

Applications to Science

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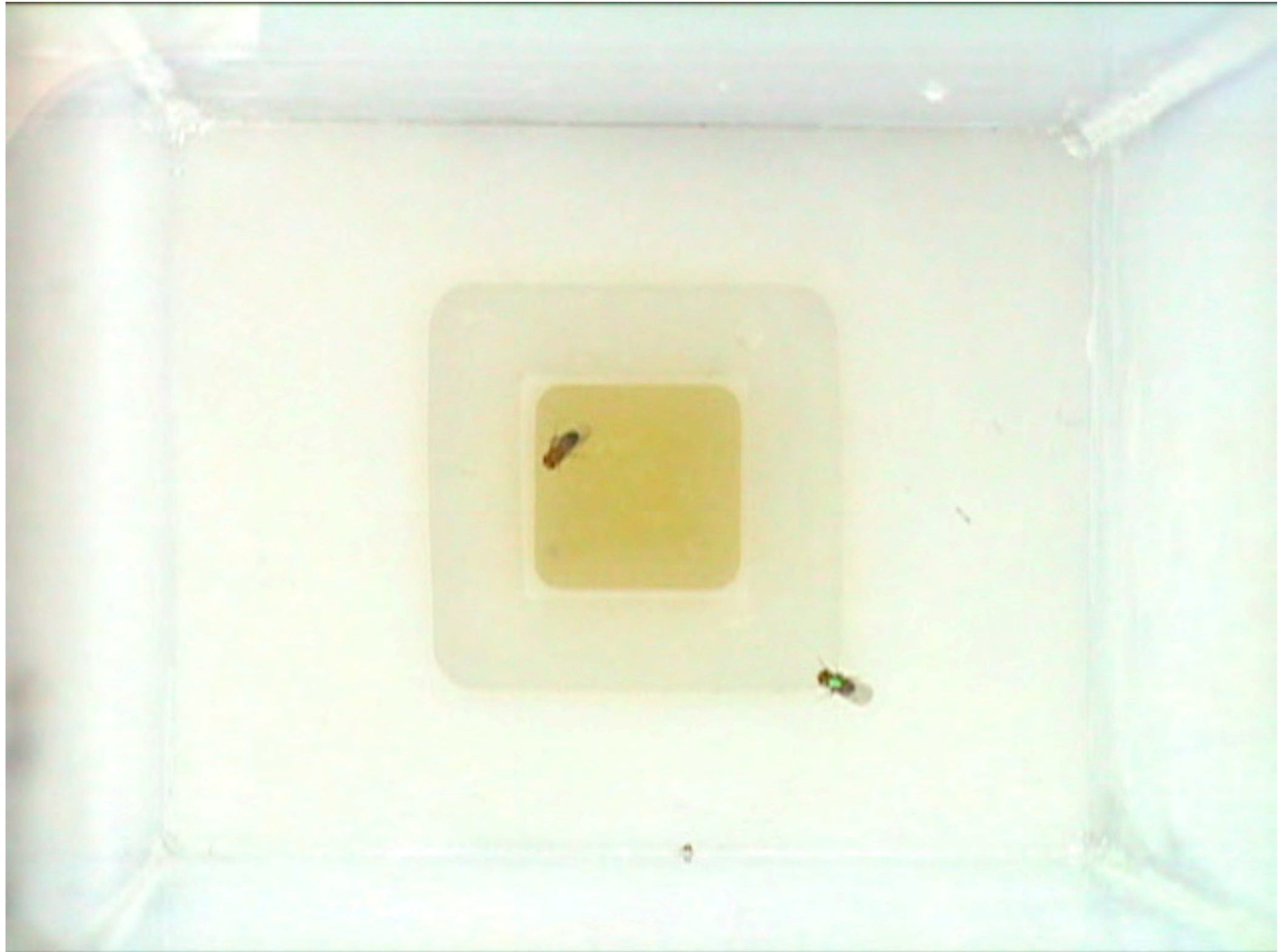
Goals

- A few examples
- Implications for machine vision
- Lessons learned
- NSF's role

Plan

- Intro (5')
- Sketch of a few success stories (50')
- Discussion (10')

'Lunging' (view from top)



