Perception Introduction

How is perception different from sensation

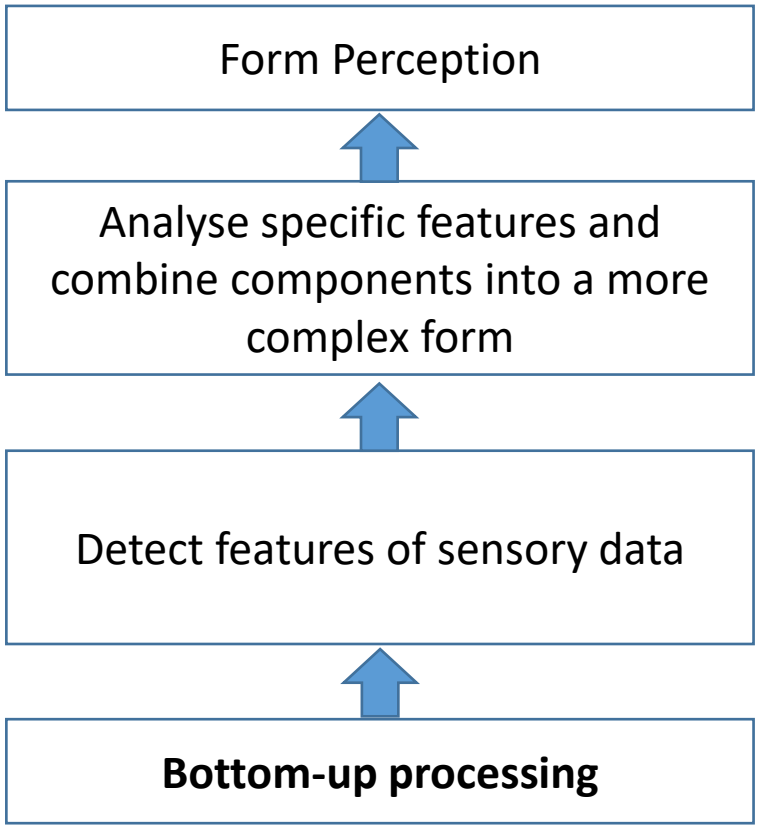
Sensation

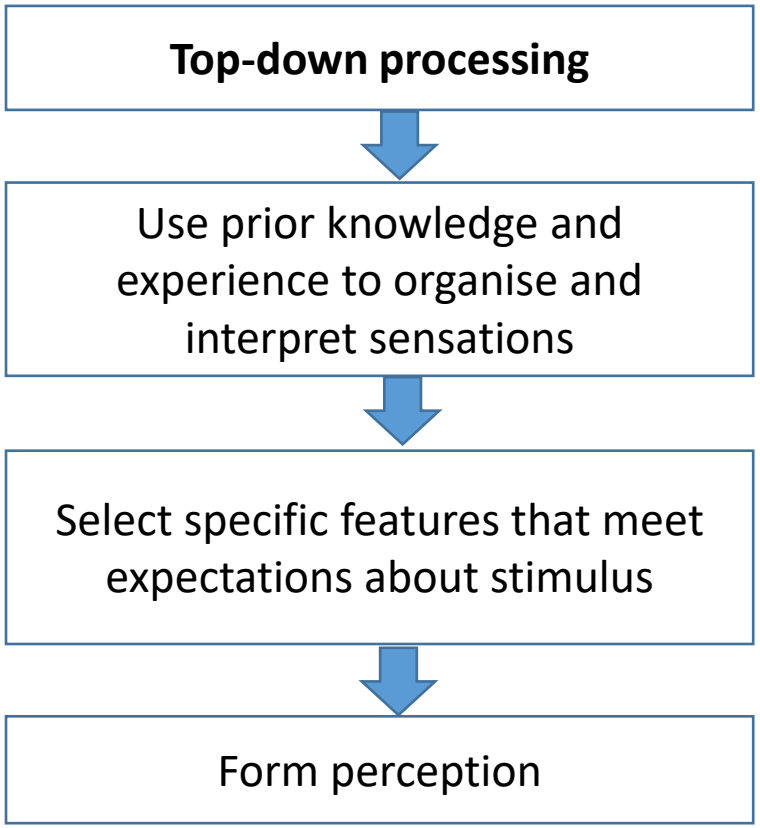
- Transduction: converting physical energy into neural impulses
- Largely bottom-up processing
- Earliest processing

Perception

- Phenomenology: perceptual experience
- Top-down processing
- Our interpretation of sensations

Bottom-up vs top-down processing





Three basic principals

Physical reality and experience are qualitatively different

Sensation and perception are active processes

- Selectively orient attention, interpret

Sensation and perception are adaptive

- Learn from experience

Sensing the environment

Sensory receptors

- Detect physical energy
- Translate energy into neural signals (transduction)

