Perception: Psychophysics and Modeling

01 | How to study vision

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Questions to think about

- Wandell stresses encoding, representation and interpretation—make sure you know what he means by the three terms.
- Marr distinguishes understanding computers from understanding computations—what is this distinction? Is one more important than the other?
- Marr, too, talks about the importance of representation—what is a representation for Marr?
- What are the three levels of analysis or explanation Marr distinguishes? Make sure you can define all three of them in one or two sentences each.

Tinbergen's four questions

Nikolaas "Niko" Tinbergen, FRS (15 April 1907 – 21 December 1988) was a Dutch biologist and ornithologist who shared the 1973 Nobel Prize in Physiology or Medicine with Karl von Frisch and Konrad Lorenz for their discoveries concerning organization and elicitation of individual and social behavior patterns in animals. He is regarded as one of the founders of modern ethology, the study of animal behavior.
(from: https://en.wikipedia.org/wiki/Nikolaas_Tinbergen)

Tinbergen described four questions he believed should be asked of any animal behaviour, which were:

Causation (mechanism): what are the stimuli that elicit the response, and how has it been modified by recent learning? How do behaviour and psyche "function" on the molecular, physiological, neuro-ethological, cognitive and social level, and what do the relations between the levels look like?

Development (ontogeny): how does the behaviour change with age, and what early experiences are necessary for the behaviour to be shown? Which developmental steps ... and which environmental factors play when / which role?

Function (adaptation): how does the behaviour impact on the animal's chances of survival and reproduction?

Evolution (phylogeny): how does the behaviour compare with similar behaviour in related species, and how might it have arisen through the process of phylogeny? Why did structural associations (behaviour can be seen as a "time space structure") evolve in this manner and not otherwise?

In ethology and sociobiology, causation and ontogeny are summarised as the *proximate mechanisms*, while adaptation and phylogeny are the *ultimate mechanisms*. They are still considered as the cornerstone of modern ethology, sociobiology and transdisciplinarity in Human Sciences.
(from: ibid)

Four causes of Aristotle

(https://en.wikipedia.org/wiki/Four_causes)

The four causes or four explanations are, in Aristotelian thought, four fundamental types of answer to the question "why?", in analysis of change or movement in nature: the *material*, the *formal*, the *efficient*, and the *final*. Aristotle wrote that "we do not have knowledge of a thing until we have grasped its why, that is to say, its cause." While there are cases in which classifying a "cause" is difficult, or in which "causes" might merge, Aristotle held that his four "causes" provided an analytical scheme of general applicability.

In *Physics II.3* and *Metaphysics V.2*, Aristotle holds that there are four kinds of answers to "why" questions:

Matter (the material cause of a change or movement): the aspect of the change or movement that is determined by the material that composes the moving or changing things. For a table, this might be wood; for a statue, it might be bronze or marble.

Form (the formal cause of a change or movement): a change or movement caused by the arrangement, shape, or appearance of the thing changing or moving. Aristotle says, for example, that the ratio 2:1, and number in general, is the formal cause of the octave.

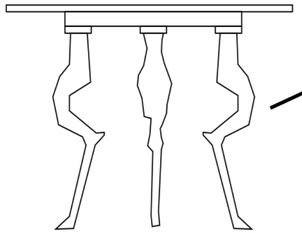
Agent (the efficient or moving cause of a change or movement): consists of things apart from the thing being changed or moved, which interact so as to be an agency of the change or movement. For example, the efficient cause of a table is a carpenter, or a person working as one, and according to Aristotle the efficient cause of a boy is a father.

End or purpose (the final cause of a change or movement): a change or movement for the sake of a thing to be what it is. For a seed, it might be an adult plant; for a sailboat, it might be sailing; for a ball at the top of a ramp, it might be coming to rest at the bottom.

Four causes of Aristotle (cont’d)

Material Cause:
Wood

Final Cause:
Dining



Formal Cause:
Design

Efficient Cause:
Carpentry

Aristotle's Four Causes illustrated for a table:
1. material (wood),
2. formal (design),
3. efficient (carpentry),
4. final (dining).