Why measure behavior

Why measure behavior

- Genes <<>> Brains <<>> Behavior

Why measure behavior

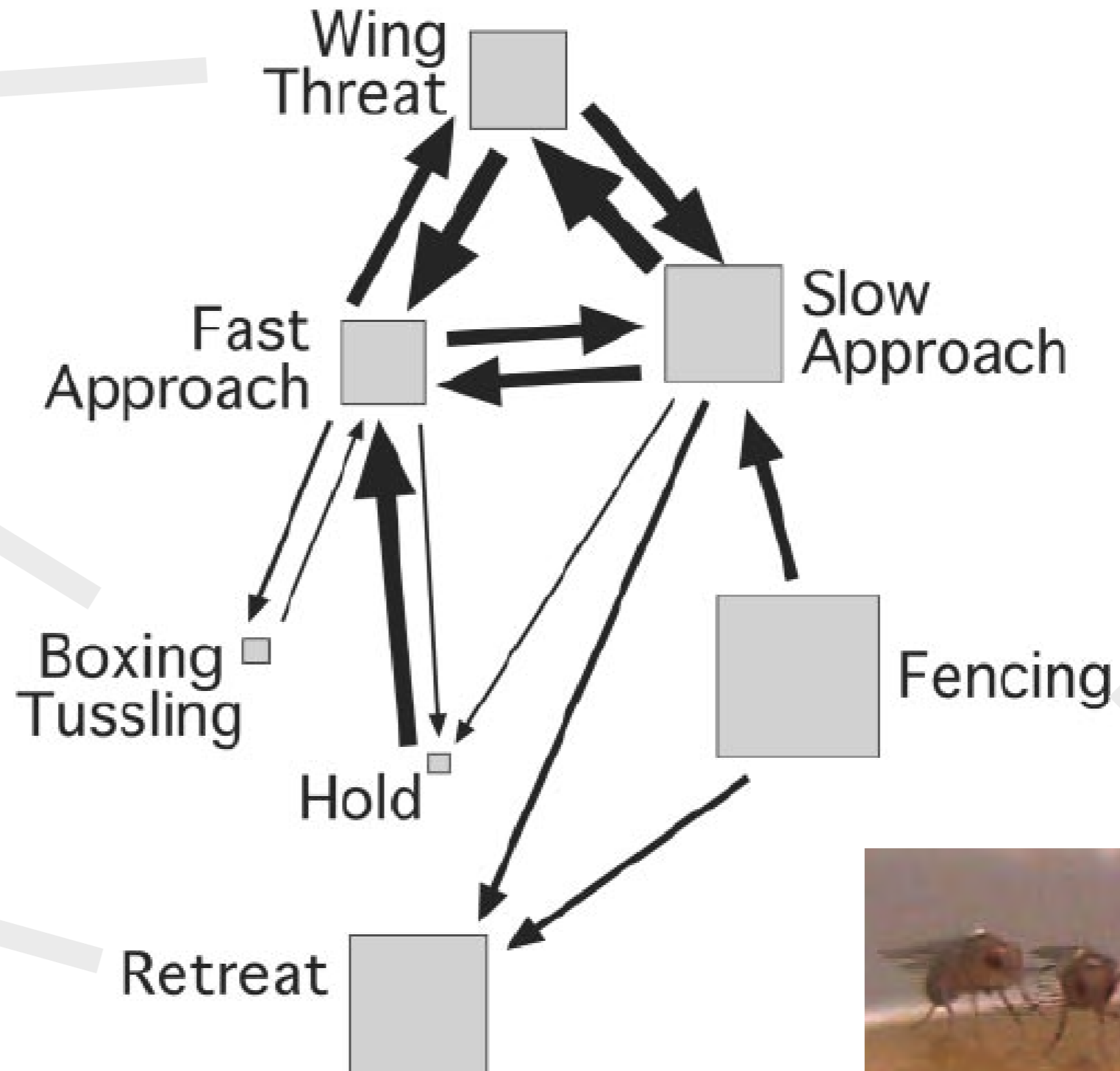
- Genes <<>> Brains <<>> Behavior
- Ethology

Why measure behavior

- Genes <<>> Brains <<>> Behavior
- Ethology
- What is behavior?

Fly behavior

(as we understand it today)