There is a minimum amount of energy needed to activate the system (threshold)

Sensory systems are sensitive changes in stimulation level

Psychophysics

Experiment techniques for measuring the percept associated with a stimulus

Data give insight into how sensory information is processed by the brain to generate perception

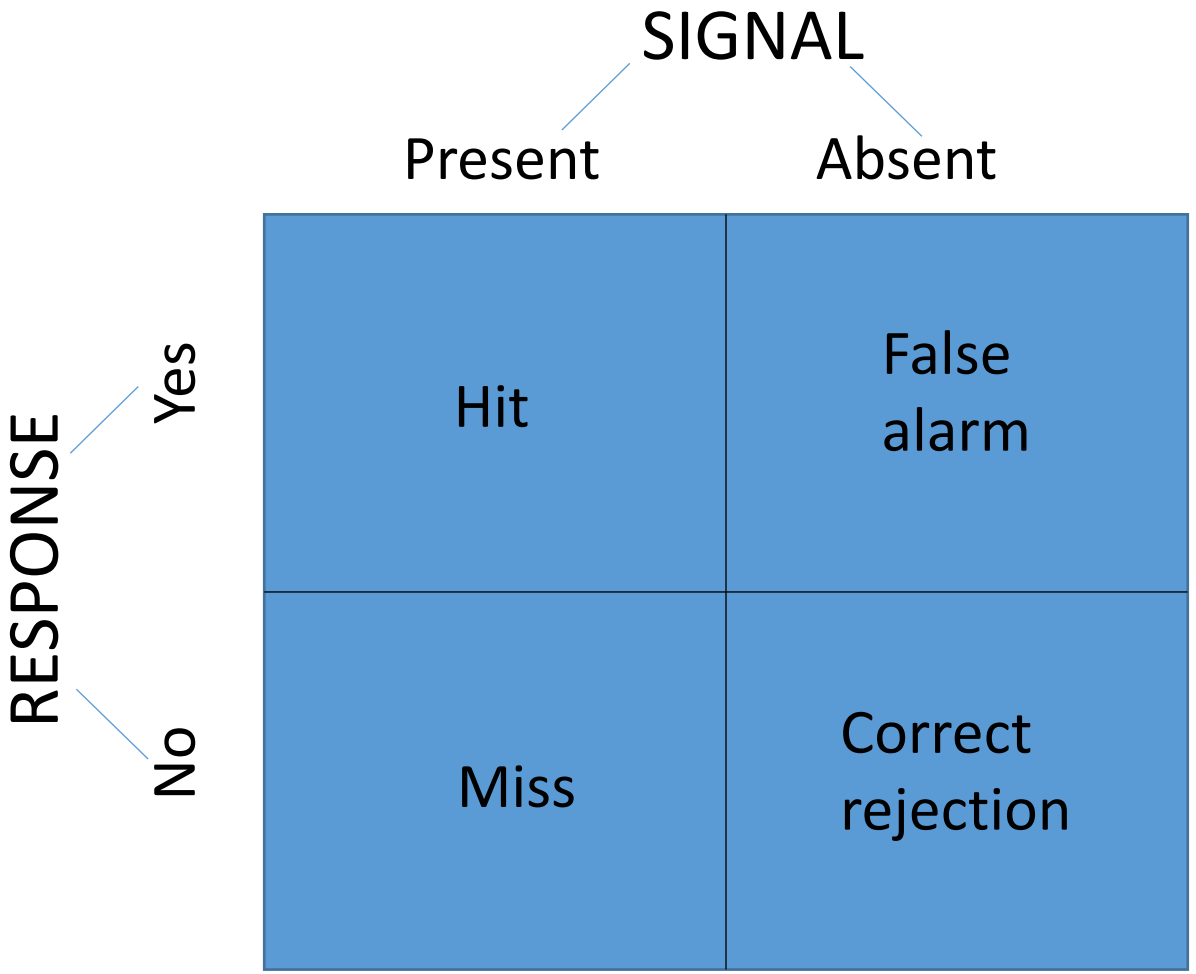
Thresholds

Sensory systems require a minimum amount of energy for activate (absolute threshold)

Signal detection theory proposes that two distinct processes are required for detecting a stimulus:

- Initial sensory process: the observer's sensitivity to the stimulus
- Decision process: the observer's **response bias** (readiness to report detecting a stimulus when not certain)

Did you see/hear/smell/ it?

