frac{1 + P(f|G) - P(f|Alt(G))}{2}$$

GENERIC SENTENCES

Assertability of
generic sentences = Strength of
association

$$\text{Ass}(G_are_f) = P(f|G) - P(f|Alt(G))$$

↑
Danks, 2003

Rescola & Wagner, (1972)

$$E_{n+1}(olc_i) = E_n(olc) + \lambda(V_n(olc_i) - \sum_j E_n(olc_j))$$

GENERIC SENTENCES

Assertability of
generic sentences = Strength of
association

$$\text{Ass}(G_are_f) = P(f|G) - P(f|Alt(G))$$

$$\text{Ass}(G_are_f) = \frac{P(f|G) - P(f|Alt(G))}{1 - P(f|Alt(G))}$$

Relative Difference

[Shep 1958]

GENERIC SENTENCES

Assertability of
generic sentences = Strength of
association

$$\text{Ass}(G_are_f) = P(f|G) - P(f|Alt(G))$$

(1) *Dogs bark.*



(2) *Kangaroos have spots.*



(3) *Sharks don't eat people.*



(4) *Robins lay eggs.*



(5) *Robins are female.*



(6) *Mosquitos carry malaria.*



GENERIC SENTENCES

$$\text{Ass}(G_are_f) = P(f|G) - P(f|Alt(G))$$

(1) *Mosquitos carry malaria.* ✓

(2) *Pit-bulls are dangerous.* ✓

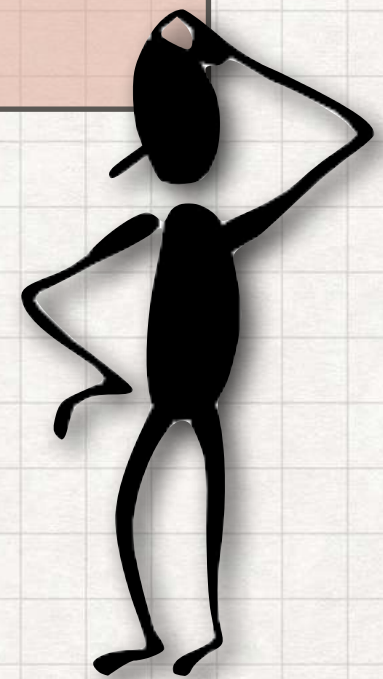
STRENGTH OF ASS. = DISTINCTIVENESS × IMPACT

➔ Experiments in aversive (i.e. fear) conditioning paradigms: acquisition and strength of association increases with the intensity of the stimulus.

GENERIC SENTENCES

Assertability of
generic sentences = Strength of
association

$$\text{Ass}(G_are_f) = P(f|G) - P(f|Alt(G))$$



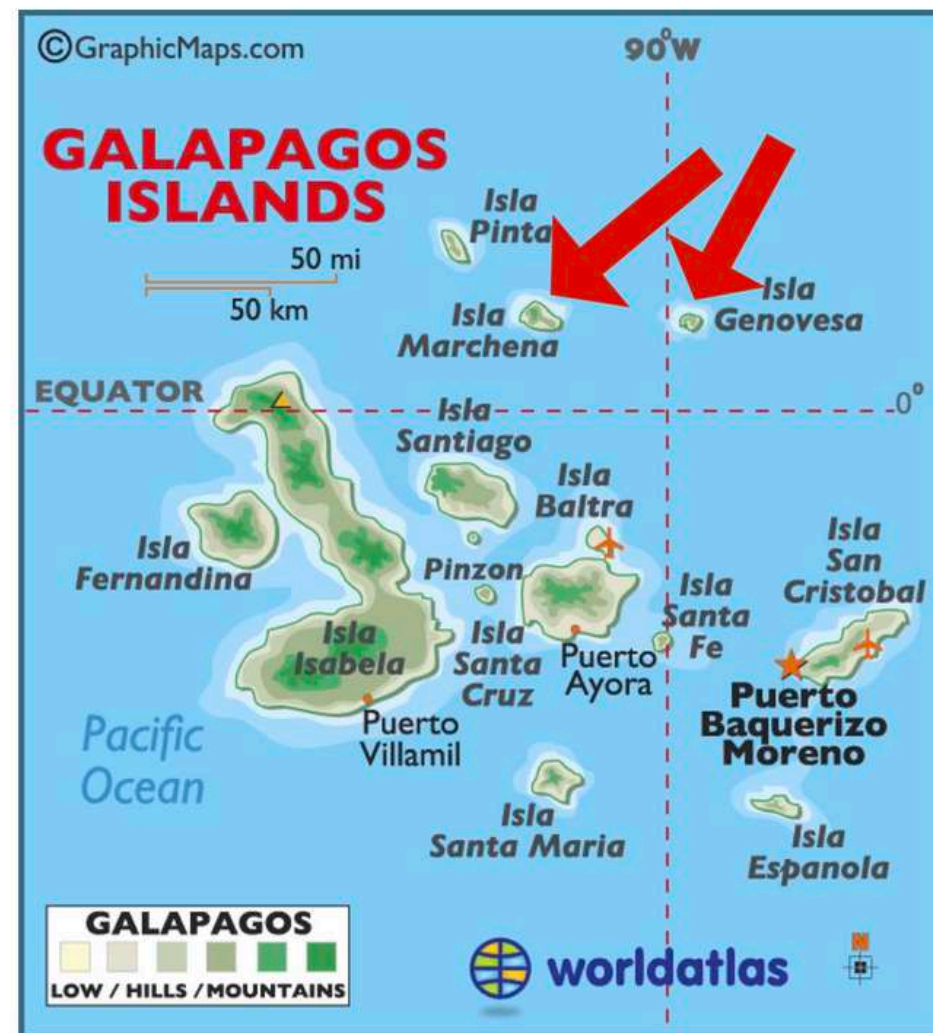
THE EXPERIMENTS

THE EXPERIMENTS

- *Relevance of contrast*
- *Continuous dependence on frequency of observation*
- *Appropriateness of contingency as measure*

THE EXPERIMENTS

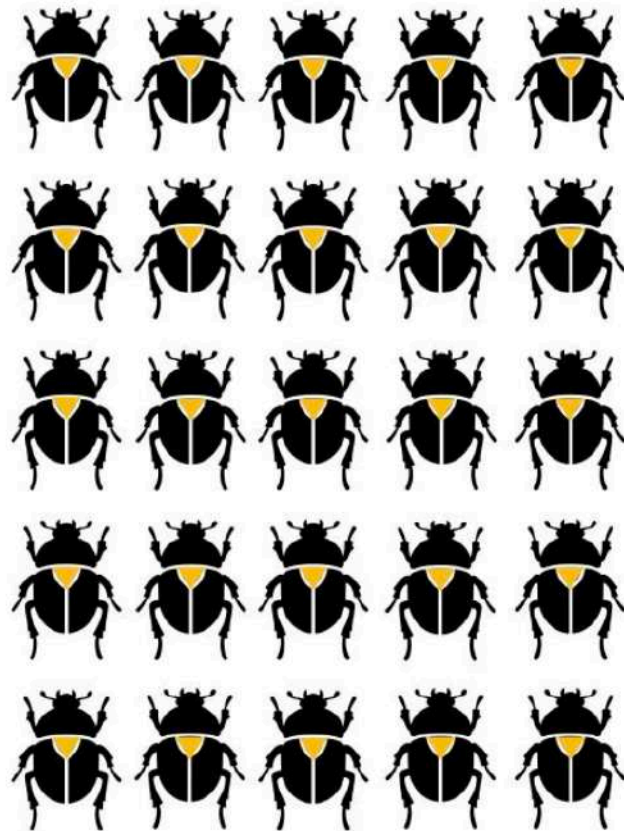
We are looking at data from two Galapagos islands, Marchena and Genovesa. Some of the animal species present on both islands show differences in colouring.



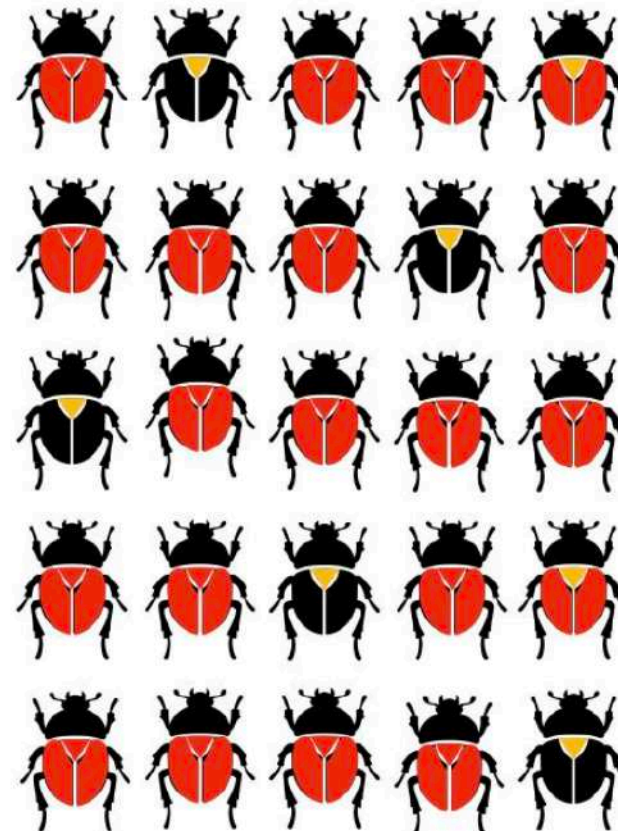
THE EXPERIMENTS

You will be shown a representative sample of a particular species from both islands (Jumping Spiders, Hide Beetles and Tree Frogs). The sample from Marchena will always be on the left side of the screen, the sample from Genovesa on the right side.