Adapted from:
Kravitz et al.
PNAS April 16, 2002
vol. 99 no. 8
5664–5668

A Lunging



Side

B Wingthreat



C Tussling



D Copulation



Top



E Chasing

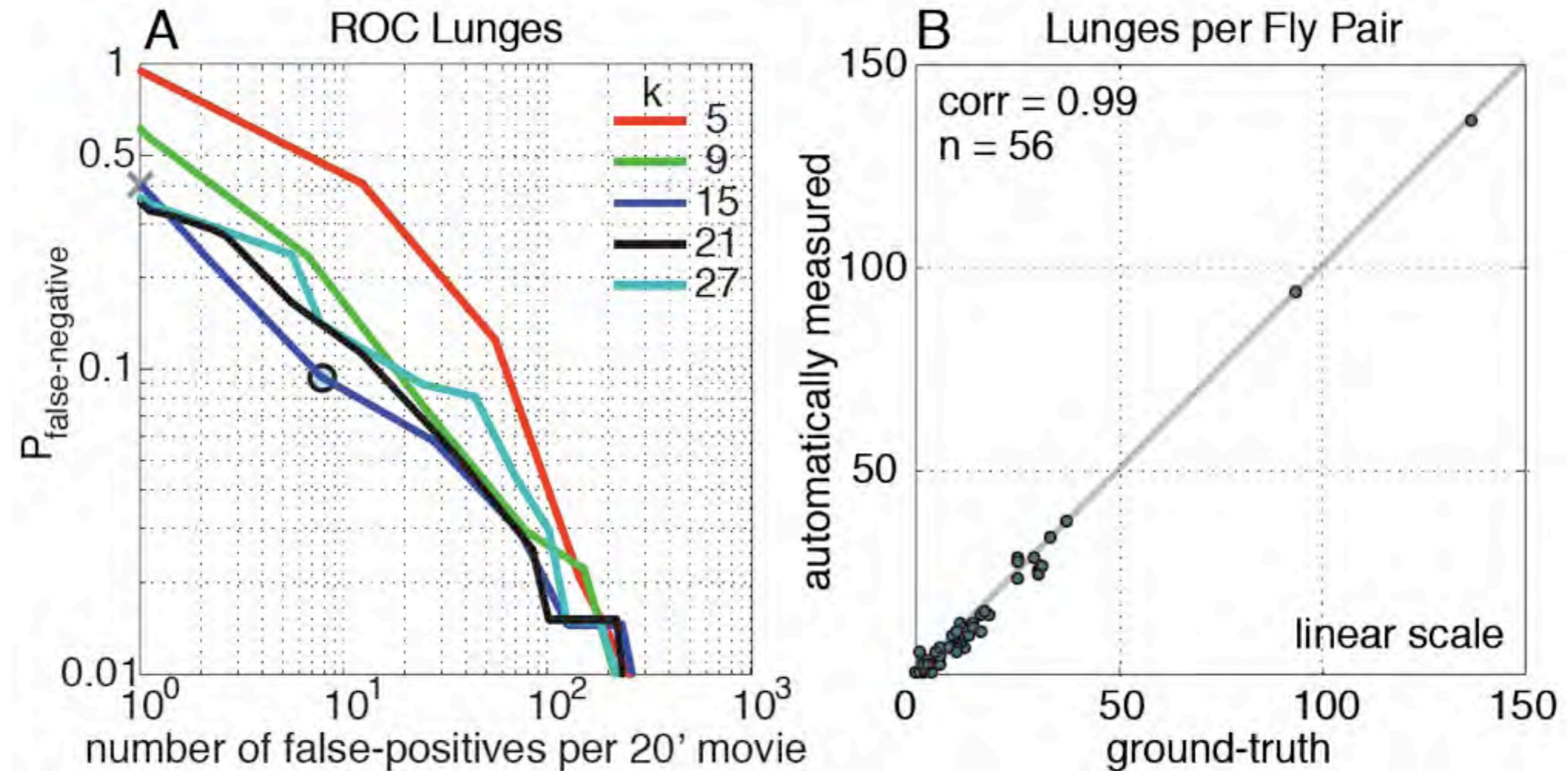
Time = [SS.CS]



