Free classification
and
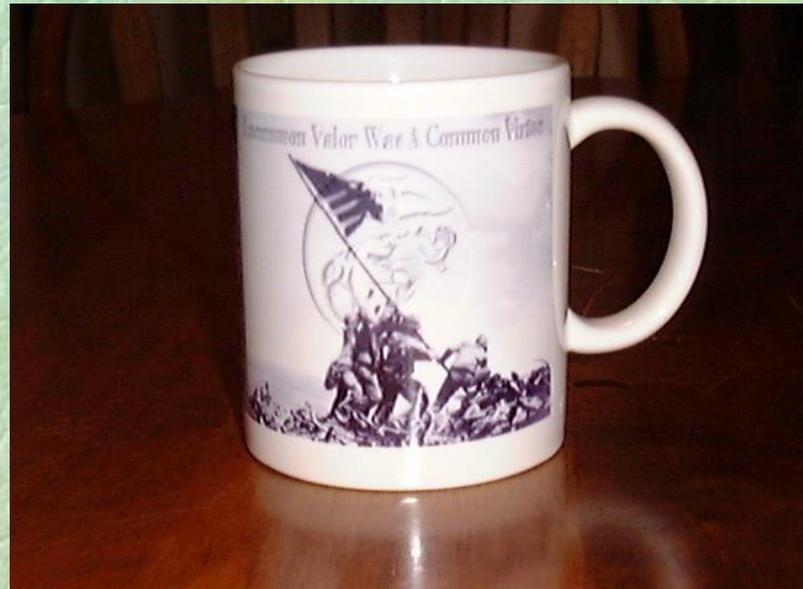# perceptual learning

Andy Wills
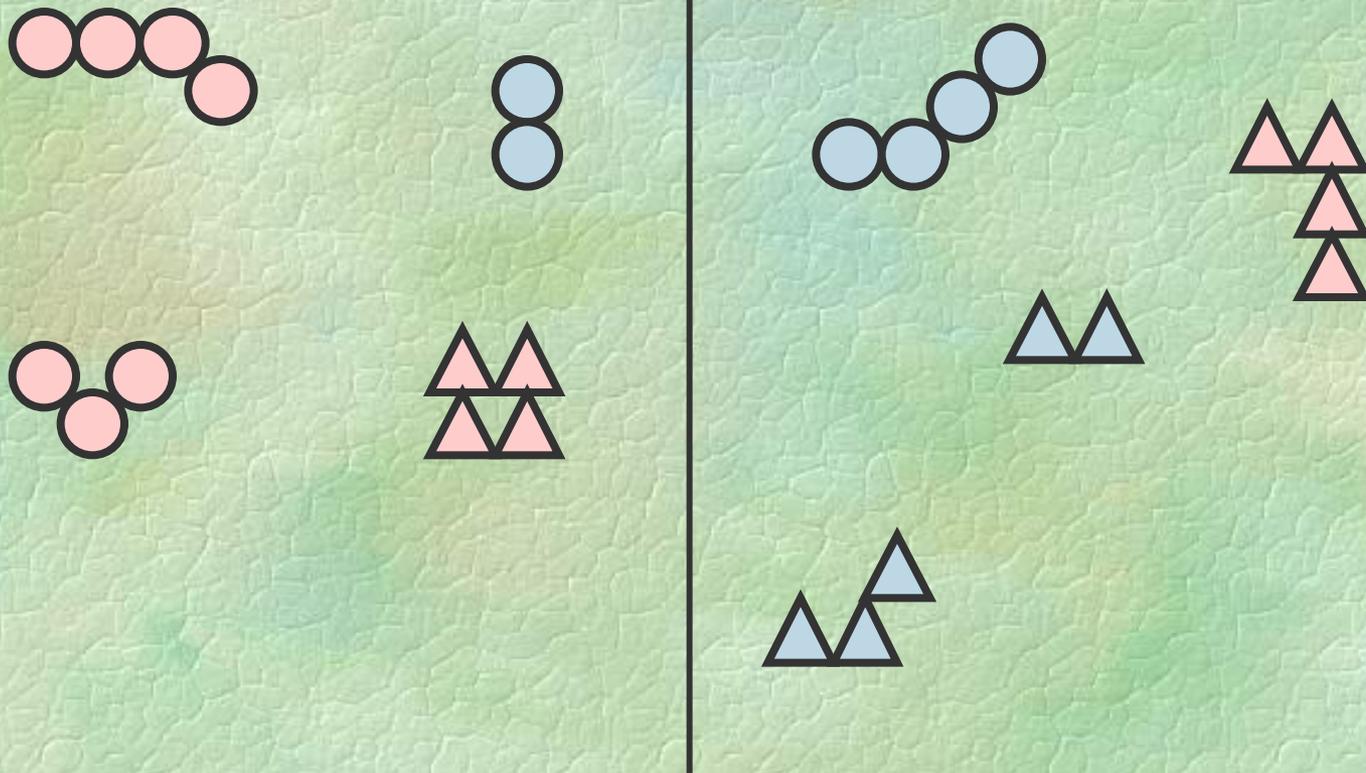
University of Exeter

Royal Holloway 28/01/04

Cup or mug?


☐ How do we do this?

Polymorphous concepts

☐ At least two of pink, symmetrical and circles.