Marchena Hide Beetles



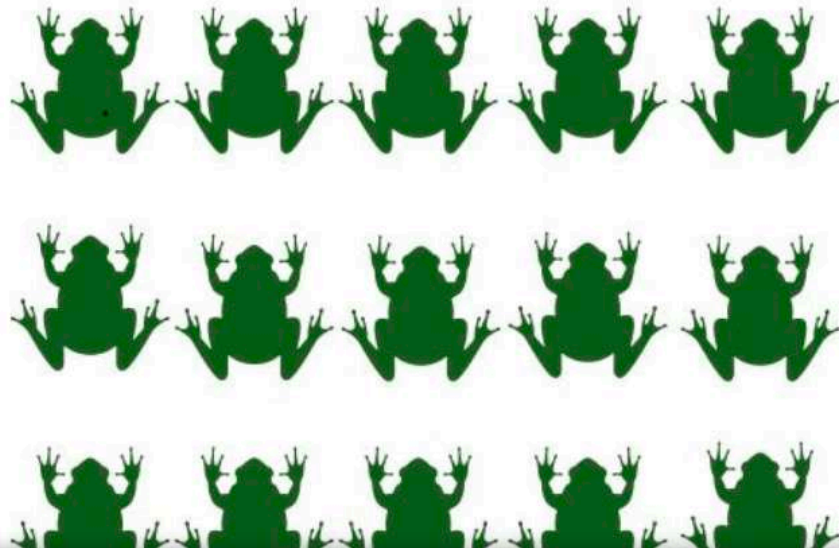
Genovesa Hide Beetles



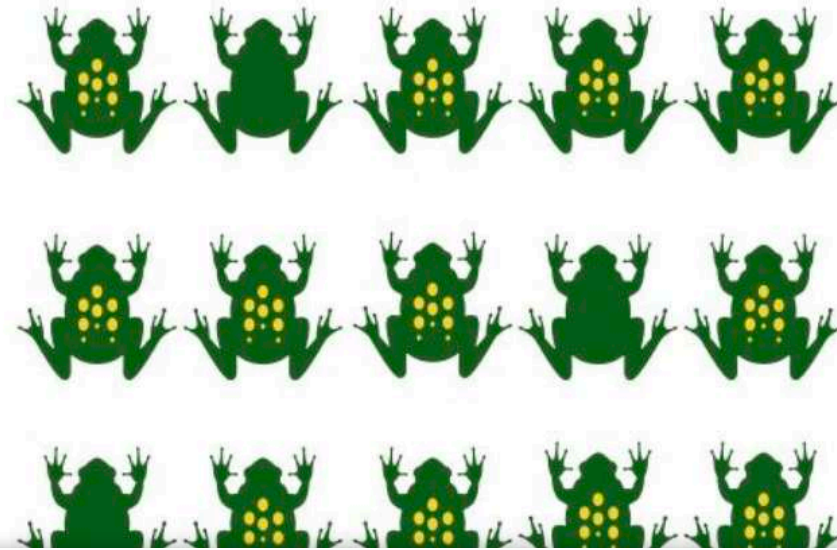
Below the sample you will see a sentence. You are asked to judge, using a slider bar, whether you can assert the sentence to describe the variety of the species living on Genovesa.

THE EXPERIMENTS

Marchena Tree Frogs



Genovesa Tree Frogs



Can you say the following to describe Tree Frogs from Genovesa?

Tree Frogs from Genovesa have yellow dots.

not at all

0

1

2

3

4

certainly

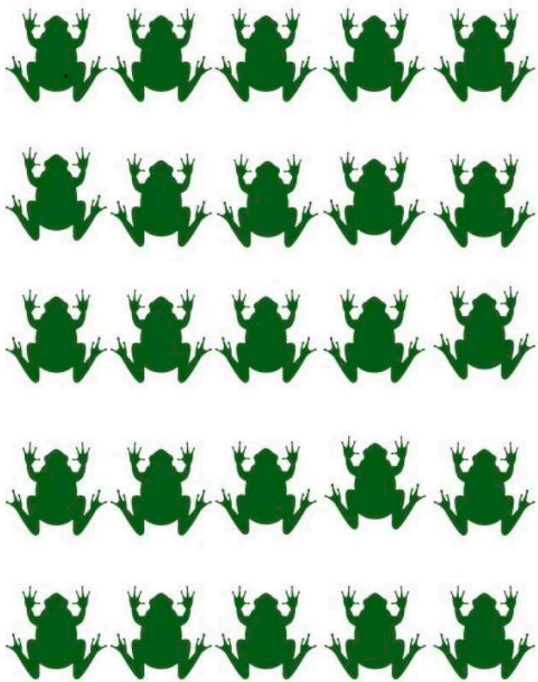
5

.

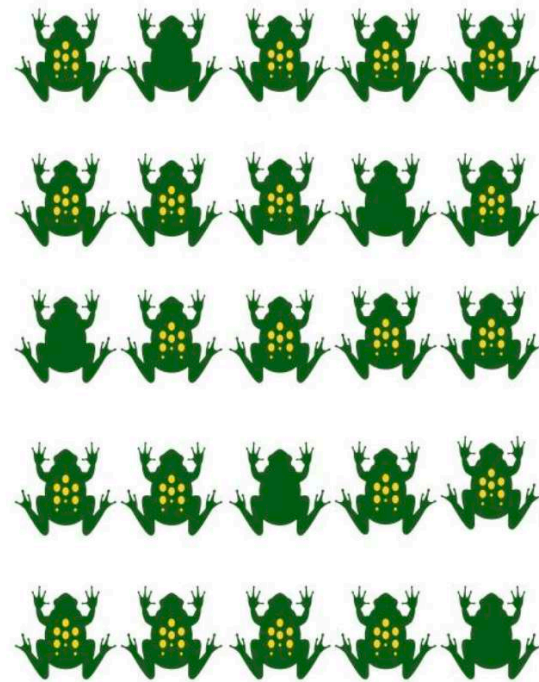


THE EXPERIMENTS

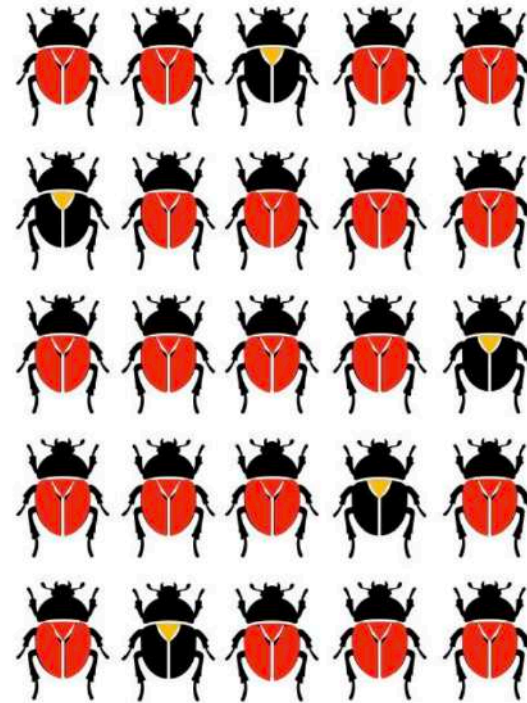
Marchena Tree Frogs



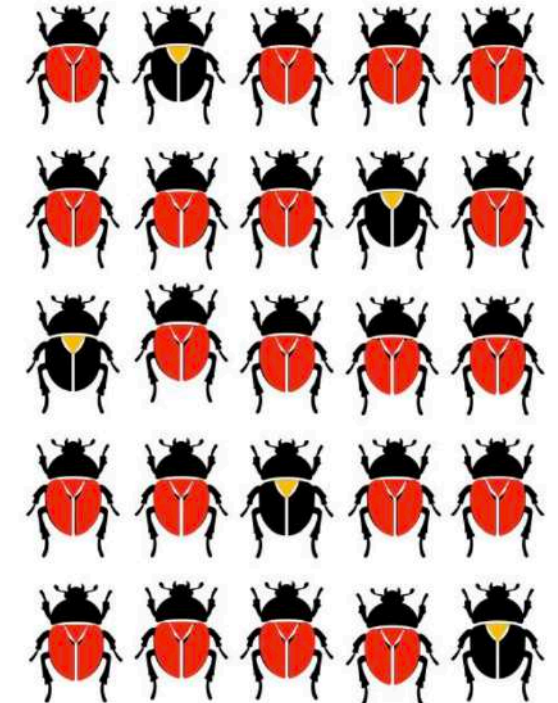
Genovesa Tree Frogs



Marchena Hide Beetles



Genovesa Hide Beetles

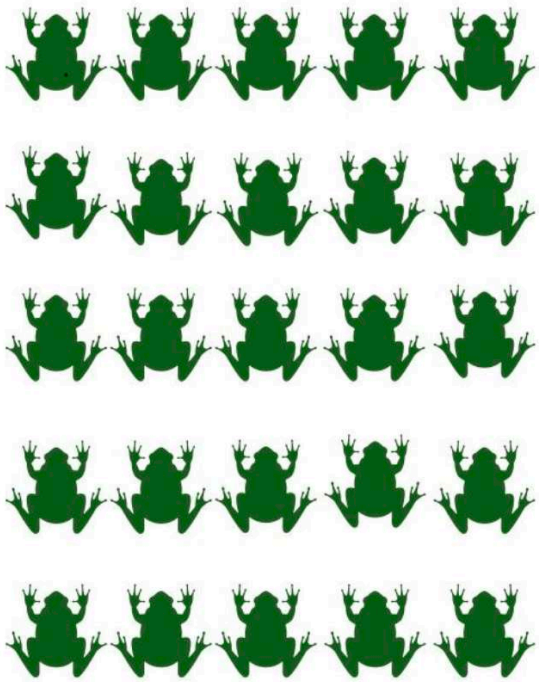


THE EXPERIMENTS

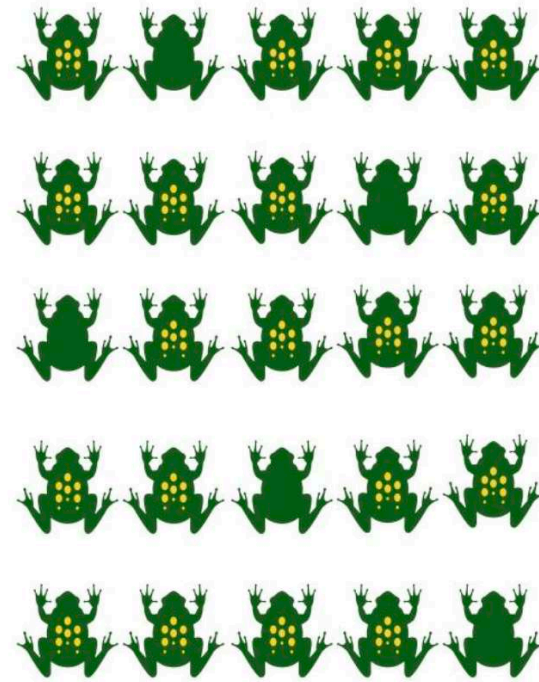
- **Relevance of contrast**
 - *H0: no interaction with contrast*
- **Continuous dependence on frequency of observation**
 - *H0: no interaction with probability*
- **Appropriateness of contingency as measure**
 - *confidence intervals for appropriateness of measure*