F Wing extension & circling

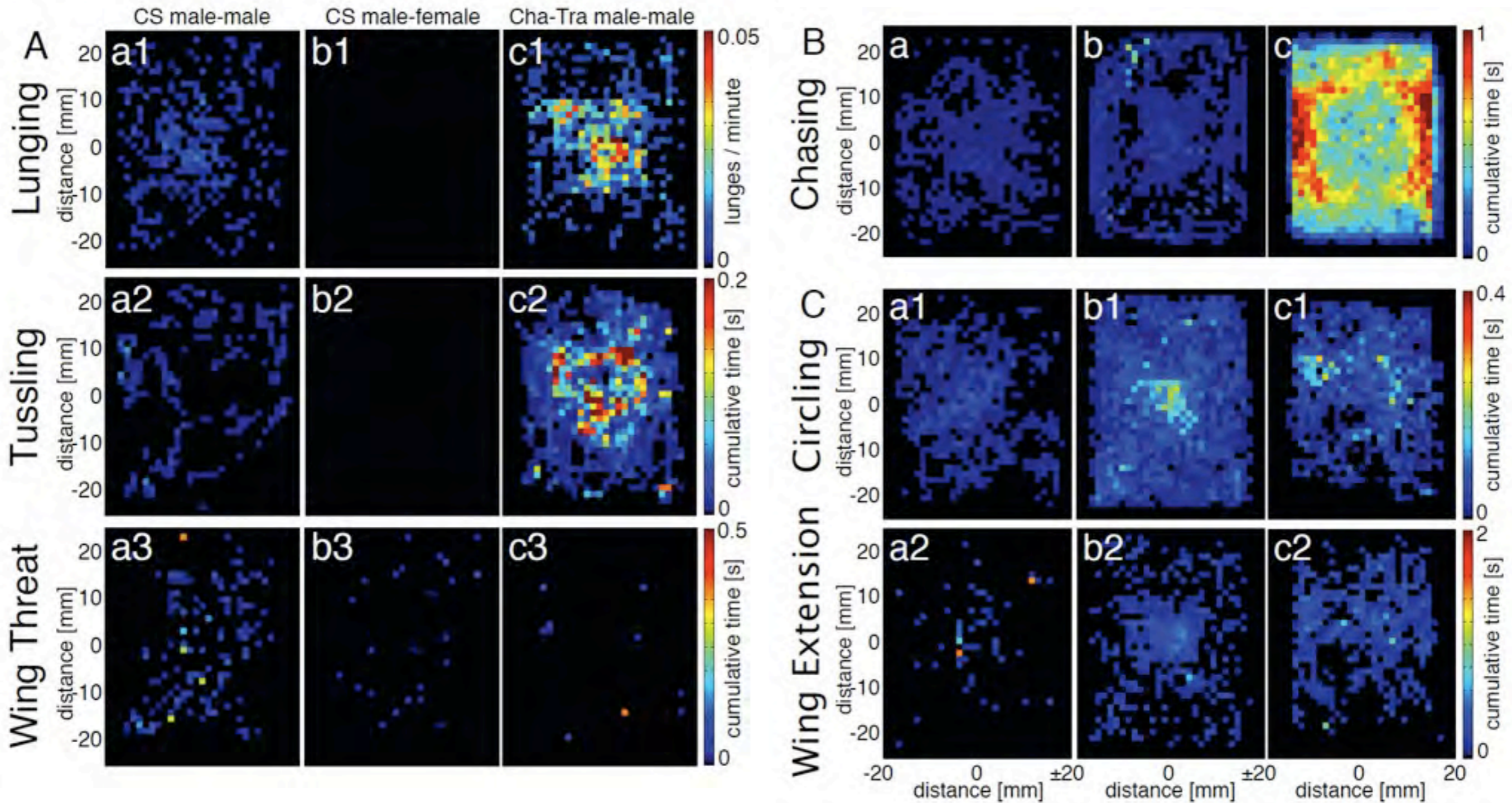


Detection performance