Wittgenstein (1958)

"Consider for example the proceedings we call "games". I mean board games, card games, Olympic games, and so on. What is common to them all?-Don't say: 'There must be something in common, or they would not be called games - but look and see whether there is anything common to all. - For if you look at them you will not see something that is common to all, but similarities, relationships, and a whole series of them at that…I can think of no better expression to characterise these similarities than 'family resemblances'"
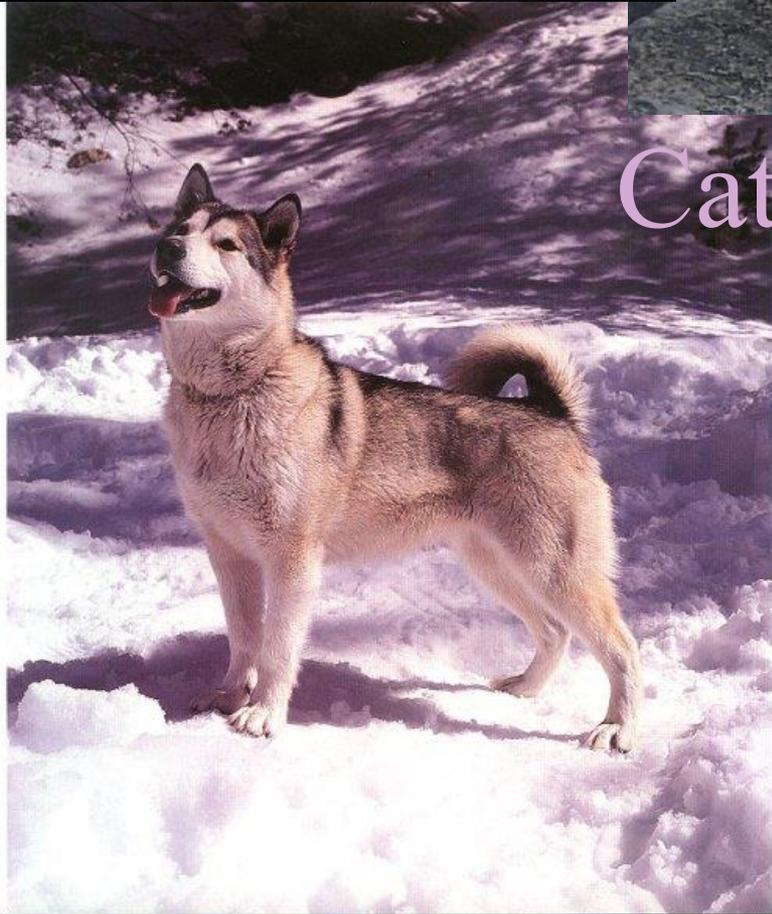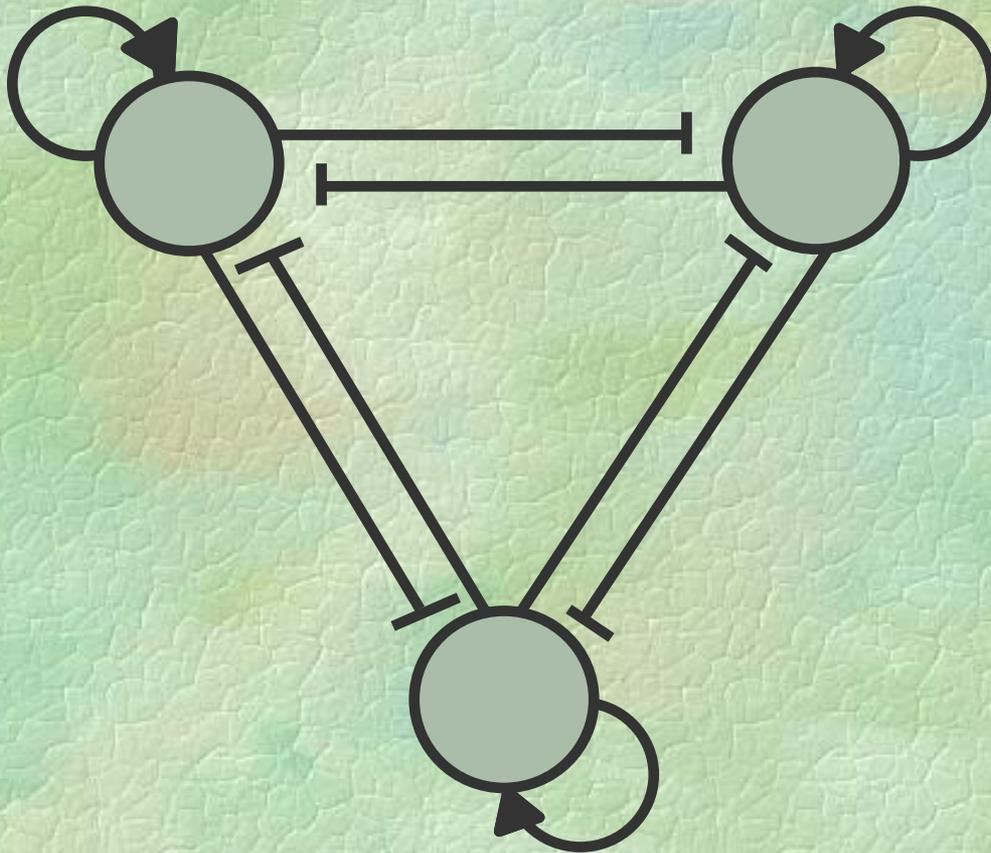
Cats and dogs