STUDY 1

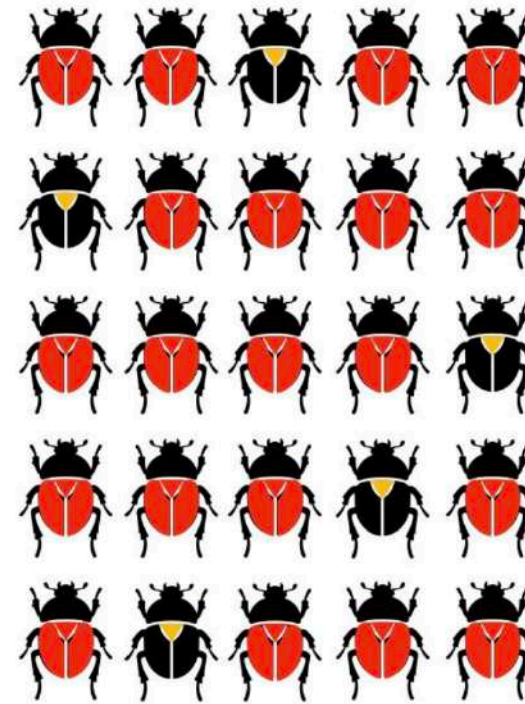
Marchena Tree Frogs



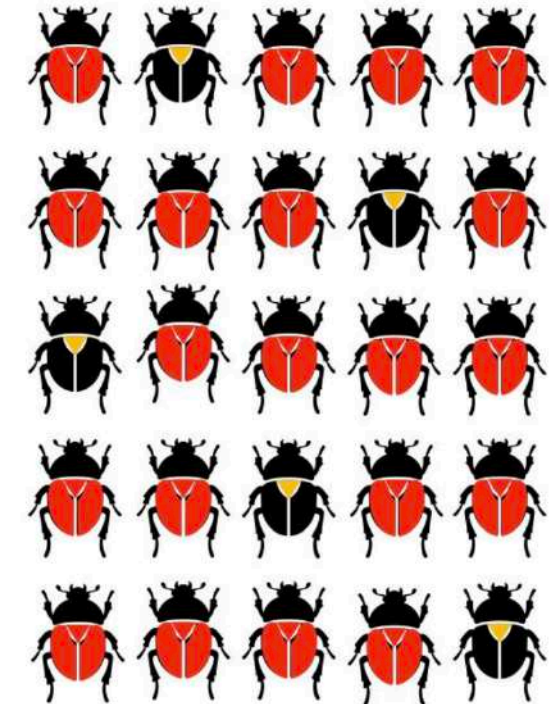
Genovesa Tree Frogs



Marchena Hide Beetles



Genovesa Hide Beetles



contrastive condition:

- $P(f|G) = 80\%$
- $P(f|Alt(G)) = 0\%$

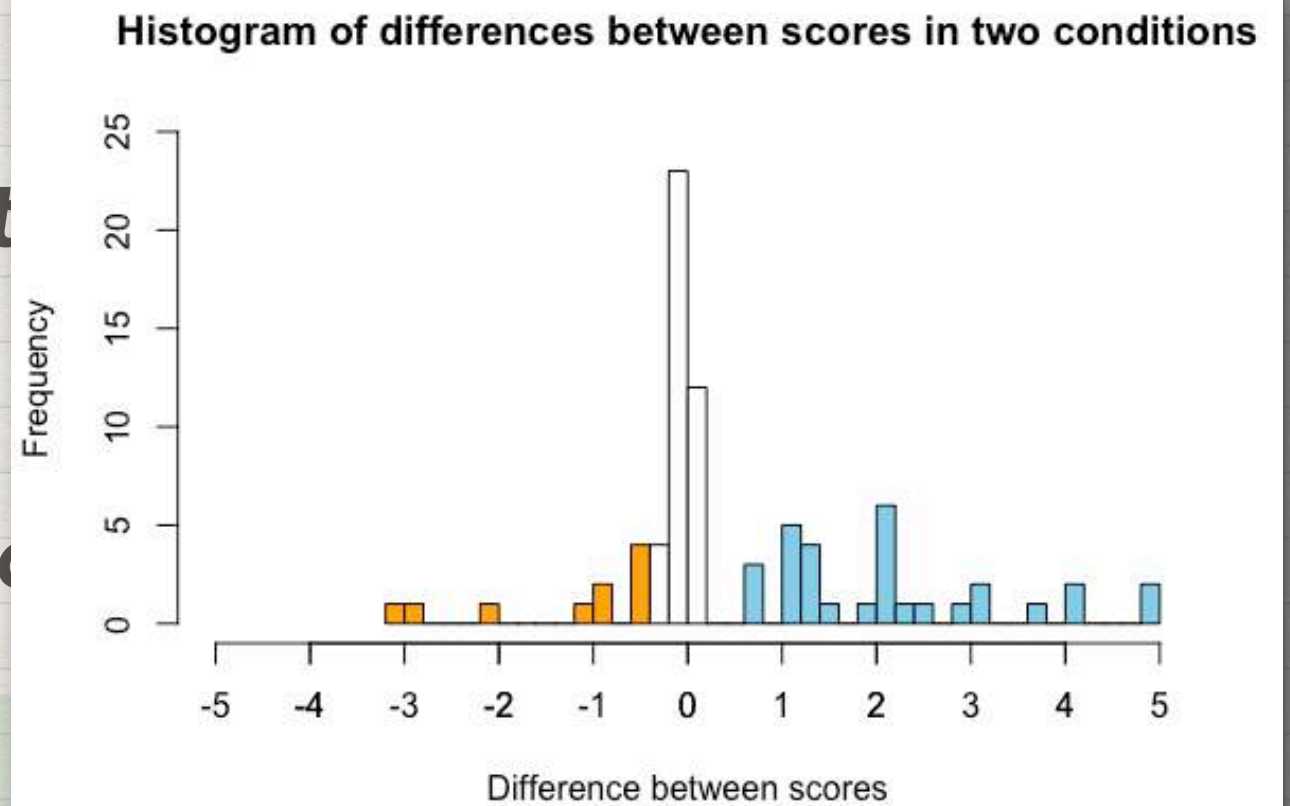
non-contrastive condition:

- $P(f|G) = 80\%$
- $P(f|Alt(G)) = 80\%$

(Study-details: Qualtrics, Prolific, 79 participants, pre-screened)

STUDY 1- RESULTS

- *Relevance of contrast*
 - *JASP $BF_{10} = 104$*
- *Appropriateness of c*



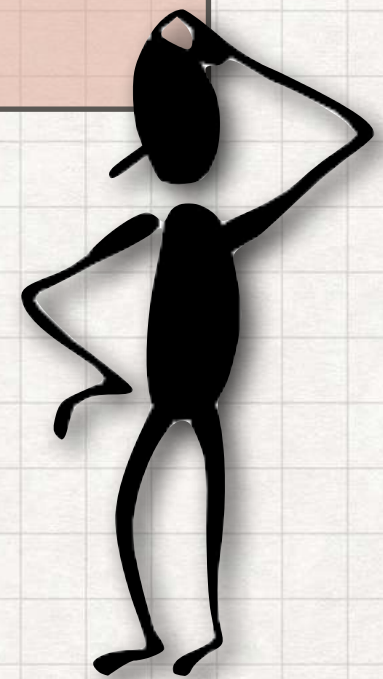
	prediction		
contrastive	4.5	3.51	3.27 - 3.74
non-contrastive	2.5	2.8	2.54 - 3.21

What if some participants don't take given alternative into account?

GENERIC SENTENCES

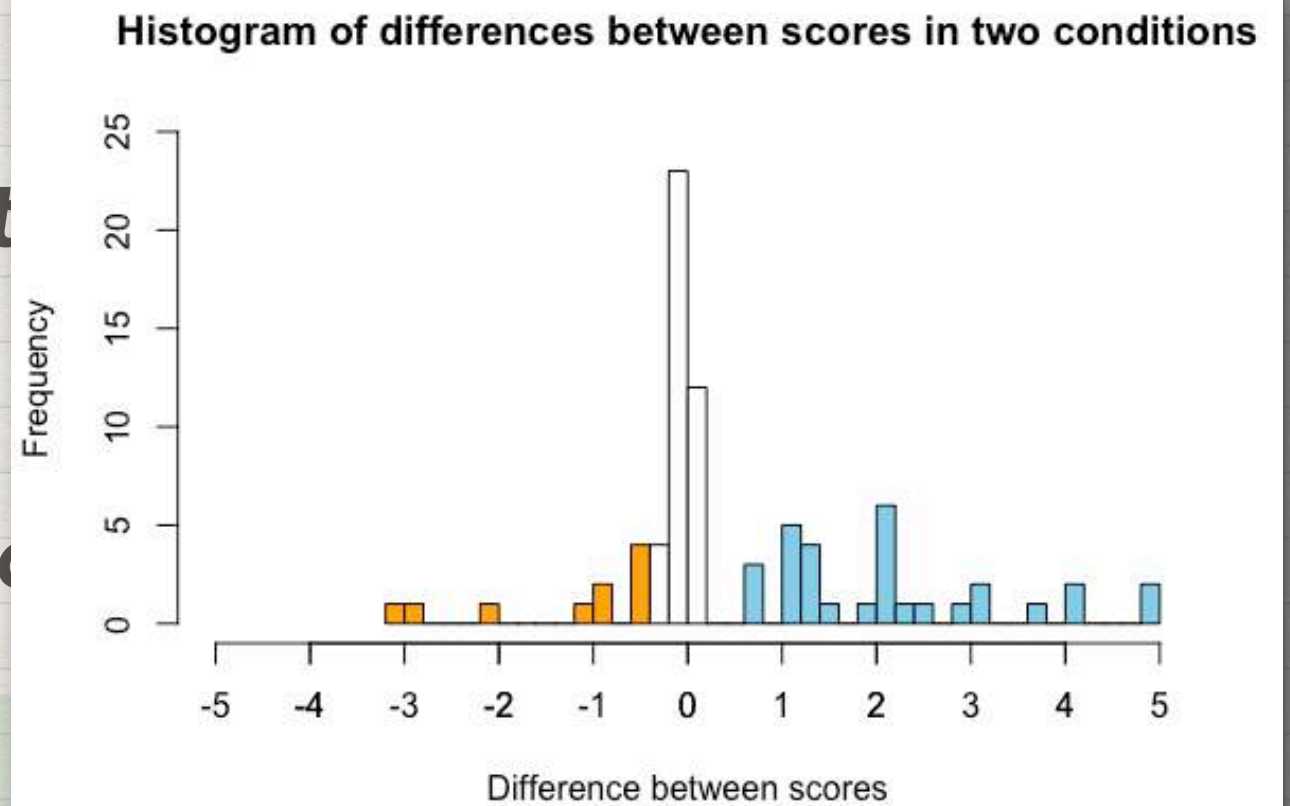
Assertability of
generic sentences = Strength of
association