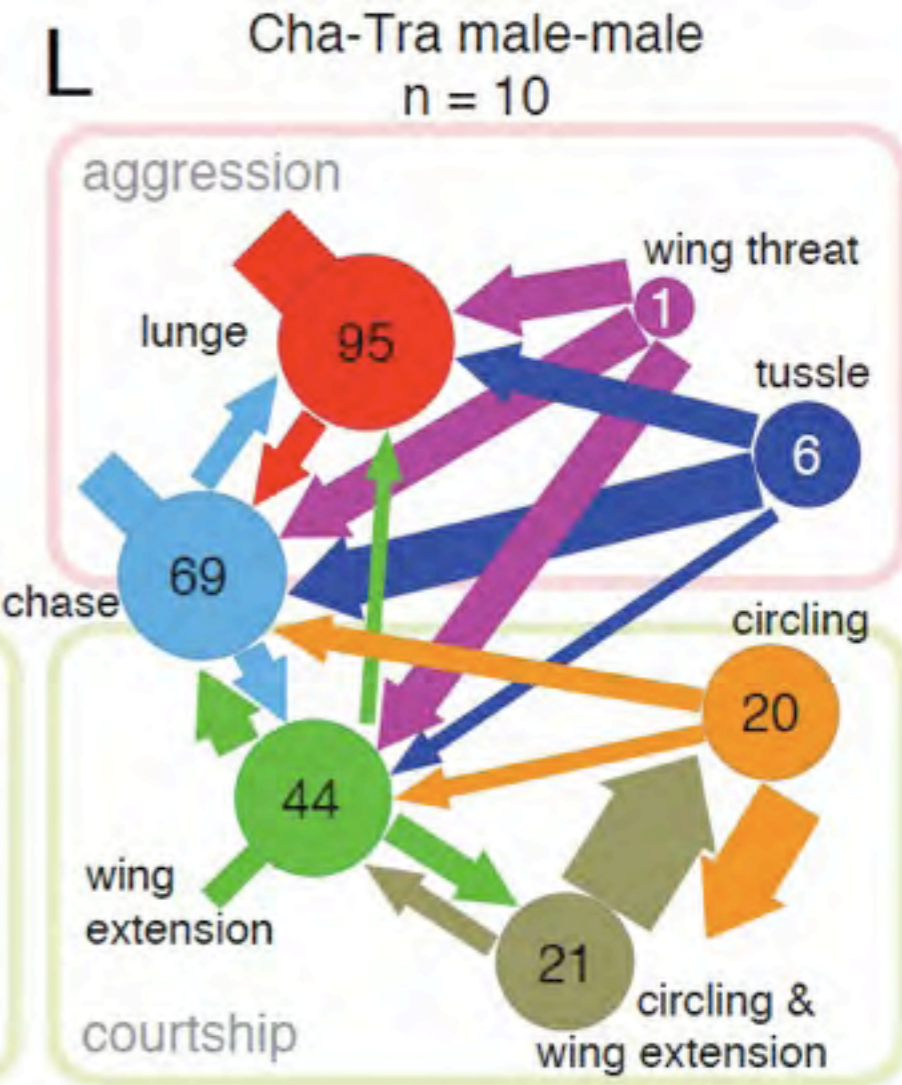
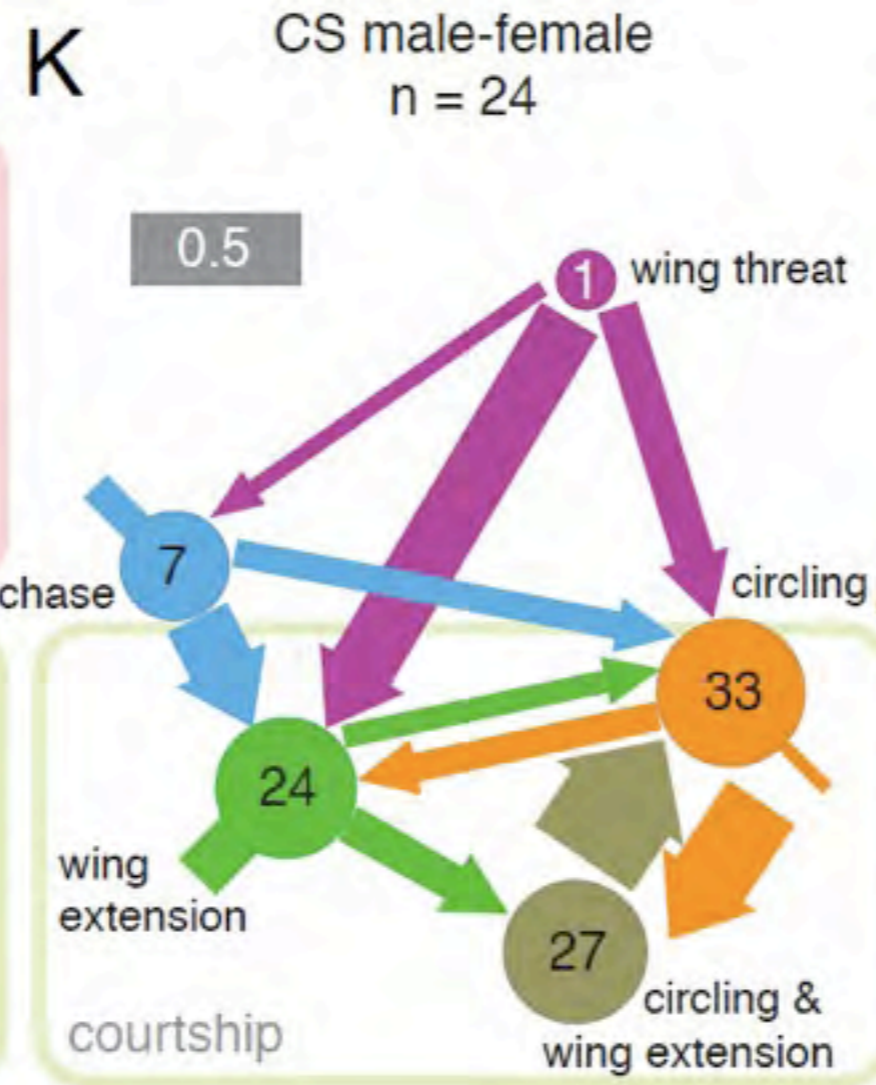