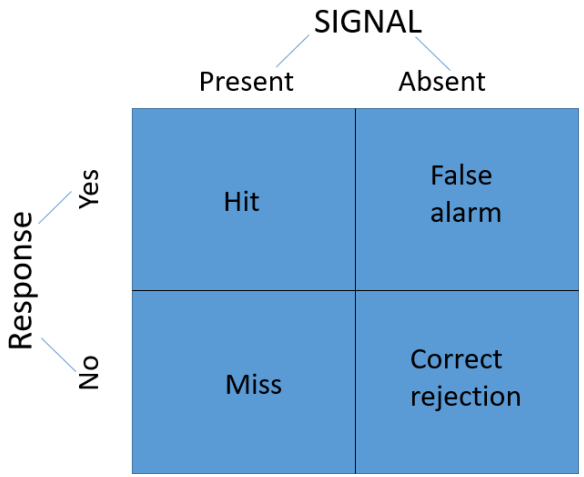


Response bias

False alarms and correct rejections give information about the decision process and sensitivity (initial sensory processing) interacts with top-down effects

Response bias occurs for many reasons

- Expectations
- Motivation
- Bottom-up effects



When do people respond? Thresholds

Absolute thresholds

- Minimal amount of stimulation needed to perceive a stimuli
  - Light, pressure difference, chemical molecules.

Just noticeable difference (JND)

- The minimum amount a stimuli must change in order to produce a noticeable difference 50% of the time

Absolute Thresholds

Examples of Absolute Thresholds

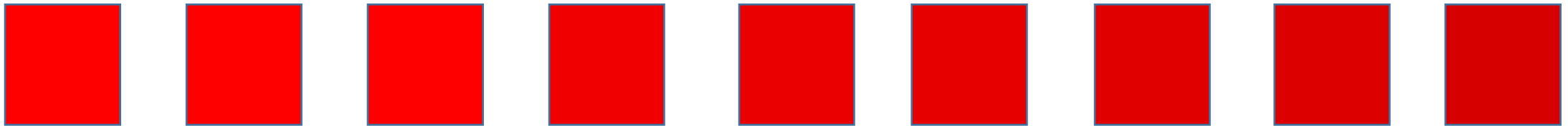
Adopted from Brown et al., 1962
D. Weston, 2003

Sense	Threshold
Vision	A candle flame 30 miles away
Hearing	A watch ticking 20 feet away
Smell	A drop of perfume in a six-room house
Taste	A teaspoon of sugar in a gallon of water
Touch	A wing of a fly on your cheek, dropped 1 cm

Just noticeable difference

650nm 655nm 660nm 665nm 670nm 675nm 680nm 685nm 690nm (wavelength)

1 2 3 4 5 6 7 8 9



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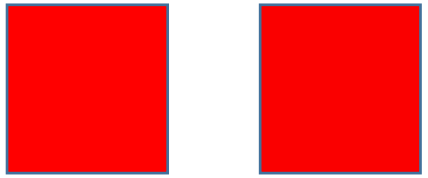

650nm 655nm = 5nm

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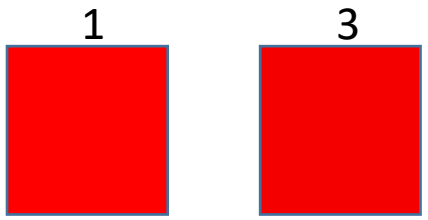

650nm 660nm = 10nm

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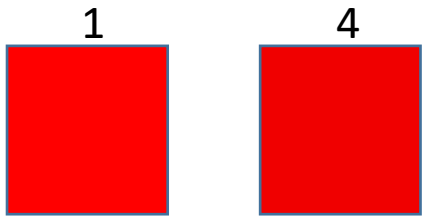
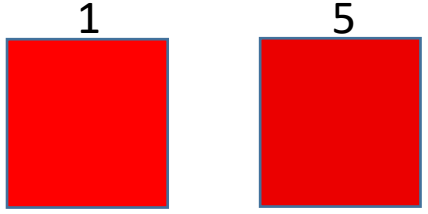


650nm 665nm = 15nm

1 5



650nm 670nm = 20nm

Repeat many times until we find
the difference you can perceive 50% of the time

A laws of perception

Weber’s Law

- Regardless of the magnitude of two stimuli, the second must differ by a constant proportion from the first to be perceived as different

2.0kg

2.5kg

3kg

3.5kg

4kg

4.5kg

5kg

2.0kg

2.5kg

Conrad's JND = 0.5kg

What proportion is the difference to the initial weight?

.5kg / 2.0kg = .25 (or 25%)

5.0kg

6.25 kg

Conrad's JND = 1.25kg

?? / 5kg = .25 (from above)
?? = .25 * 5kg

Predicted JND = 1.25kg

That's Weber's Law!

