

How to recognize a predator: key features, color or size?

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Introduction

The mechanism of predator categorization has not been understood well yet. There are two main theoretic attitudes explaining how a potential prey can recognize a predator. Animals could use the **key features** of the stimuli (*beak, eyes, claws*) or they have a **general concept** how the predator should look like (*color, size*).

Using artificial dummies we have already found out that raptor features play an important role in predator categorization. In this study we examined how coloration pattern and size influence predator recognition by a prey under labor conditions.

Material & Methods

- **subject:** great tit (*Parus major*) – wild living, captured before the experiment, n=140
- **plush dummies:** 4 different color morphs of sparrowhawk made in the size of female sparrowhawk (cca 35 cm) and the size of great tit (cca 15 cm)



- **experimental cage:** 2 x 1 x 0,5 m, equipped with perches, bushes, nesting box and food, dummy placed in front of the cage

Each tit starved for 1,5h before the experiment and then was placed in the experimental cage. Tit behavior was recorded for 10 minutes. Observer XT was used to evaluate the recordings and results were analyzed using PCA (principal component analysis) and RDA (redundancy analysis) in CANOCO. Scores of the first axis were compared by ANOVA in STATISTICA 9.0.

- **observed behavior types:**

abbreviation	description	measure
cap	raised feathers on the head	total number
knee	knee-bending	total number
warn	warning calls	total number
approach	approaching the dummy	total number
scan	scanning the dummy	total number
move	changing the position in the cage	total number
sitting	staying still on one place	total duration
peck	pecking into perches, bushes, etc.	total duration
bedding	pecking into corn bedding	total duration
feeding	feeding on the presented food	total duration

Results

basic types of behavior according to PCA axis (Fig. 1):

- **stress** - warning calls, raised feather on the head, knee-bending
- **excited behavior** – approaching the dummies and increased moving in the cage
- **feeding** – feeding on the presented food, surveying the bedding for food independent on excited behavior, negatively correlated with stress one.