Categorical decisions

Gun = 0.5
Banana = 1.0
Gherkin = 0.1
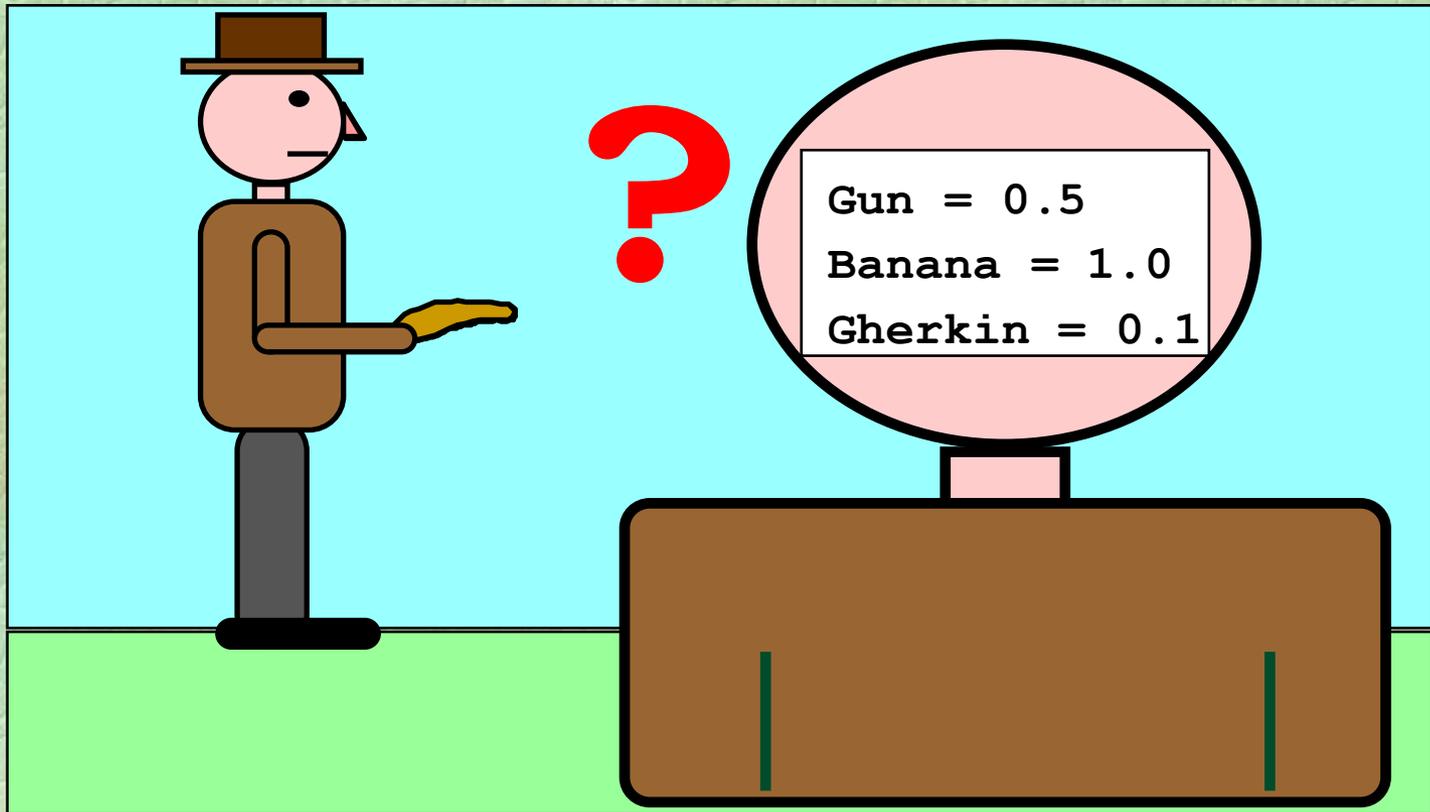
$$P(ba. : gu., ba., gh.) = \frac{v_{ba}}{v_{ba} + v_{gu} + v_{gh}}$$
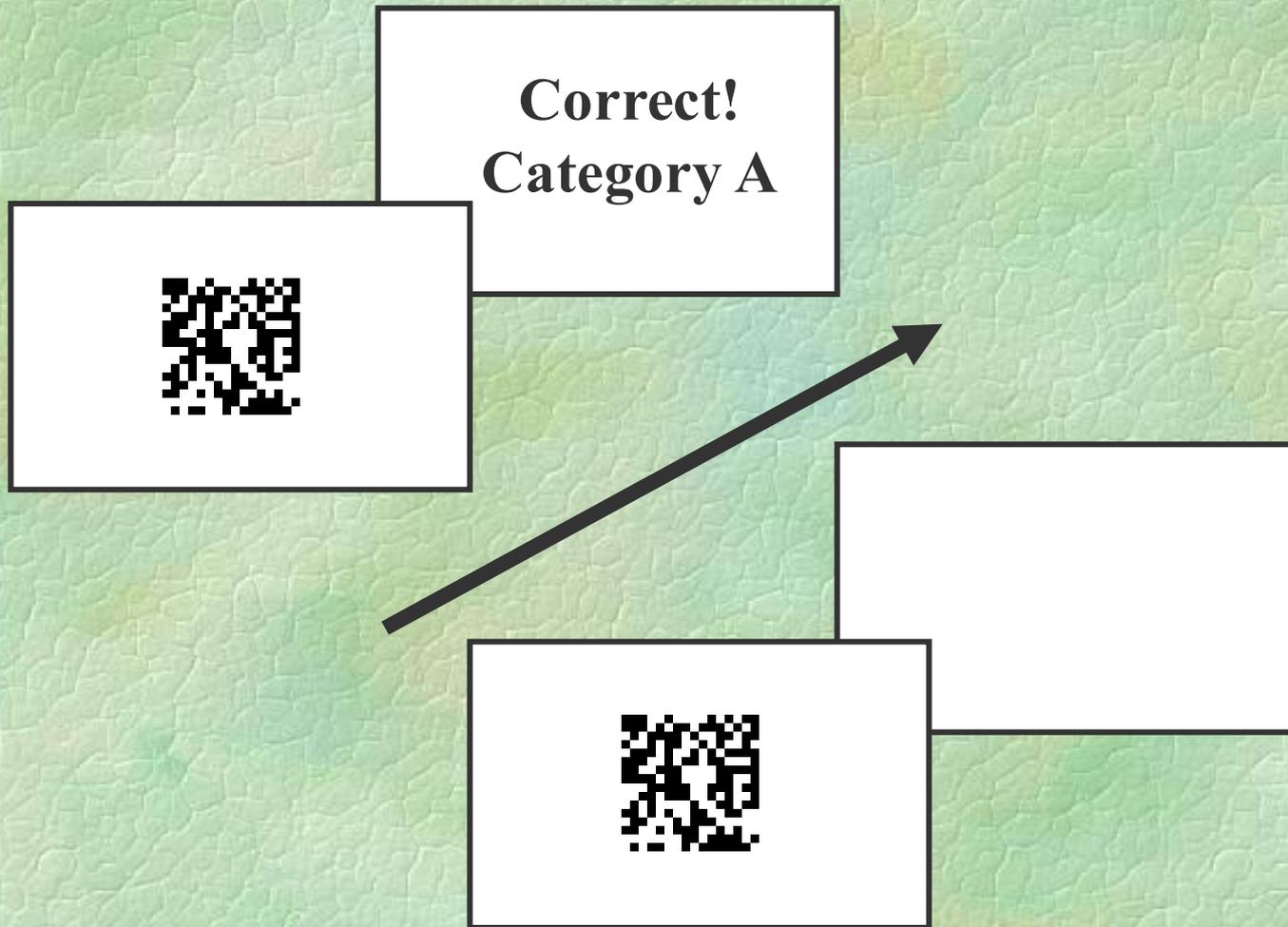
Winner-take-all system