Interesting stuff

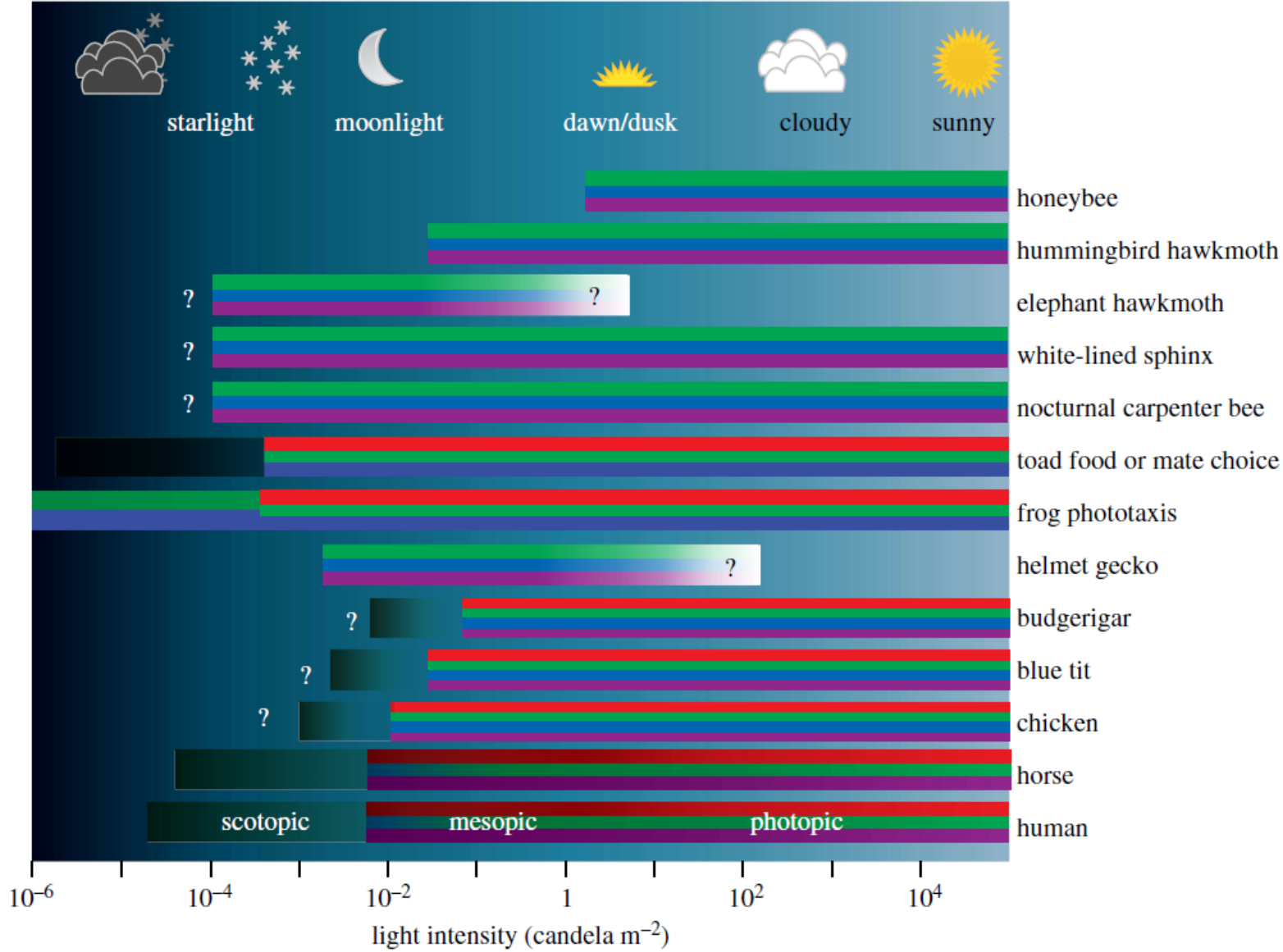


Figure 3. Dim light colour vision and thresholds of species tested so far. Colours in the bars code for receptor types contributing to vision (red: peak sensitivity >550 nm, green: peak sensitivity 490–550 nm, blue: peak sensitivity 430–490 nm, purple: peak sensitivity <430 nm, grey indicates achromatic rod vision). Question marks indicate unknown thresholds. Honeybee *Apis mellifera* [14], hummingbird hawkmoth *Macroglossum stellatarum* [29], elephant hawkmoth *Deilephila elpenor* [30], white-lined sphinx *Hyles lineata* [30], nocturnal carpenter bee *Xylocopa tranquebarica* [31], common toads *Bufo bufo* and *B. garganizans* [32], common frog *Rana temporaria* [32], helmet gecko *Tarentola chazaliae* [33], budgerigar *Melopsittacus undulatus* [34], blue tit *Cyanistes caeruleus* [35], chicken *Gallus gallus* [36] and horse *Equus caballus* [37].