$$\text{Ass}(G_are_f) = P(f|G) - P(f|Alt(G))$$



STUDY 1- RESULTS

- *Relevance of contrast*
 - *JASP $BF_{10} = 104$*
- *Appropriateness of c*



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STUDY 1- RESULTS

- **Relevance of contrast**

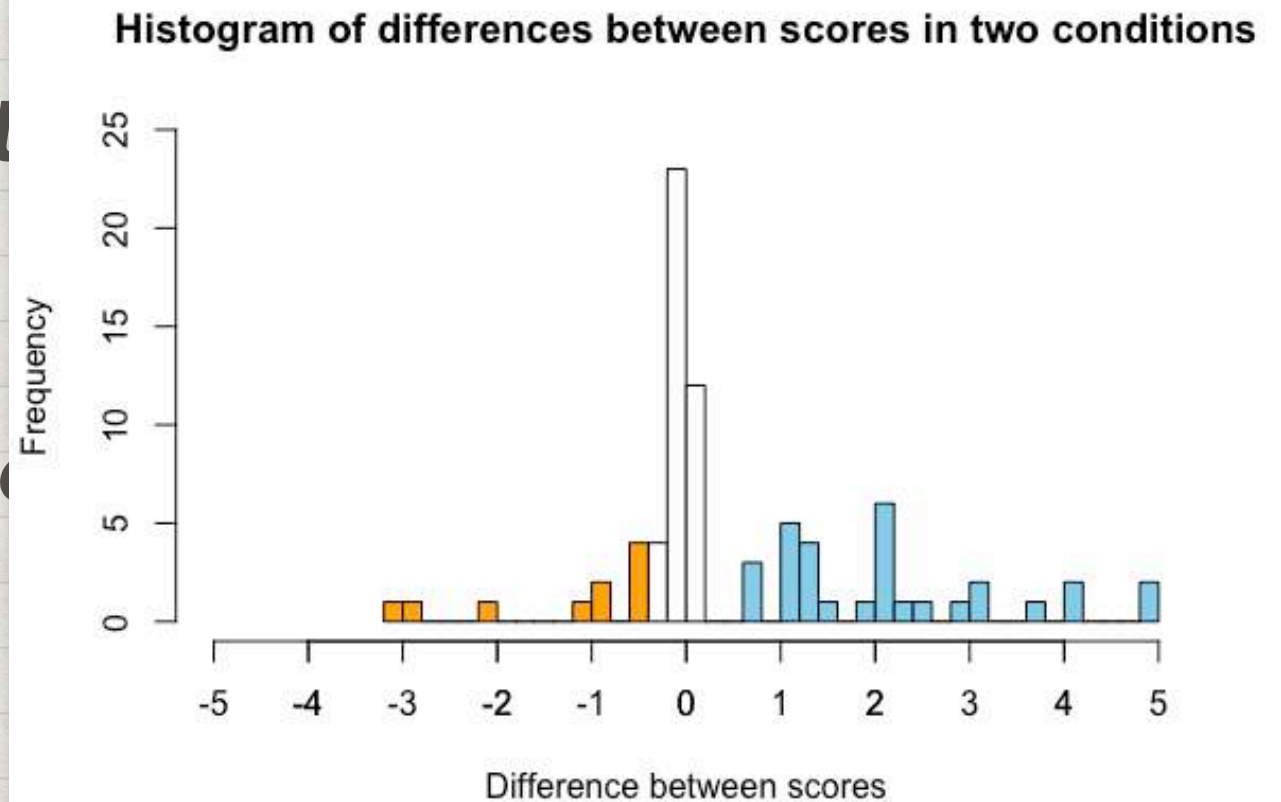
 - $JASP BF_{10} = 104$

- **Appropriateness of contingency as measure**

		prediction	mean	confidence-
no alt	contrastive	4	3.4	2.98 - 3.71
(51%)	non-contrastive	4	3.35	3.02 - 3.77
alt	contrastive	4.5	3.86	3.57 - 4.14
(38%)	non-contrastive	2.5	1.72	1.28 - 2.15

STUDY 1- DISCUSSION

- *Relevance of contrast*
 - *confirmed*
- *Appropriateness of contrast*
 - *Weakly confirmed*



Issues

- *relatively low assertability value for highly assertable generics*
- *relatively low assertability values for weakly assertable generics*
- *substantial variation in the contrastive group*

STUDY 1- DISCUSSION

- *Relevance of contrast*
 - *confirmed*
- *Appropriateness of contingency as measure*
 - *Weakly confirmed*

Problems with the set-up

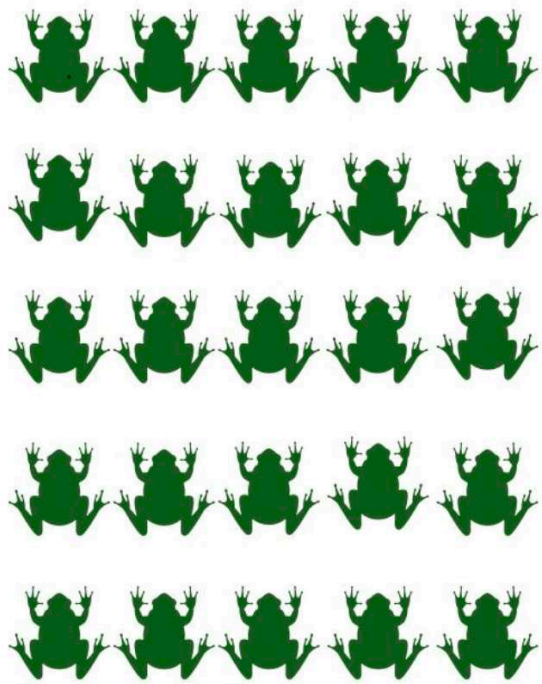
- *the matter of the interval translation*
- *the matter of relevant alternatives*

STUDY 2

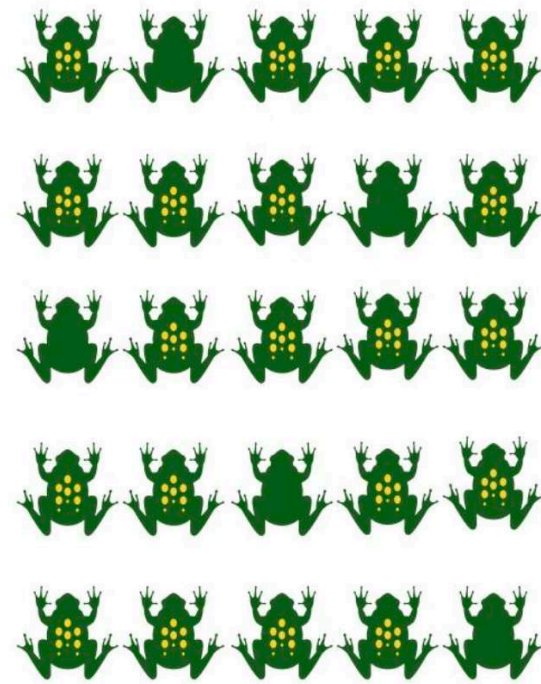
- **Relevance of contrast**
 - *H0: no interaction with contrast*
- **Continuous dependence on frequency of observation**
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- **Appropriateness of contingency as measure**
 - *confidence intervals for appropriateness of measure*

STUDY 2

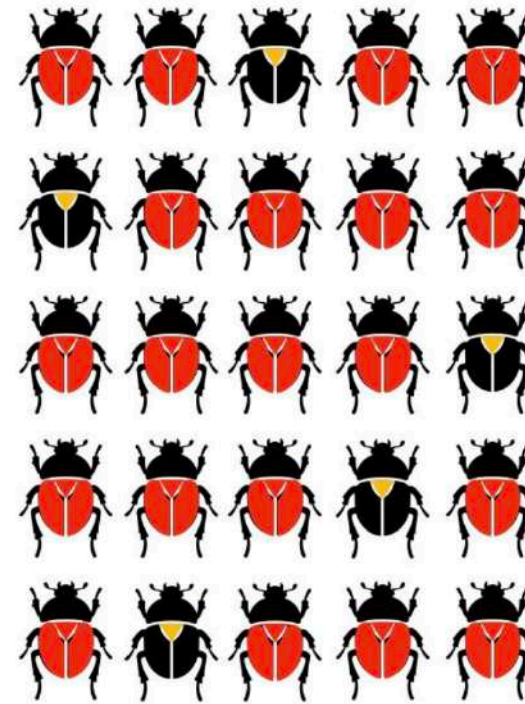
Marchena Tree Frogs



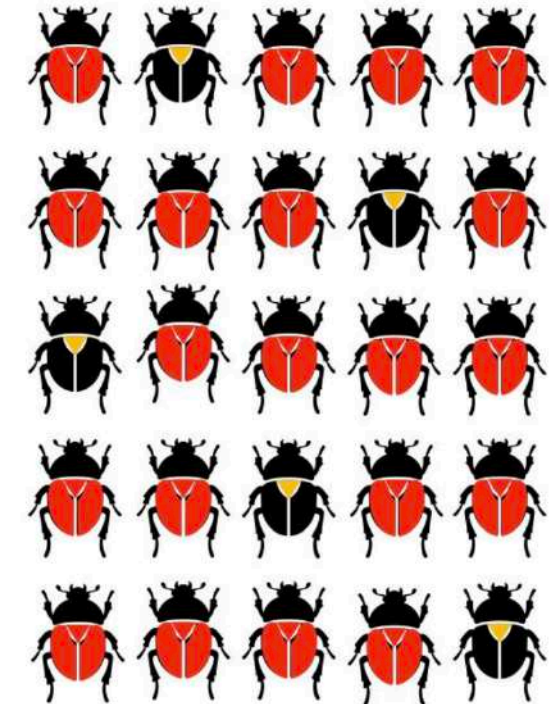
Genovesa Tree Frogs



Marchena Hide Beetles



Genovesa Hide Beetles



contrastive condition:

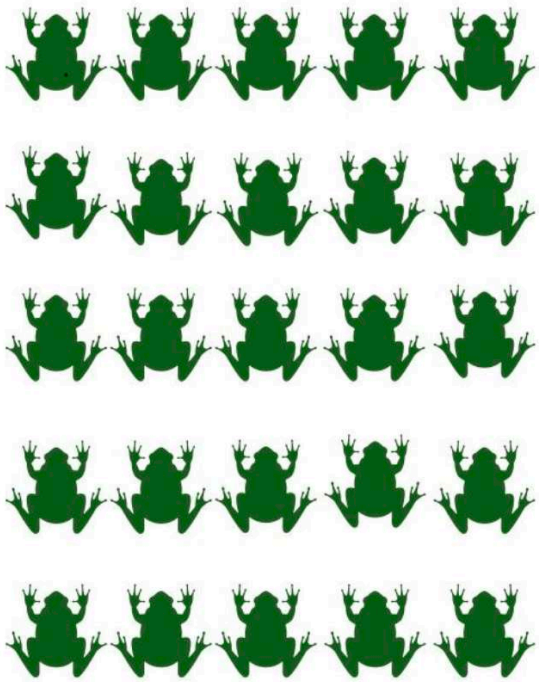
- $P(\text{f}|G) = 80\%$ / $P(\text{f}|A \neq G) = 0\%$

non-contrastive condition:

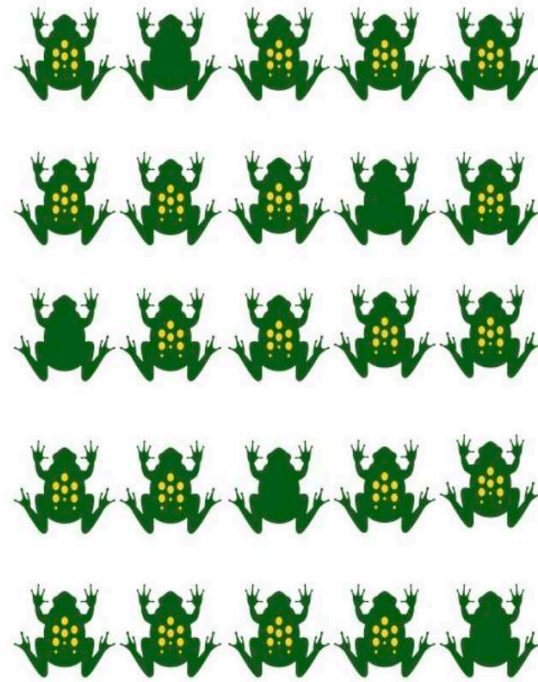
- $P(\text{f}|G) = 80\%$ / $P(\text{f}|A \neq G) = 80\%$

STUDY 2

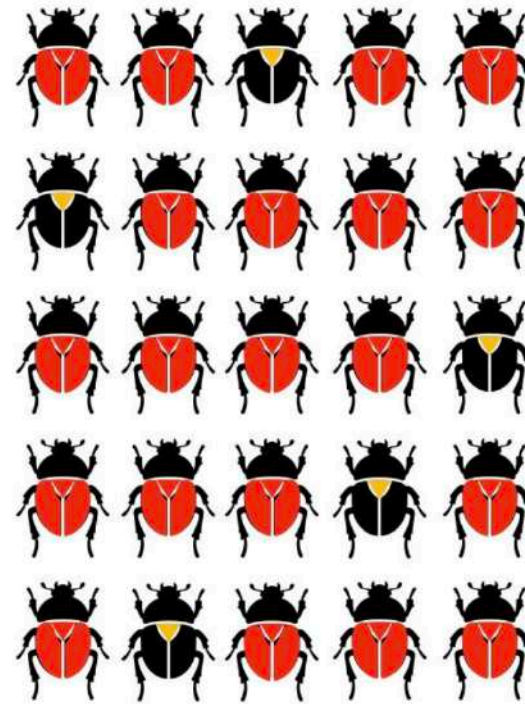
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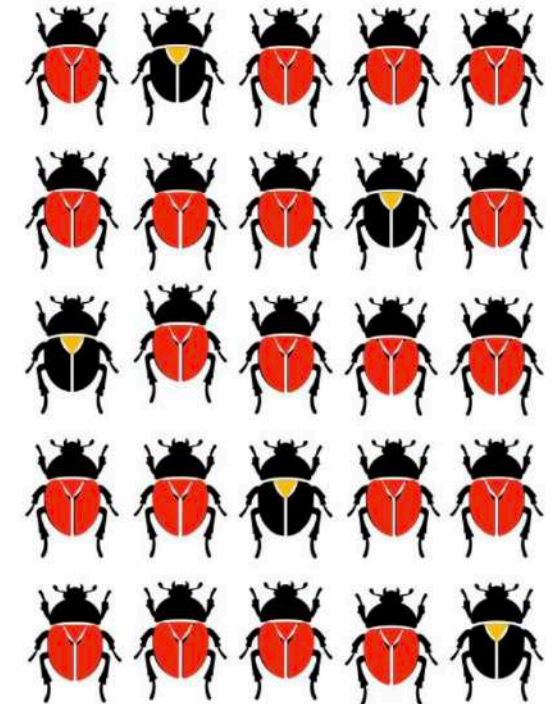
Genovesa Tree Frogs



Marchena Hide Beetles



Genovesa Hide Beetles



contrastive condition:

- $P(f|G) = 54\%$ / $P(f|Alt(G)) = 0\%$
- $P(f|G) = 68\%$ / $P(f|Alt(G)) = 0\%$
- $P(f|G) = 80\%$ / $P(f|Alt(G)) = 0\%$
- $P(f|G) = 92\%$ / $P(f|Alt(G)) = 0\%$

non-contrastive condition:

- $P(f|G) = 54\%$ / $P(f|Alt(G)) = 54\%$
- $P(f|G) = 68\%$ / $P(f|Alt(G)) = 68\%$
- $P(f|G) = 80\%$ / $P(f|Alt(G)) = 80\%$
- $P(f|G) = 92\%$ / $P(f|Alt(G)) = 92\%$

(Study-details: Qualtrics, Prolific, 375 participants, pre-screened)

STUDY 2- RESULTS

condition	$P(f G)$	group Con			group noCon		
		Mean	SD	N	Mean	SD	N
contrast, $P(f Alt(G)) = 0$	54%	3.34	1.04	37	2.80	1.01	49
	68%	3.67	0.69	35	2.81	1.32	43
	80%	3.79	1.20	32	3.43	1.22	58
	92%	4.06	0.81	31	3.59	1.30	59
no contrast, $P(f Alt(G)) = P(f G)$	54%	1.71	1.15	37	2.78	1.00	49
	68%	2.20	0.91	35	2.77	1.27	43
	80%	1.89	1.40	32	3.41	1.21	58
	92%	2.27	1.38	31	3.58	1.32	59

No Alt-Group (noCon)

- No effect of contrast
- Strong effect of proportion
- No interaction contrast-proportion

➔ But notice jump between 68% and 80%!

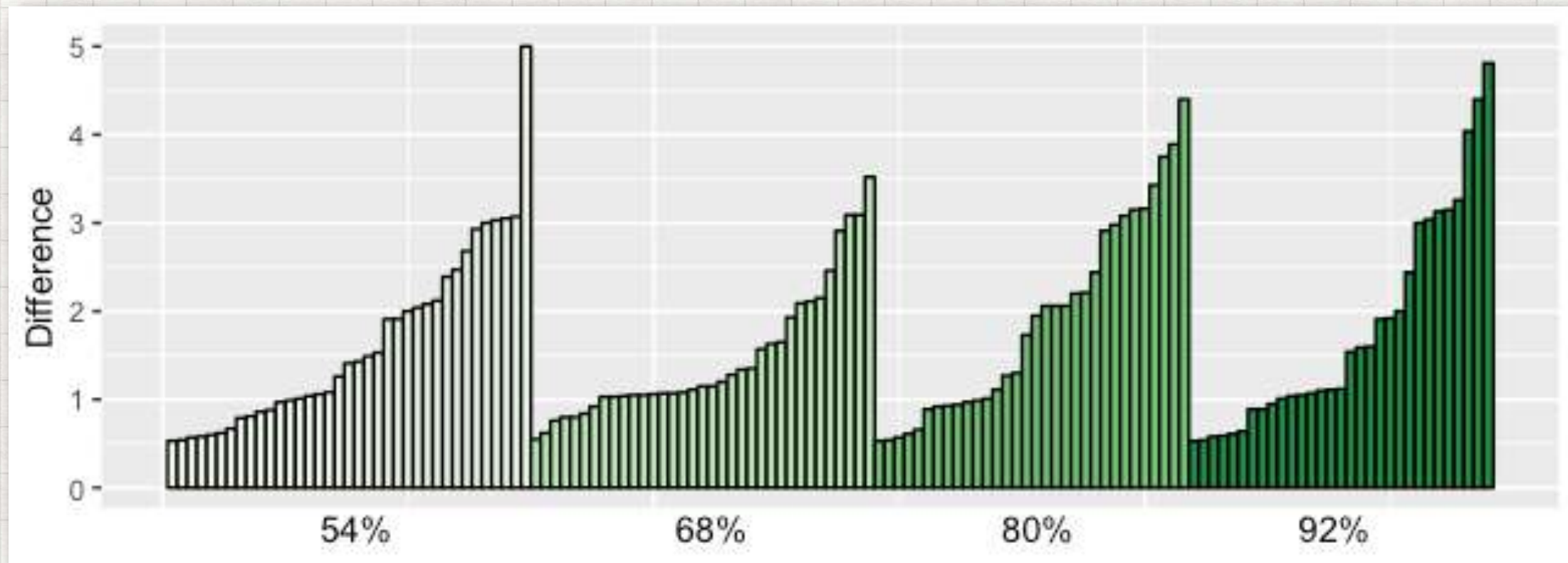
STUDY 2- RESULTS

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Alt-Group (Con)

- Extreme evidence for effect of contrast
- Inconclusive evidence for effect of proportion
- Modest evidence against interaction contrast-proportion

STUDY 2- RESULTS



Alt-Group (Con)

- Extreme evidence for effect of contrast
- Inconclusive evidence for effect of proportion
- Modest evidence against interaction contrast-proportion

STUDY 2- DISCUSSION

- ***Relevance of contrast***
 - *confirmed*
- ***Continuous dependence on frequency of observation***
 - *partly confirmed, but not linear*
- ***Appropriateness of contingency as measure***
 - *weakly confirmed*