- Grossberg (1976)

- Wills & McLaren (1997)
- Jones, Wills & McLaren (1998)
- Wills et al. (2000)
- Wills (2002)
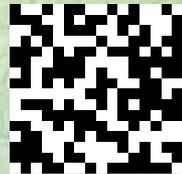
This is a concept we'll return to...
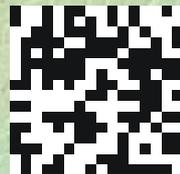
Free classification
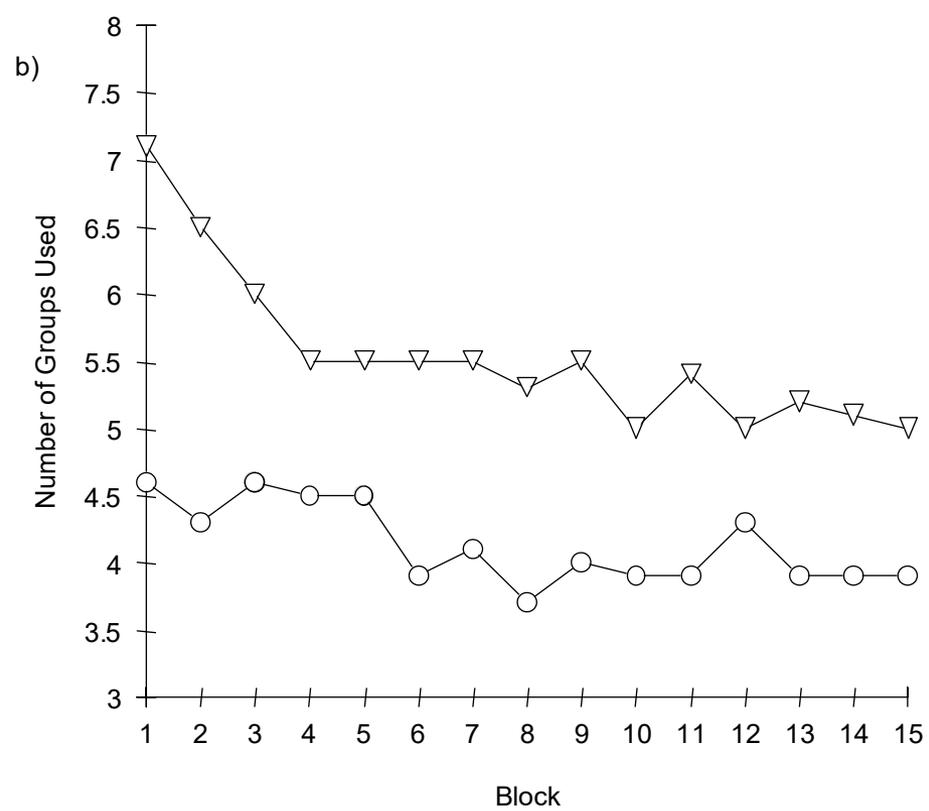
Wills & McLaren (1998)

Master pattern

Base patterns

Square replacement

Experiment 1a

Exposure learning

Saksida Figure 1

888

• Gibson & Walk (1956)