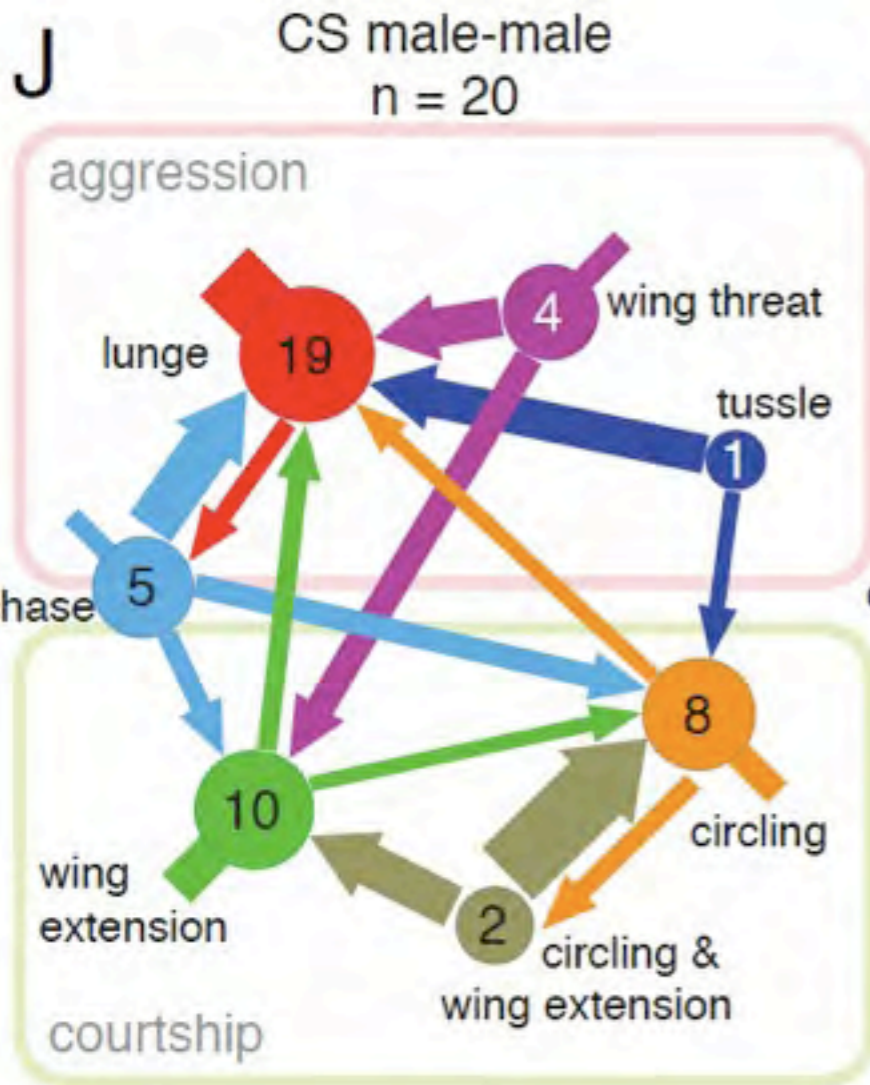
[Dankert et al., Nature Methods, April 2009]