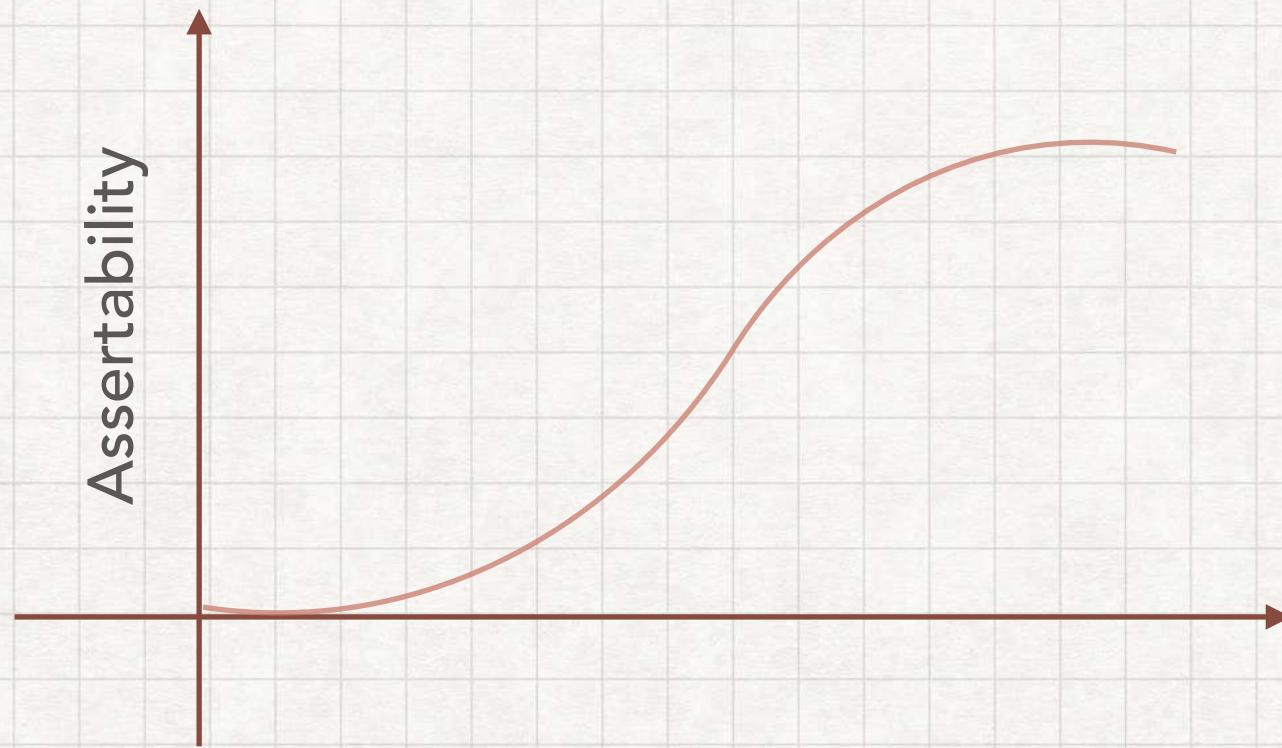
STUDY 2- DISCUSSION

Issues

- *relatively low assertability value for highly assertable generics*
- *relatively low assertability values for weakly assertable generics in Alt-group*
- *huge variation in the Alt-group*
- *weak threshold effect for Alt-group*
- *huge variation in non-contrastive condition for Alt-group, even between different probabilities*
- *The higher $P(f|G)$, the less alternatives seem to matter.*

DISCUSSION

FIRST ATTEMPT AT EXPLAINING THE DATA



PLUS

- *Explains variation*
- *Explains threshold*
- *Explains slow approach of ceiling values*
- *Explains low values for weakly assertable generics*

- Mixing and absolute and a relative reading

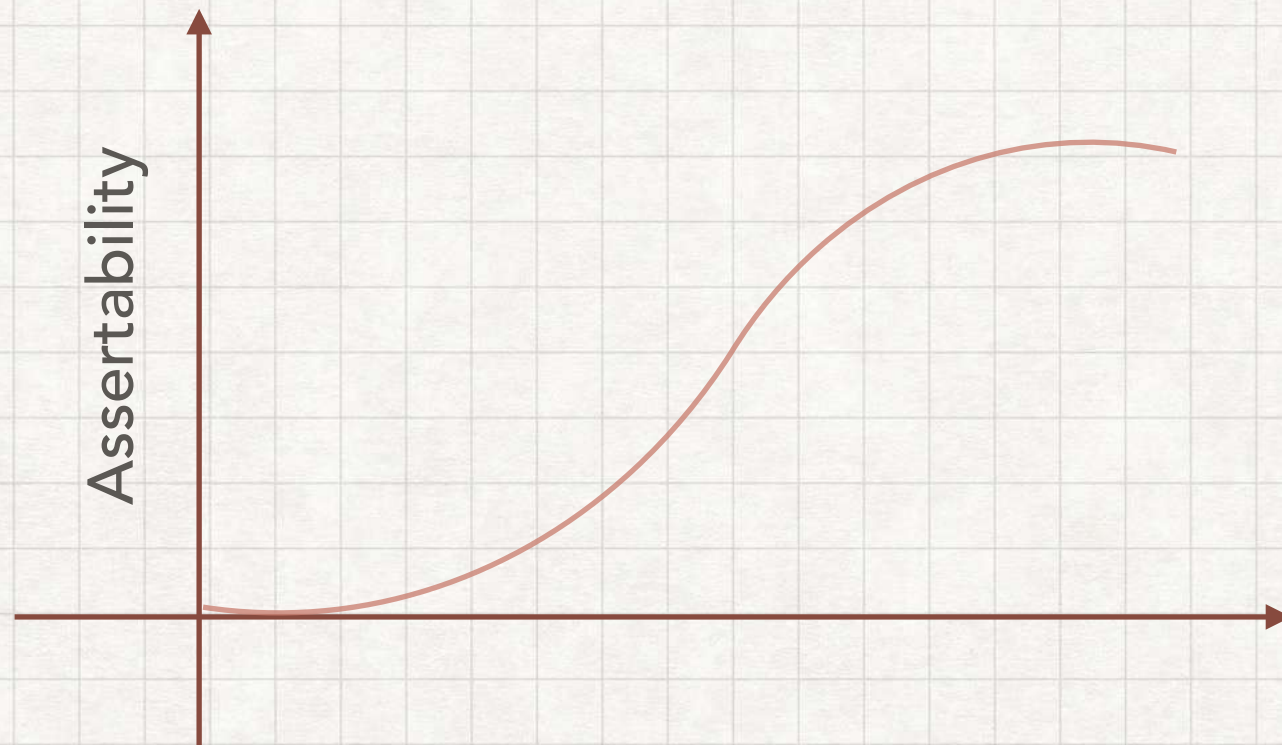
$$\frac{1}{1 + e^{\beta(1-\alpha)x - (1-\alpha)y}}$$

↑ steepness of curve

↑ contingency

↑ probability

FIRST ATTEMPT AT EXPLAINING THE DATA



- Mixing and absolute and a relative reading

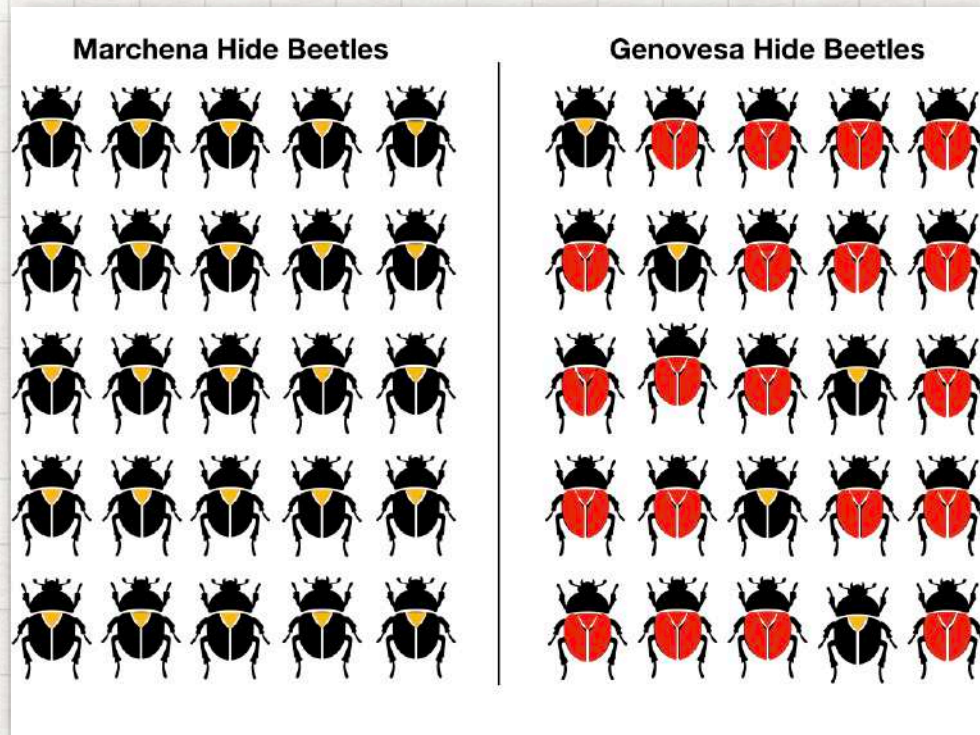
$$\frac{1}{1 + e^{\beta(1-\alpha)x - (1-\alpha)y}}$$

↑ steepness of curve
↑ contingency
↑ probability

BUT

- *Too much flexibility*
- *What do the fitting variables stand for?*
- *Why mixing two readings?*
- *Why have two readings in the first place?*

SECOND ATTEMPT AT EXPLAINING THE DATA



- Take into account dependency on what counts as alternative

(1) *Tree bugs from Genovesa have red wings.*

Alternatives considered

1. All alternative animals
2. All other bugs
3. Tree bugs from Marchena

prior

0.0001

0.2

?