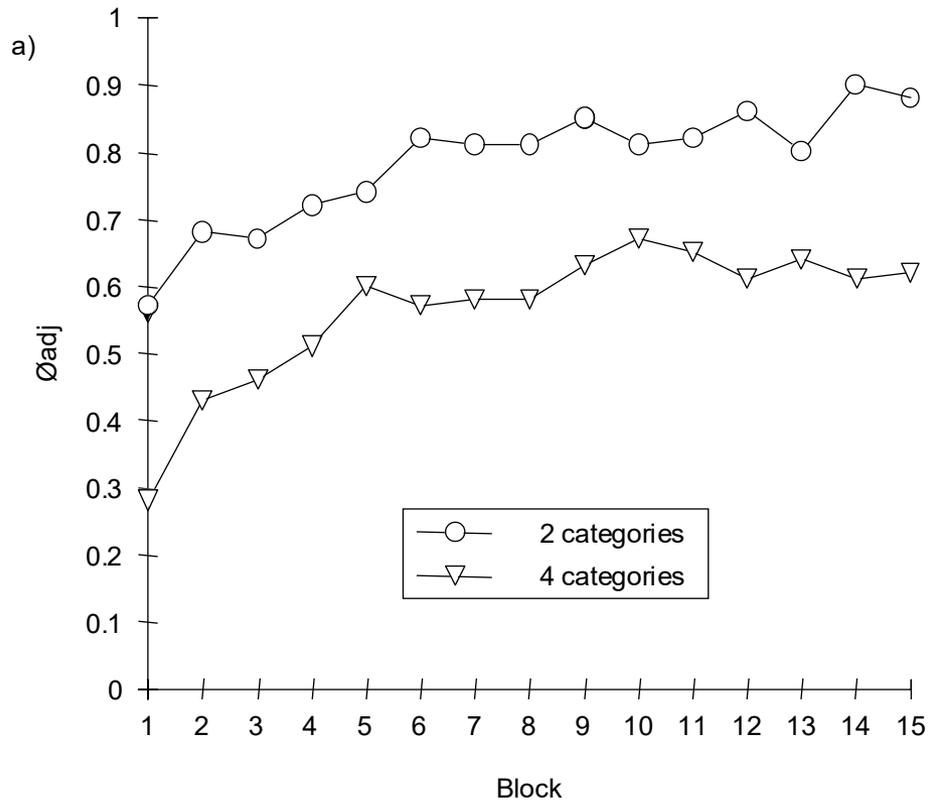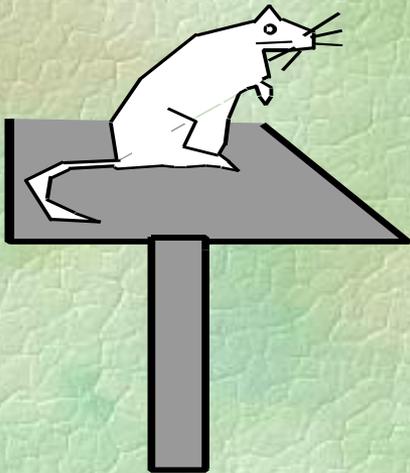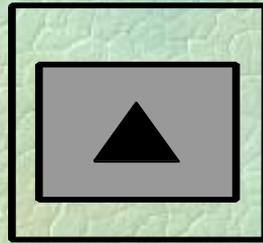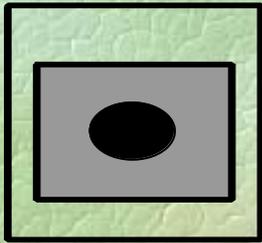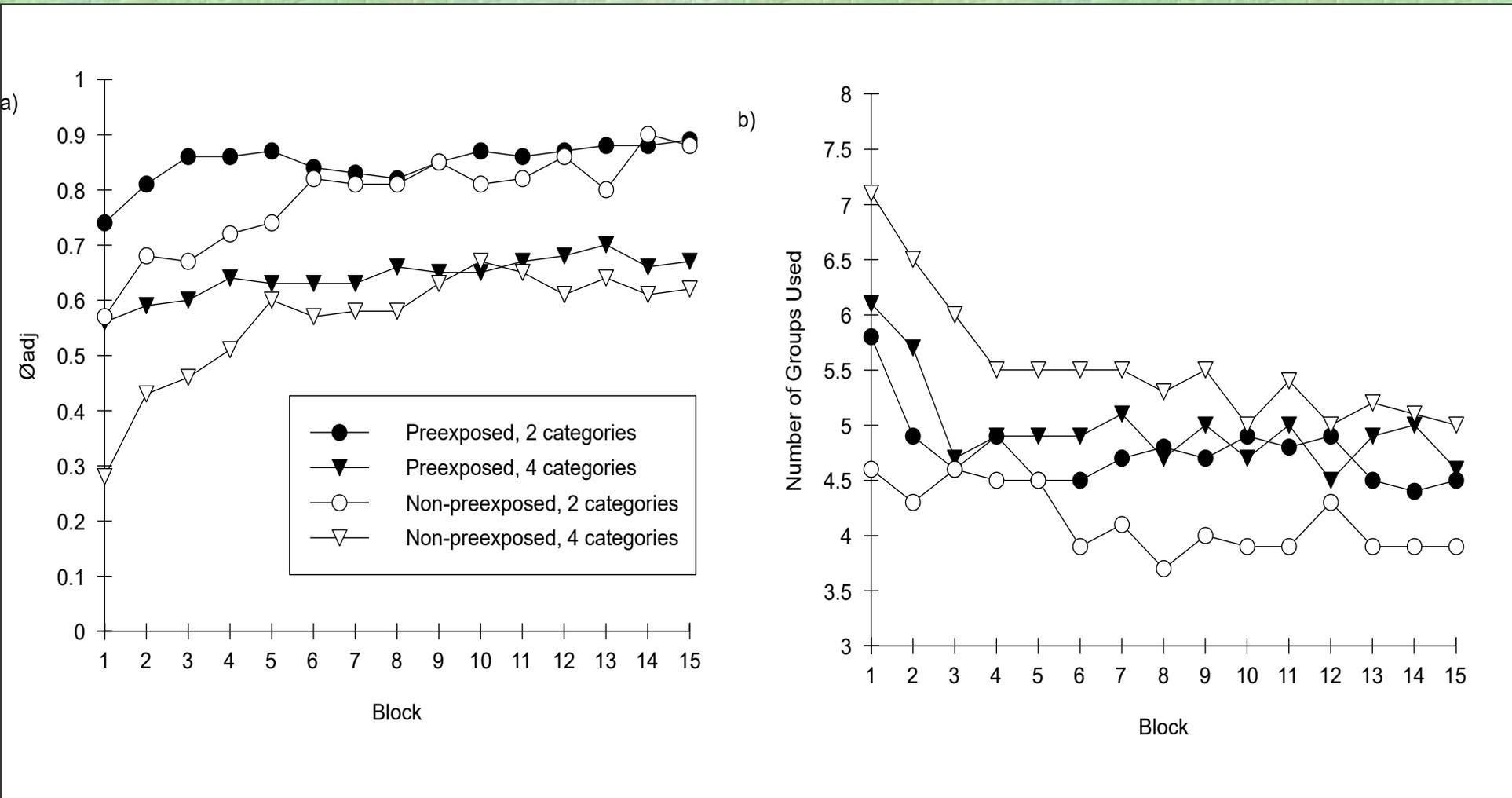• Saksida (1999)