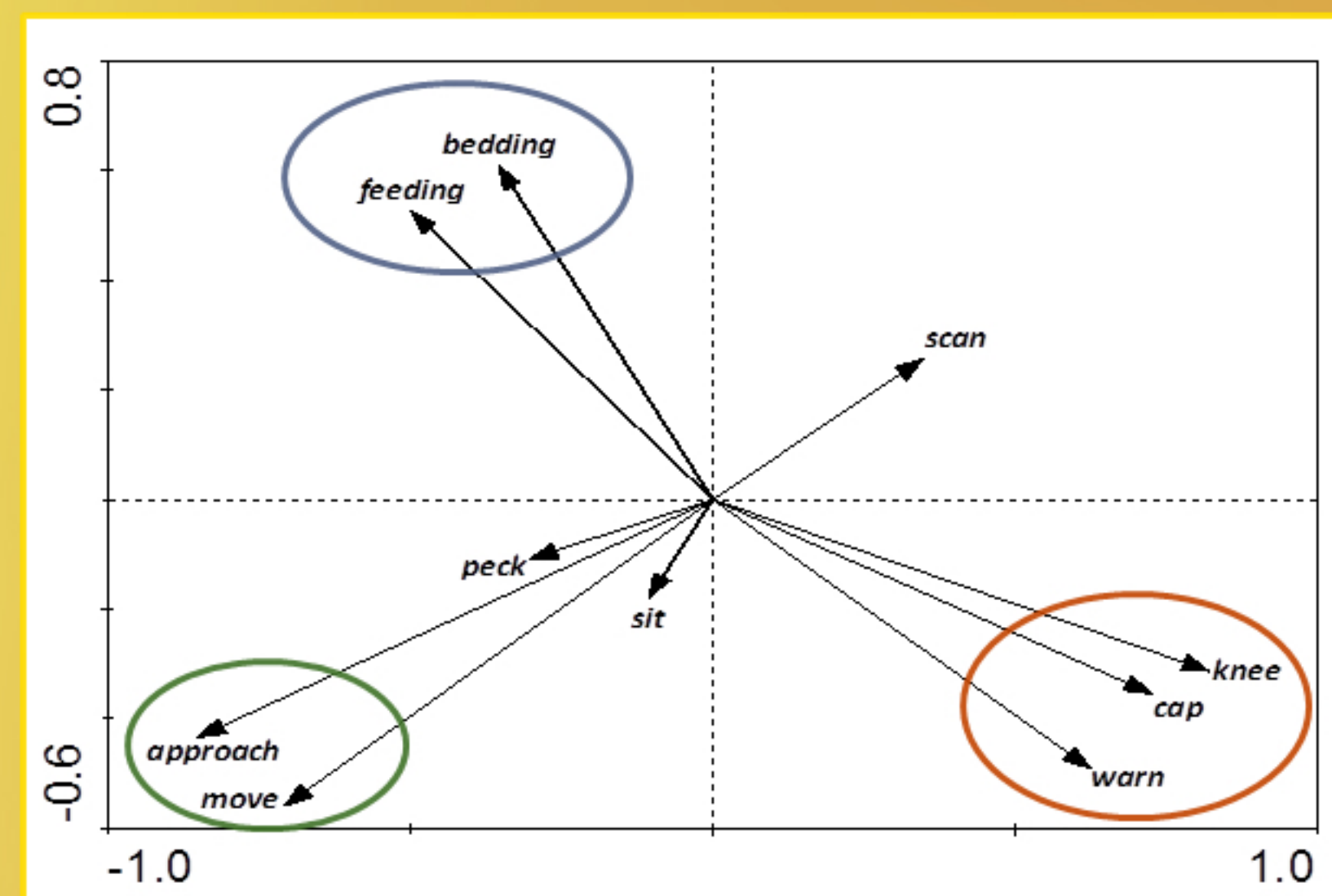


Fig.1: PCA of all observed behavior types during the experiment, 1st axis explains 37.3% of variability, 2nd explains 17.7% of variability.

reactions on the dummies (Fig. 2,3):

color	size	reaction
sparrowhawk	large	intense stress
	small	intense stress
robin	large	stress behavior
	small	feeding
great tit	large	feeding
	small	excitement
pigeon	large	excitement

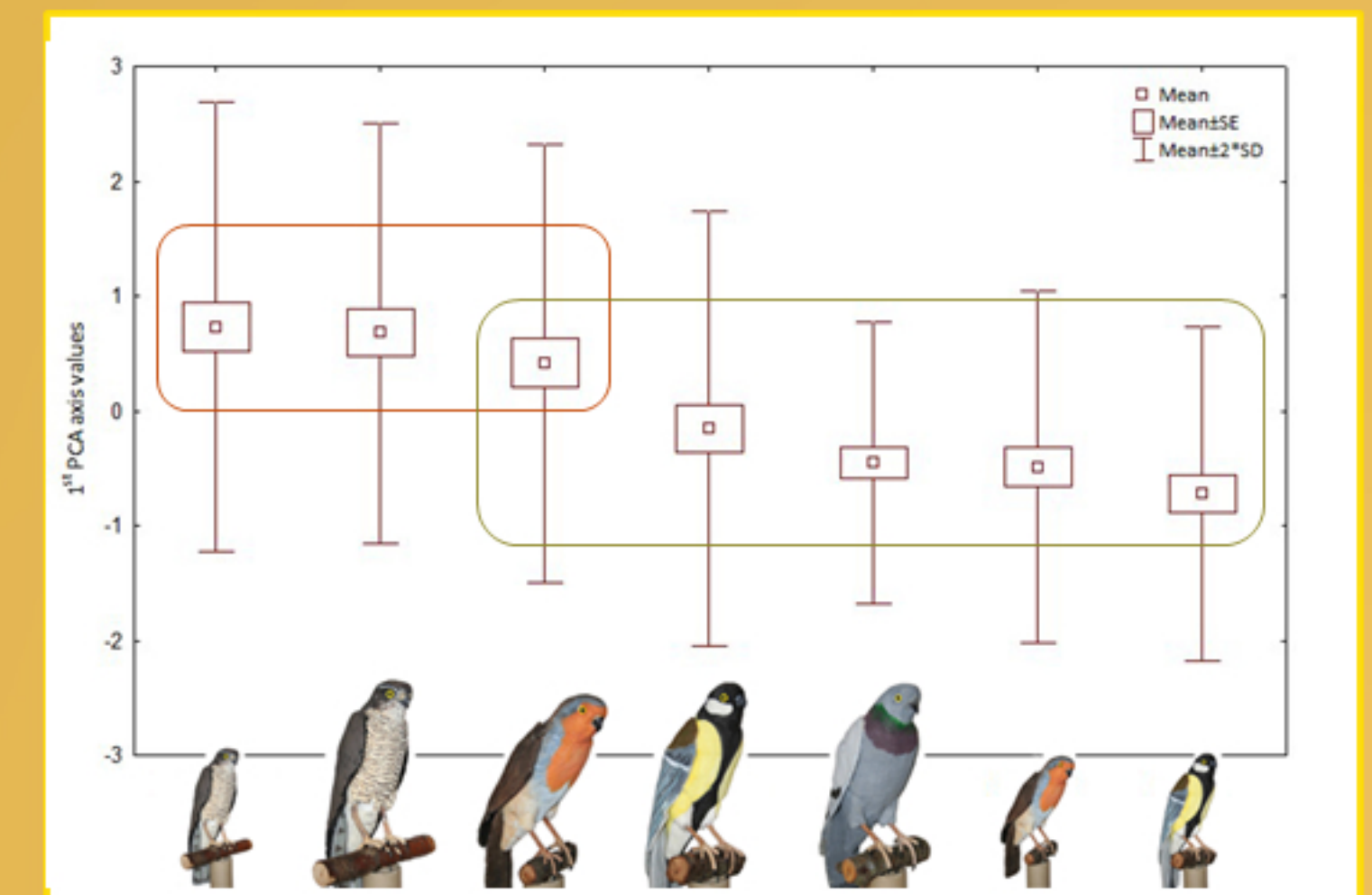


Fig.2: Differences between the dummies according to the first PCA axis scores ($F = 9.915$, $df = 6$, $p < 0.001$). Frames show dummies with no significant differences (Tukey HSD test).