$P(f|Alt(G))$

after contrastive picture

≈ 0.0001

≈ 0.15

= 0

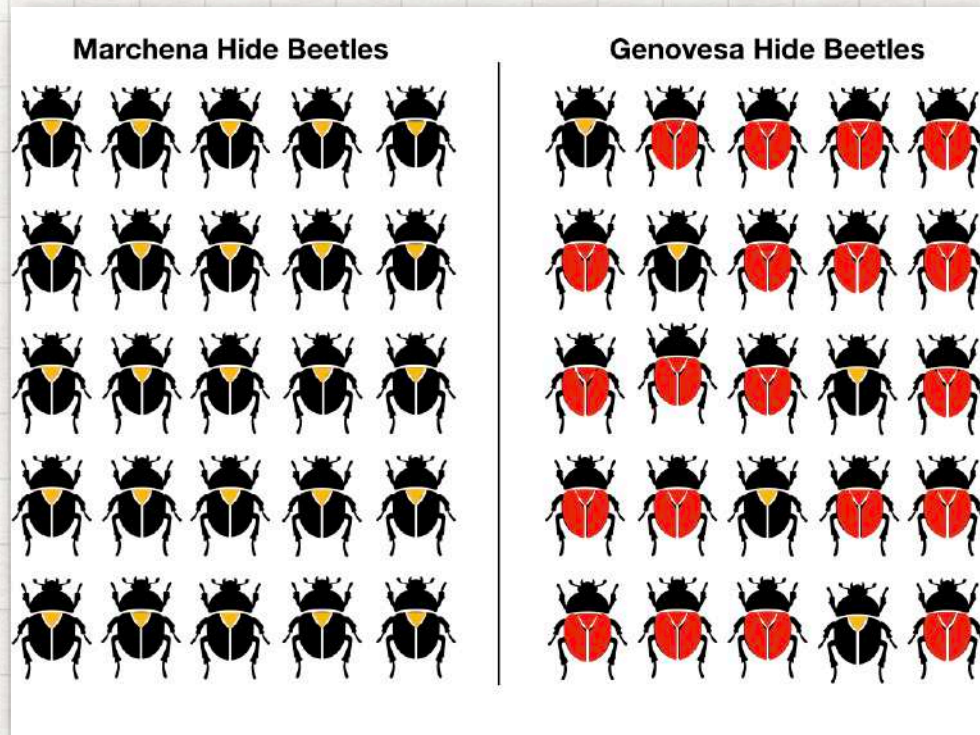
after non-contrastive picture

≈ 0.0001

≈ 0.25

= 0.8

SECOND ATTEMPT AT EXPLAINING THE DATA



- Take into account dependency on what counts as alternative

(1) *Tree bugs from Genovesa have red wings.*

Assertability of (1)

Alternatives considered

1. All alternative animals
2. All other bugs
3. Tree bugs from Marchena

contrastive condition

$$\approx P(\text{flG})$$

$$= P(\text{flG}) - 0.15$$

$$= P(\text{flG}) - 0$$

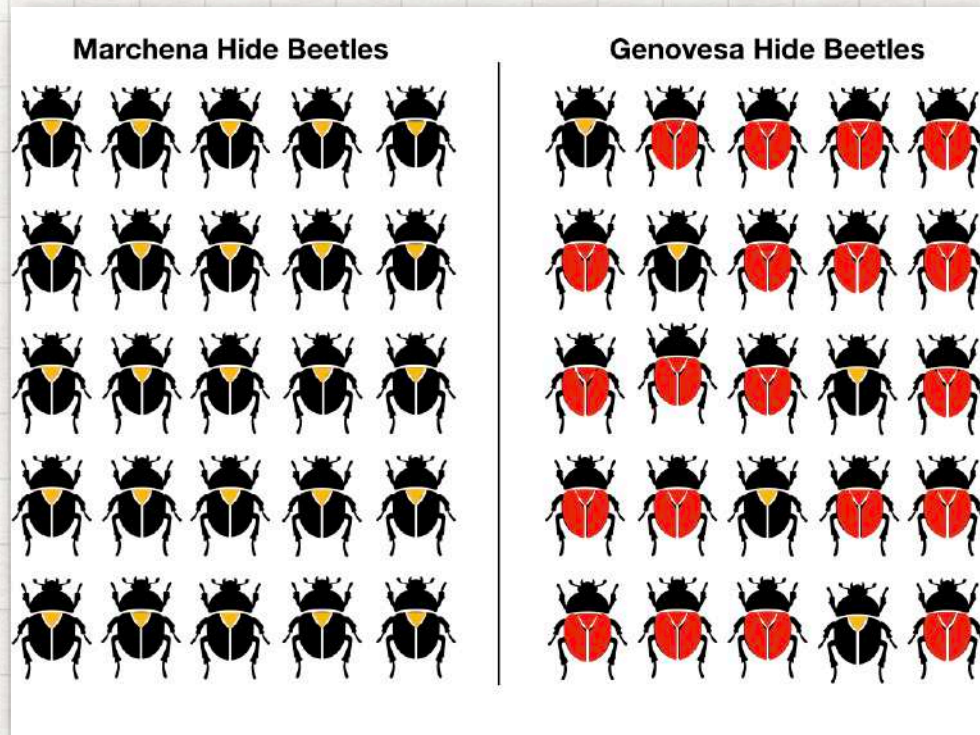
non-contrastive condition

$$\approx P(\text{flG})$$

$$= P(\text{flG}) - 0.25$$

$$= P(\text{flG}) - 0.8$$

SECOND ATTEMPT AT EXPLAINING THE DATA



- Take into account dependency on what counts as alternative

(1) Tree bugs from Genovesa have red wings.

Assertability of (1)

Alternatives considered

1. All alternative animals
2. All other bugs
3. Tree bugs from Marchena

contrastive condition

≈ 0.8

= 0.65

= 0.8

non-contrastive condition

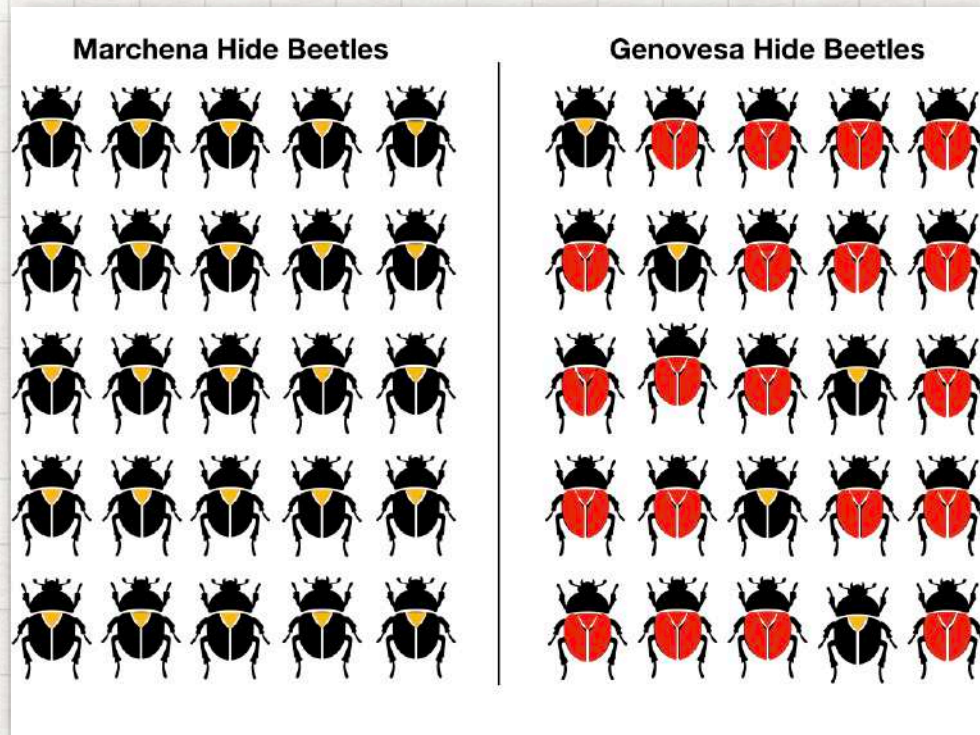
≈ 0.8

= 0.55

= 0

... and everything in-between.

SECOND ATTEMPT AT EXPLAINING THE DATA



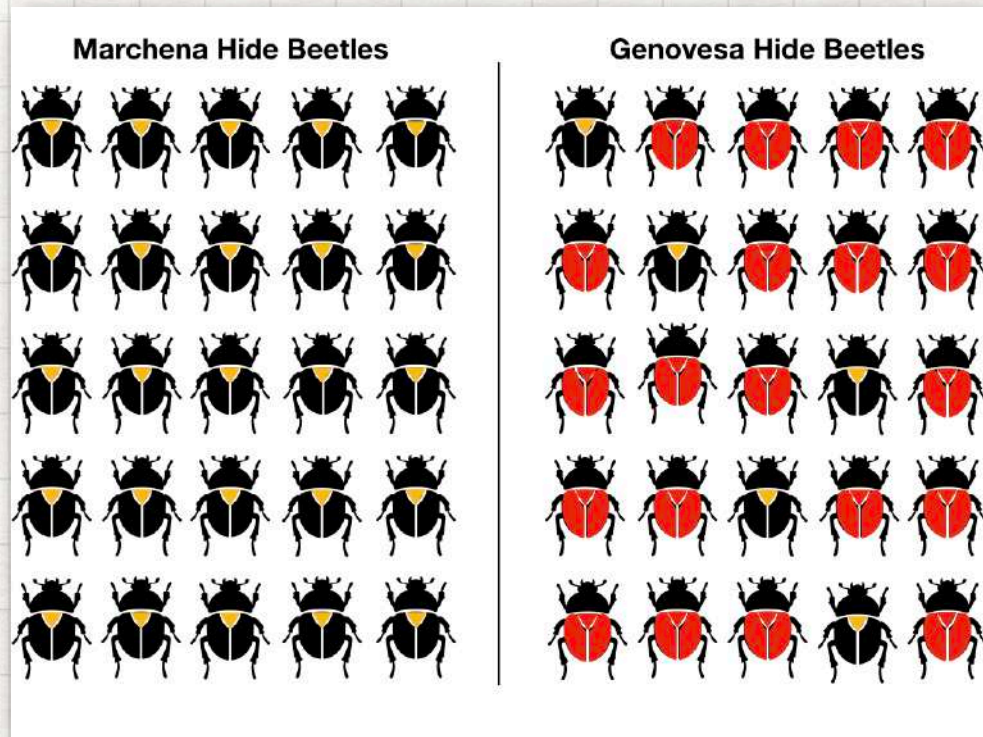
- Take into account dependency on what counts as alternative

(1) Tree bugs from Genovesa have red wings.