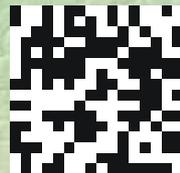# Free classification = Exposure learning?

Wills & McLaren (1998)

Master pattern

Base patterns

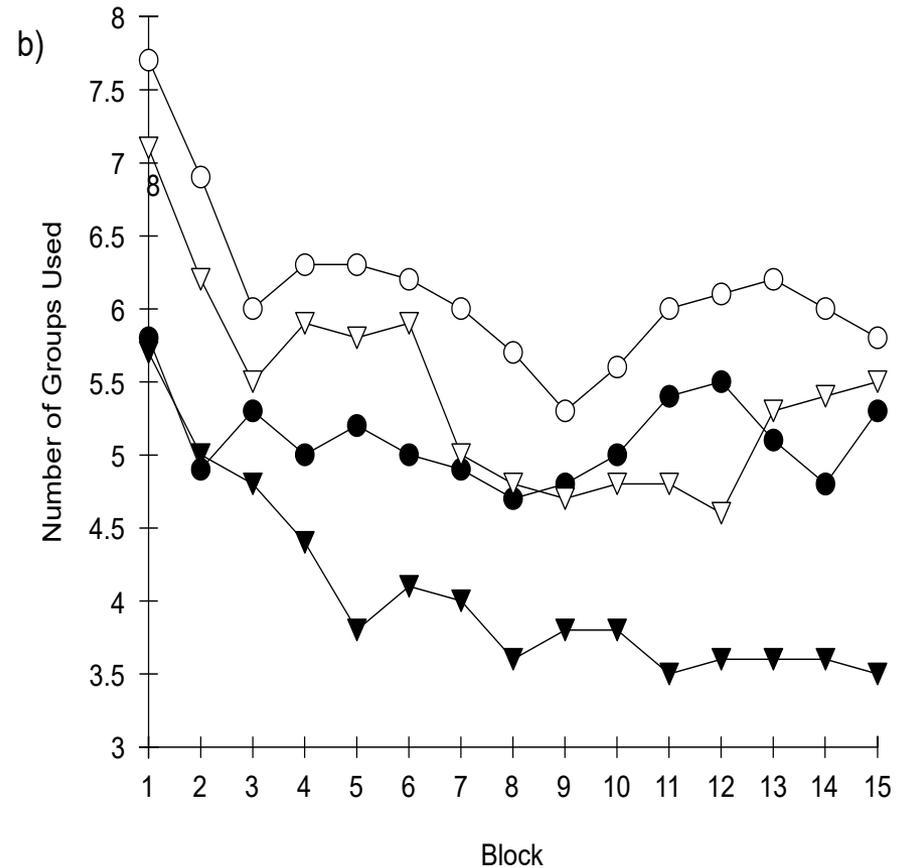**Square replacement**
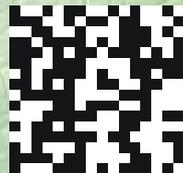
Shuffled rows

Free classification = Exposure learning?

a)

Pre-Exposed / 2 categories
Pre-Exposed / 4 categories
Non Pre-Exposed / 2 categories
Non Pre-Exposed / 4 categories

Øadj

Block

b)