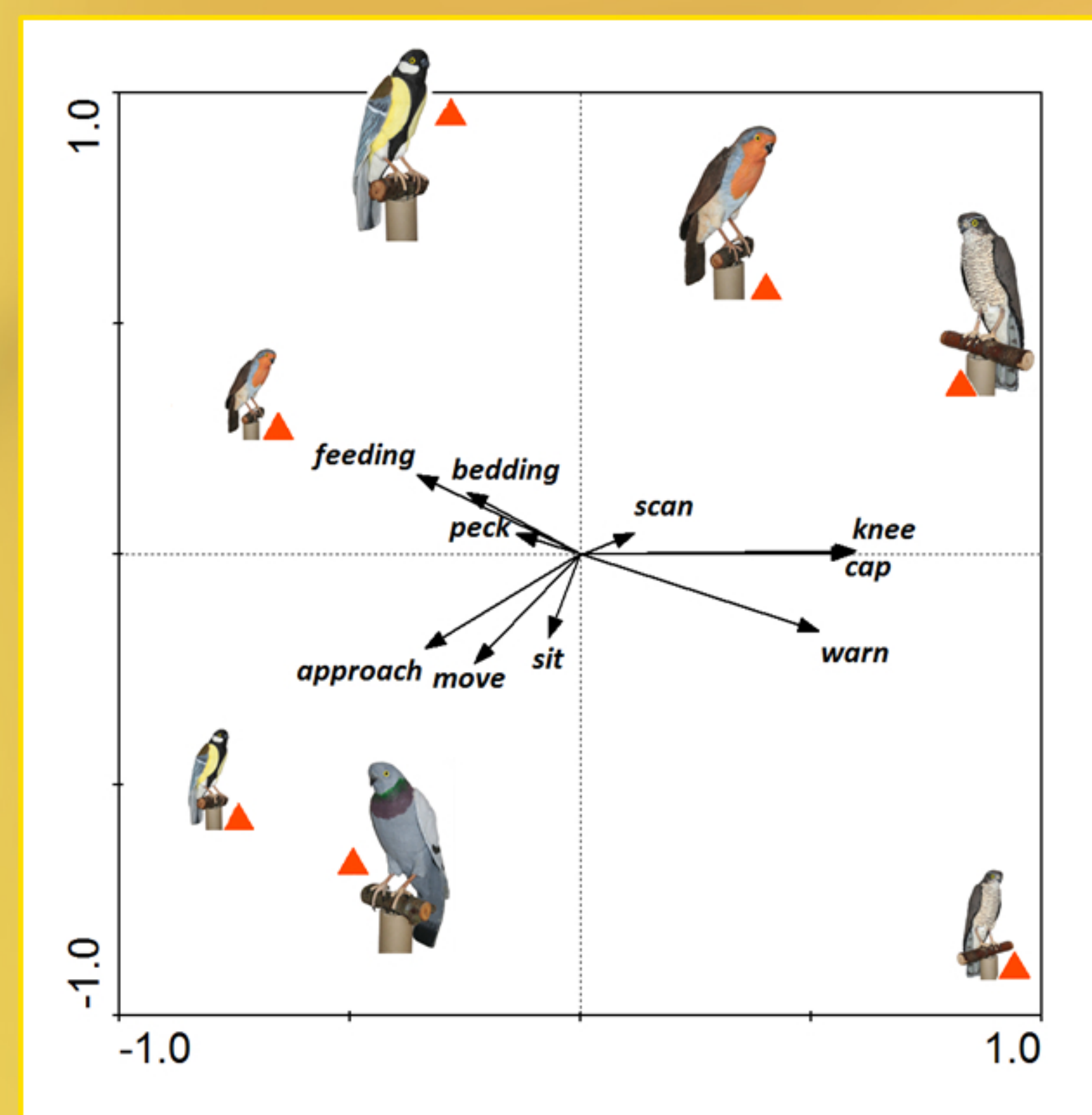


Fig.3: RDA of observed behavior and used dummies, 1st axis explains 13.0% of variability, 2nd explains 2.1% of variability, $F = 4.554$, $p = 0.002$ (Monte Carlo permutation test)

Conclusion:

- **color**
 - key features are important for predator recognition but they properly work only in the combination with right color.
 - raptor features on a dummy with strange color causes either incuriousness or intense interest in the dummy but no fear. The only one exception is robin coloration. We assume that it could be caused by the red breast and face which resembles the plumage of male sparrowhawk.
- **size**
 - doesn't matter in complete sparrowhawk, both sizes exude intense stress behavior
 - changes the meaning of a dummy in strange coloration
 - "large robin" – stress (*resemblance to male sparrowhawk?*)
 - "small robin" – feeding (*resemblance to real robin?*)
 - "large tit" – no interest (*too weird?*)
 - "small tit" – frequent approaching (*strange conspecific?*)