PLUS

- *Explains observation of two groups without assuming an ambiguity*
- *Explains variation, but now for real*
- *Explains lower value in case of high assertability*

SECOND ATTEMPT AT EXPLAINING THE DATA



- Take into account dependency on what counts as alternative

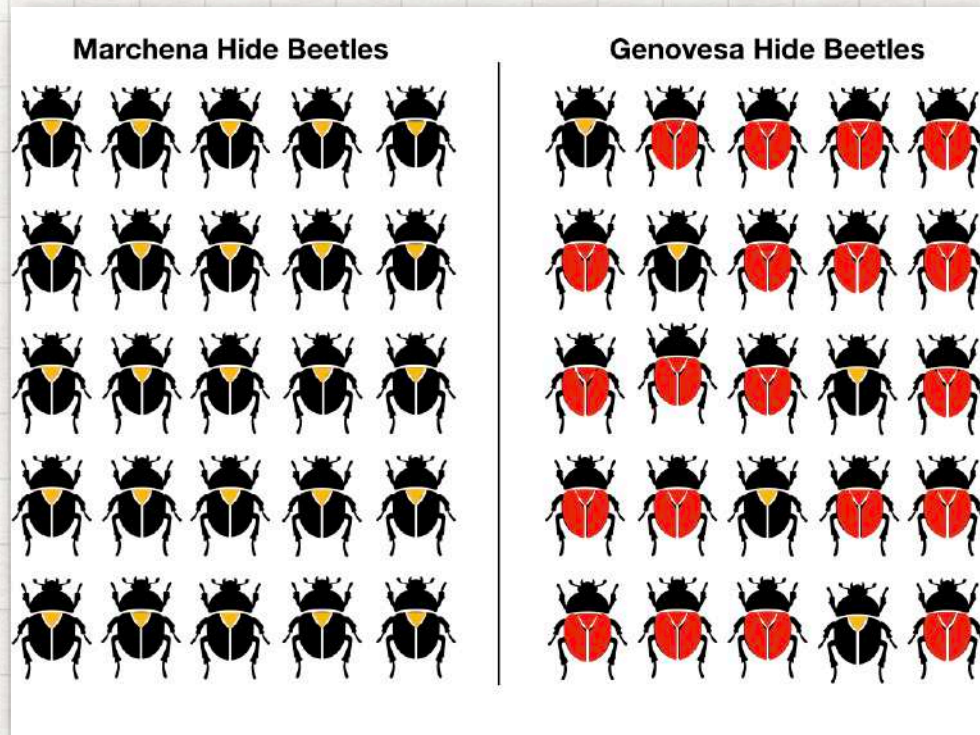
(1) Tree bugs from Genovesa have red wings.

BUT

- *We need to measure the prior.*
- *We need to test this for different types of group-feature combination.*
- *There are still observations unexplained by this attempt.*

WHAT NEXT?

SECOND ATTEMPT AT EXPLAINING THE DATA



- Take into account dependency on what counts as alternative

(1) Tree bugs from Genovesa have red wings.

BUT

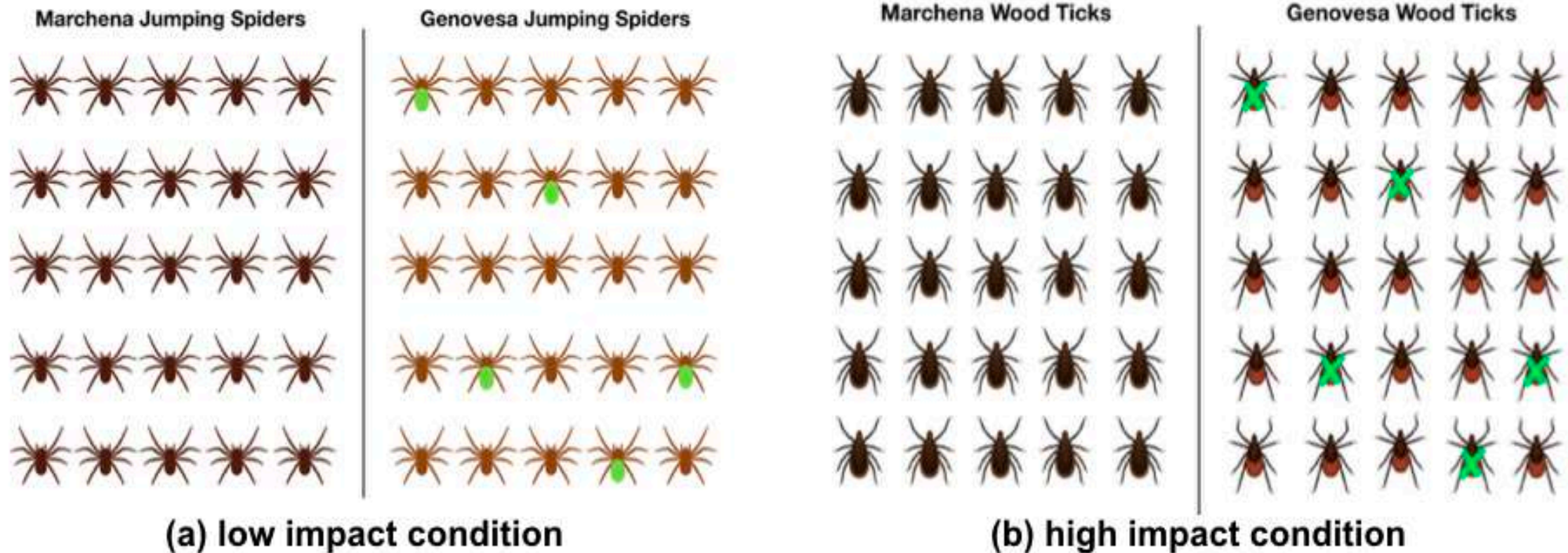
- *We need to measure the prior.*
- *We need to test this for different types of group-feature combination.*
- *There are still observations unexplained by this attempt.*

THE ROLE OF IMPACT

STRENGTH OF ASS. = DISTINCTIVENESS × IMPACT

(1) *Mosquitos carry malaria.* ✓

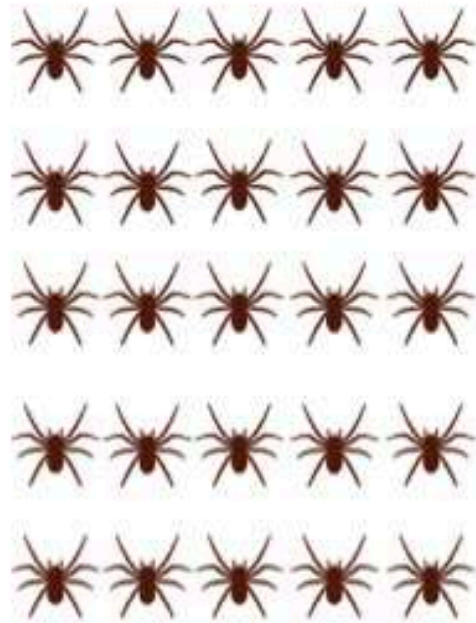
(2) *Pit-bulls are dangerous.* ✓



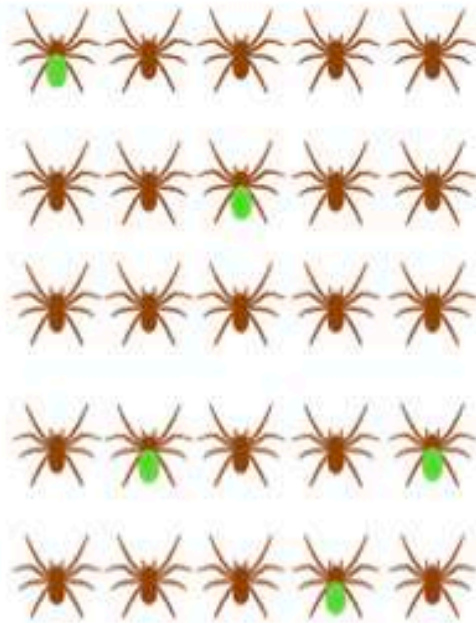
THE ROLE OF SEQUENTIAL LEARNING

- Teach the frequency information sequentially.

Marchena Jumping Spiders



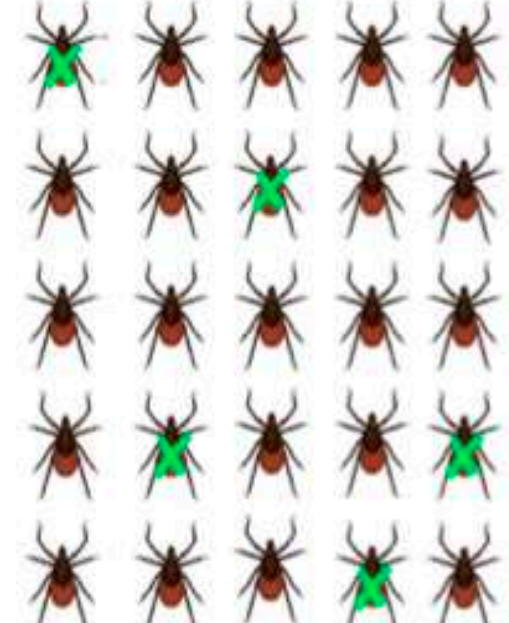
Genovesa Jumping Spiders



Marchena Wood Ticks

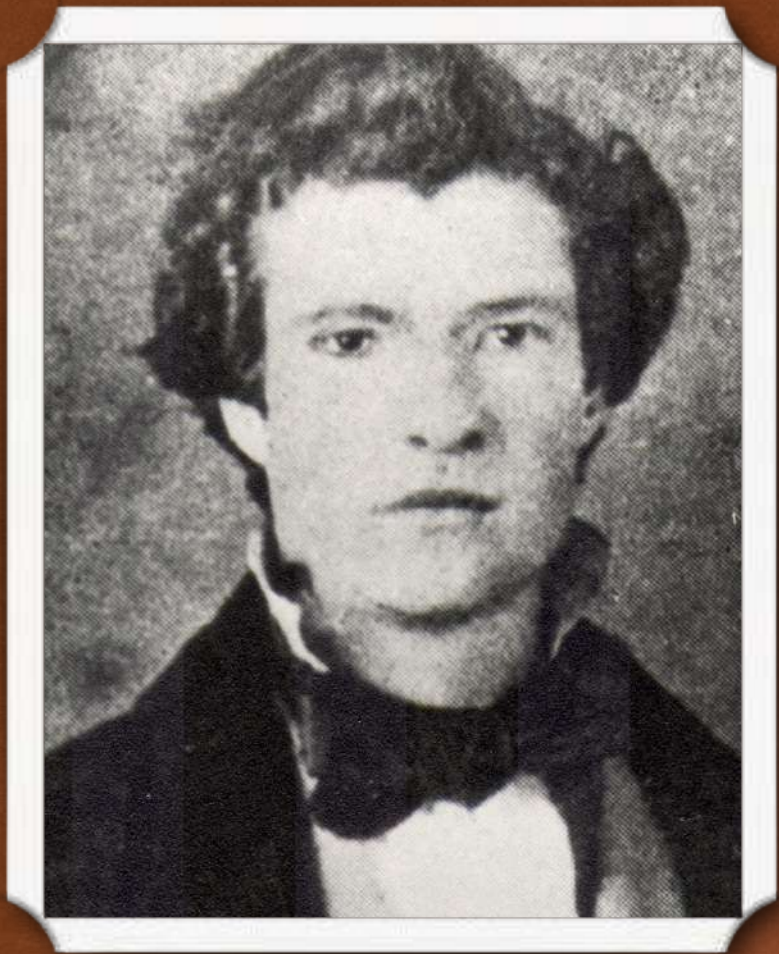


Genovesa Wood Ticks



(a) low impact condition

(b) high impact condition



*“All generalisations are false
- including this one.”*

— Mark Twain

Generics in contrast

A theory and some experiments

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