Number of Groups Used

Block
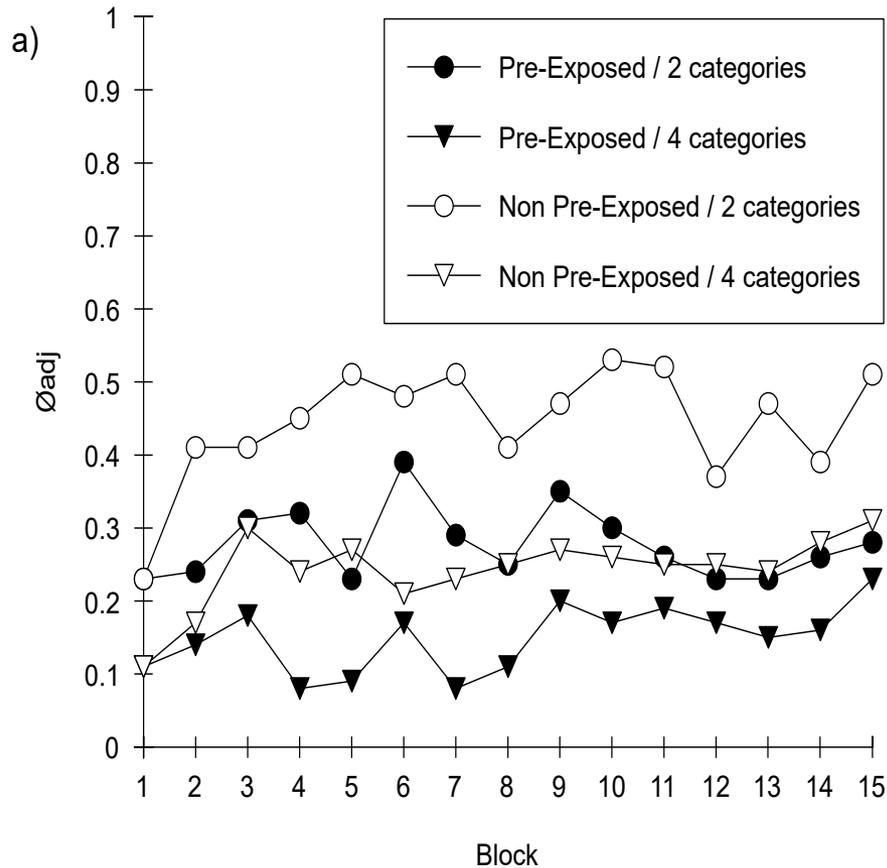
Generalisation to "guess & correct"

(B)

Square-replacement Shuffled

Trials to criterion vs. Non pre-exposed / Pre-exposed
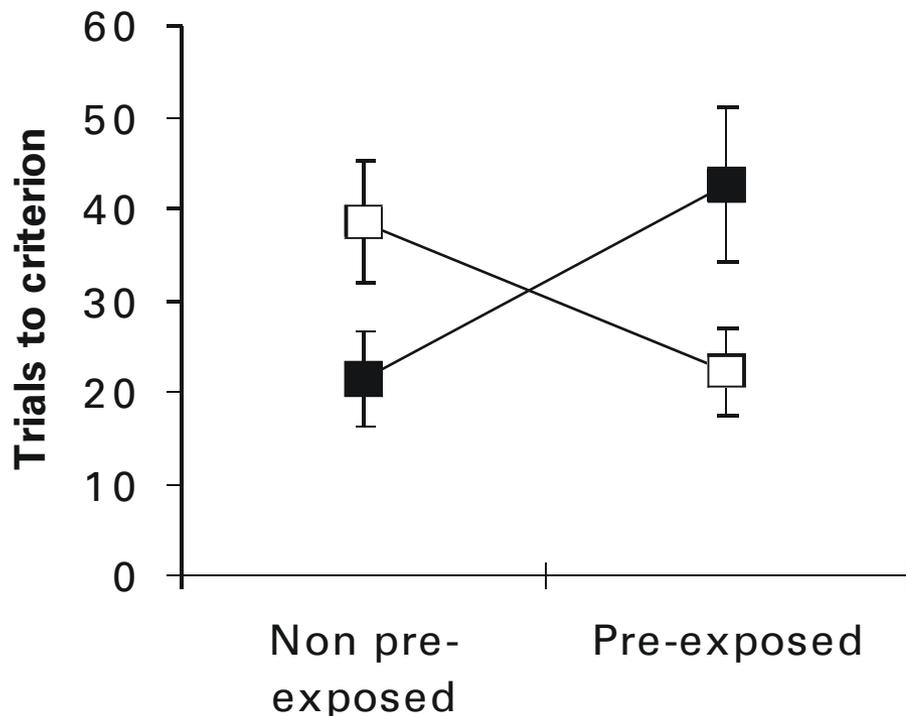
Wills, Suret & McLaren (2004)

• Predictability and salience.

• Predictability and frequency.

• Frequency-diagnosticity relation in most stimuli

• Not true for shuffled stimuli.