Phenotyping



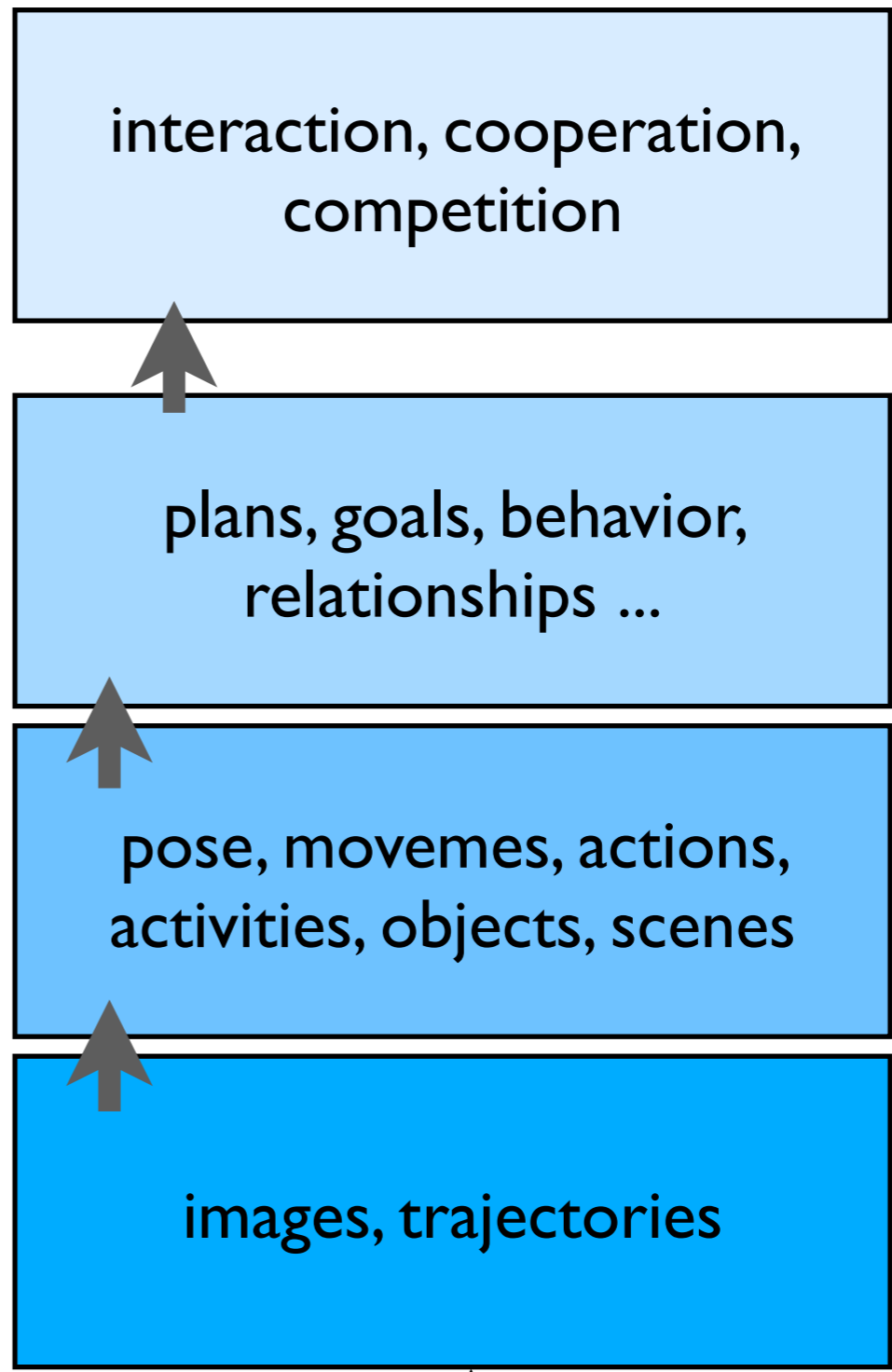
[Dankert et al., Nature Methods, 2009]

Ethograms



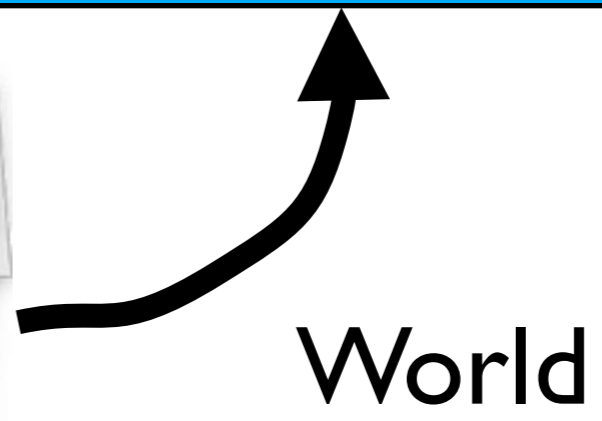
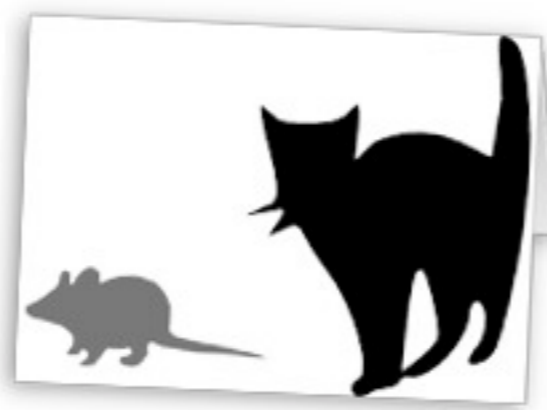
[Dankert et al., Nature Methods, April 2009]

