Who's whos to do

Jenny:		**4**	
Michele:		**4**	
Ming:	**5**		
Shea:	**5**		
Erica:		**4**	
Will:		**4**	
Laura:			**2**
Keith:	**5**		
Tuan:			**3**

Perception
(information acquisition)

Recap last lecture I

- Definitions of cognitive processes in biology are usually based on observable behavior, in psychology on internal processes/mechanism
- Danger of anthopomorphising
- Danger of presuming too much simplicity if animals tested in simple, artificial conditions
- Methods: comparative studies, field observations, lab experiments, neurophysiology, computational neuroscience

Recap last lecture II

Cognitive science
- interdisciplinary
- studies behavioral mechanisms (algorithmic and physiological level) – mechanisms matter to explain behavior!

(constraints, cost/benefit)

In what way is understanding mechanisms of perception relevant to understanding the function of a behavior?

Sensory thresholds

- Sensitivity to stimuli: relevant in predator-prey interactions, sexual selection, division of labor in social groups, measurement of learning ability, etc., etc.
- How should we measure sensitivity/thresholds?

Perception

Measuring sensory thresholds

- What modality does the animal perceive when it reacts to a stimulus?

Animal perception

Things we don't have senses for

- UV (some birds, butterflies, bees, fish)
- IR (pit vipers)
- Extra colors (some birds & butterflies (4 receptors, mantis shrimp (12 receptors))
- Polarized light (many insects)
- Echolocation (bats)
- 3-D hearing (owls)
- Ultrasound (whales, dolphins, bats)
- Infrasound (elephants)
- Electrical (some fish)
- Water & air currents (fish, arthropods)

Animal perception

Things we don't have senses for

- UV (some birds, butterflie
- IR (pit vipers)
- Extra colors (some birds & butterflies (4 receptors, mantis shrimp (12 receptors))
- Polarized light (many insects)
- Echolocation (bats)
- 3-D hearing (owls)
- Ultrasound (whales, dolphins, bats)
- Infrasound (elephants)
- Electrical (some fish)
- Water & air currents (fi

Extended range

Extra modalities

Increased sensitivity

Animal perception

Things we don't have senses for

- UV (some birds, butterflie
- IR (pit vipers)
- Extra colors (some bi es (4 receptors, ma ors))
- Polariz
- E
- Electrical (some fish)
- Water & air currents (fi

Extended range

ra modalities

Increased sensitivity

Equally, we have some sensory abilities that any given animal may not have

whales, dolphins, bats)

sound (elephants)

Perception

Measuring sensory thresholds

- What modality does the animal perceive when it reacts to a stimulus?
- How sensitive are its receptors?

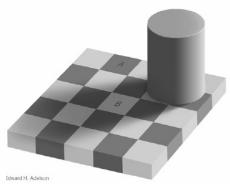
Some buzzwords

Perception

- Receptors, transduction, peripheral nervous system processing (e.g. contrast enhancement, color constancy)
- Weber's law, tuning curves

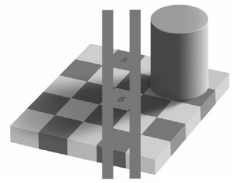
Processing of sensory information

Is A or B lighter color?



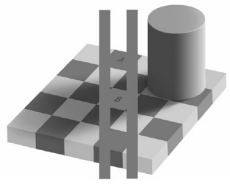
Processing of sensory information

Is A or B lighter color?



Processing of sensory information

Is A or B lighter color?



Conclusion: relevant 'perception' is not just at receptor level!

Some buzzwords

Perception

- Receptors, transduction, peripheral nervous system processing (e.g. contrast enhancement, color constancy)
- Weber's law, tuning curves

  → 'sensitivity' must be measured as relative quantity, not a simple absolute difference

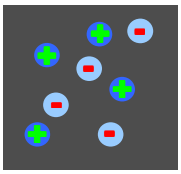
Perception

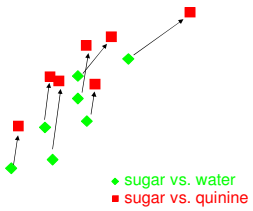
Measuring sensory thresholds

- What modality does the animal perceive when it reacts to a stimulus?
- How sensitive are its receptors? How is the stimulus processed peripherally?
- Motivation and differences between electrophysiological and behavioral thresholds

Behavioral vs. Receptor thresholds

Bees are more sensitive when errors are costly





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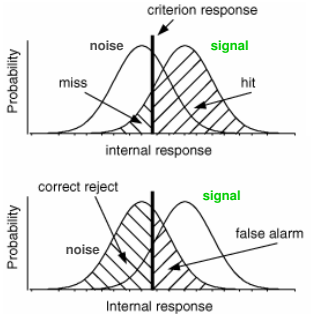
Perception

Measuring sensory thresholds

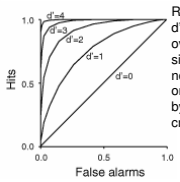
- What modality does the animal perceive when it reacts to a stimulus?
- How sensitive are its receptors? How is the stimulus processed peripherally?
- Motivation and differences between electrophysiological and behavioral thresholds
- What about noise?

Perception

Signal detection theory



Another step in translating sensory input into behavioral response: distinguishing signal from noise



ROC: high d' = less overlap of signal & noise; move on the curve by changing criterion

Perception

Measuring sensory thresholds

- What modality does the animal perceive when it reacts to a stimulus?
- How sensitive are its receptors? How is the stimulus processed peripherally?
- Motivation and differences between electrophysiological and behavioral thresholds
- What about noise? Use d' as sensitivity measure?

Perception

In what way may perception be important for your research?

Perception

More processing of sensory information

- Visual search, parallel – serial search
- Cross-modality processing, feature integration theory, texture segregation
- Attention, search image, priming

Next time

More on perception & attention

What does having an 'attention focus' mean?

What does it imply about behavioral flexibility and how it is limited by neural mechanisms?

Does this explain specialization on particular foods in herbivores or on particular flowers in bees ('flower constancy')?