Feature emergence
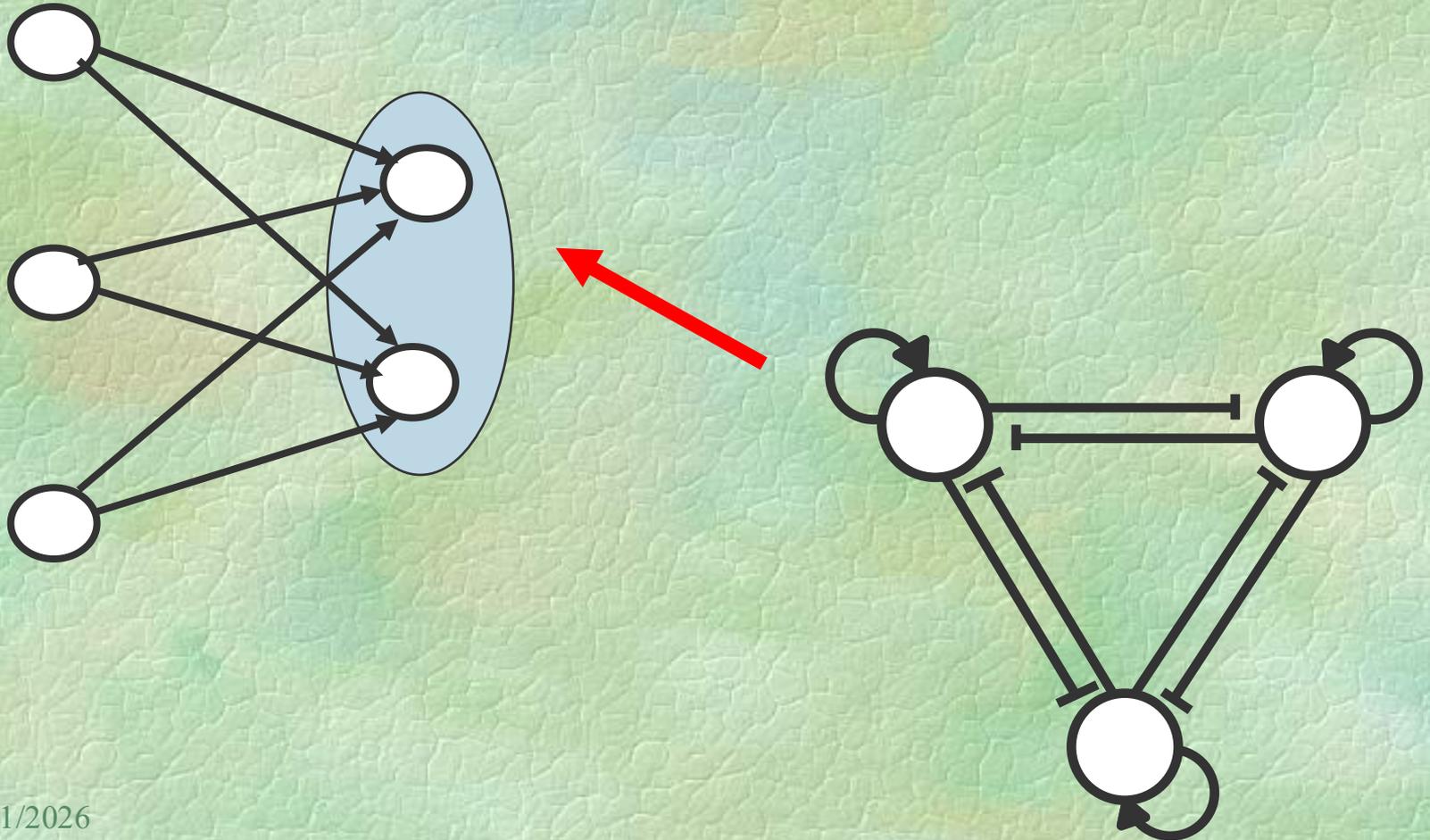
Alice Figure 1

Alice Figure 2

Rumelhart-Zipser model

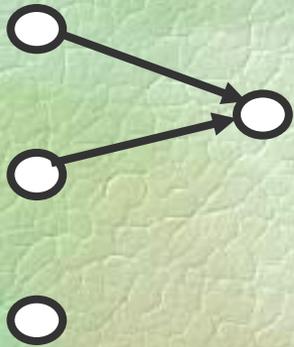# Learning rules

$$\Delta w = G\left(\frac{a}{n} - w \right)$$

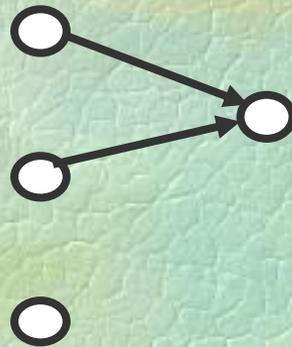$$\Delta w = G(\lambda - \Sigma w)a$$

Contrasting predictions

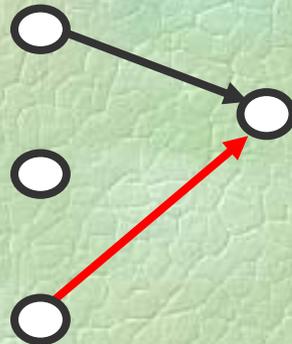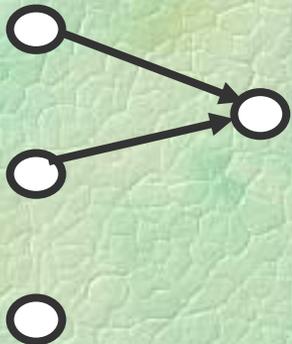|	**AB->1**	**AE->1**	

Rescorla-Wagner

$$\Delta w = G(\lambda - \Sigma w)a$$

Rumelhart-Zipser

$$\Delta w = G\left(\frac{a}{n} - w\right)$$

3/31/2026

Design

Phase 1	Phase 2	Test
AB	AE	
		EF
CD	GF	

Method

☐ Complex stimuli
  ◻ Each letter = 6 icons
  ◻ Random position
  ◻ Replacement (p=0.1)
☐ Rapid presentation
  ◻ 800ms presentation
  ◻ 2000ms ISI
☐ Training to criterion (80%)
  ◻ 10 blocks of 24 trials per phase.

Results

Design		Learners	Non-learners
AB	AE	8	1
	EF		
CD	GF	2	5

- Zwickel & Wills (2004)

- see also Zwickel & Wills (2002)