Perception



PSYCHOLOGY

SENSORY

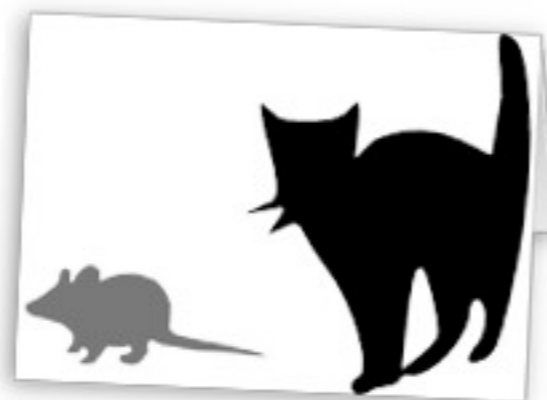
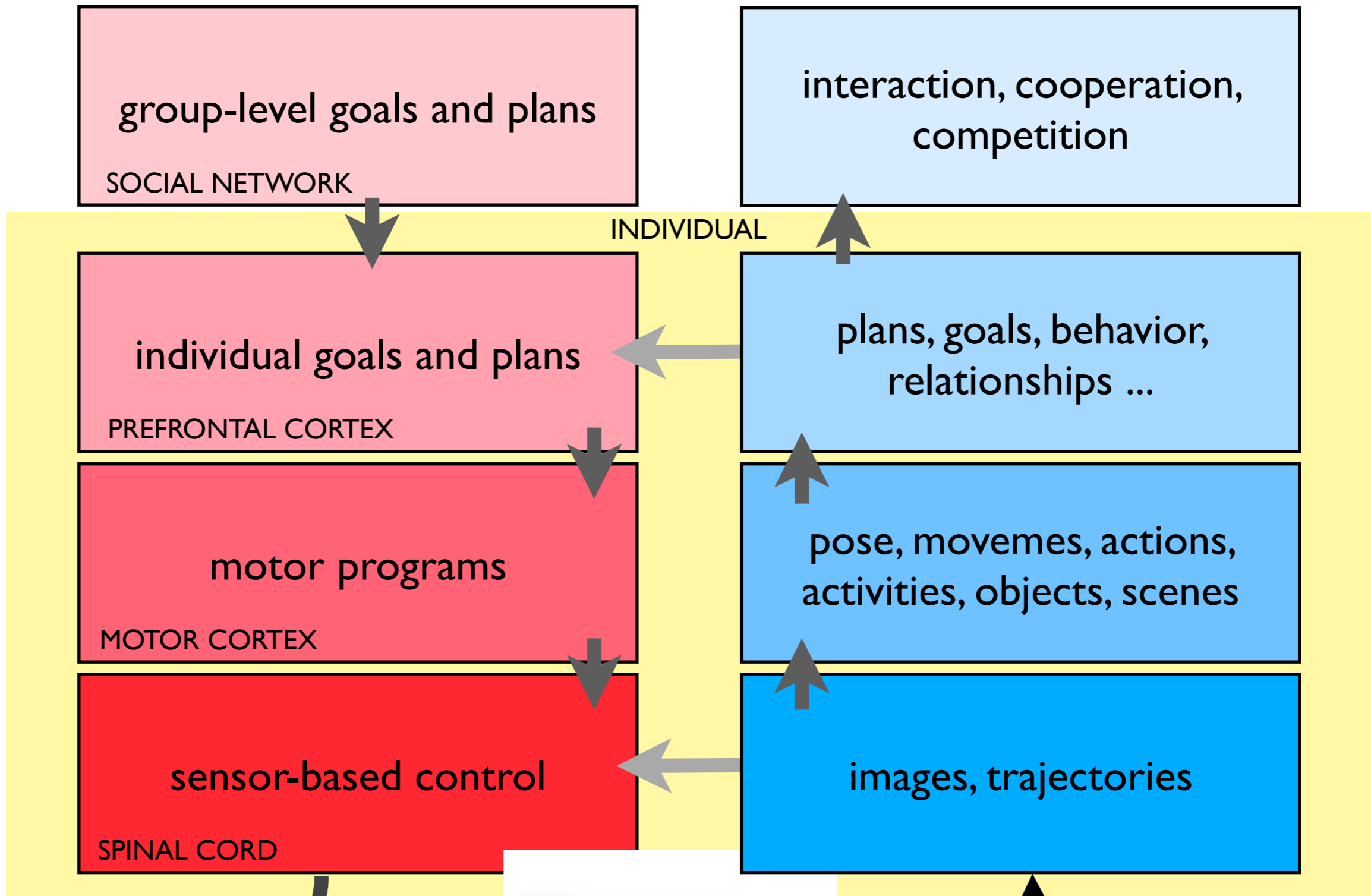


Action

Perception

MOTOR PLANNING

PSYCHOLOGY
SENSORY



World

Lessons learned

- Image deluge in science
- Doing better than the scientists
- Payoffs in science, not in MV (short term)
 - ▶ Must work as scientist
 - ▶ Students must be interested in science too
 - ▶ Publish in unfamiliar venues
 - ▶ CV publications are suspicious
- Benefit to MV: new challenges and datasets
- Benefit to PI: fun, learning

Basic research needed

- Tracking, detection and identification
- Parts and pose
- Hierarchical models (for time series)
- Unsupervised discovery of categories
- Weakly supervised learning