

## **PSYC 2530: Associations**

From philosophy to early animal  
cognition

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# Reminders

Reading is chapter 5 on [Associations](#) from the textbook.

This is part I of II mini-lectures on Associationism

# Roadmap

1 Philosophy and Associationism

2 Cattell's Associations

3 Thorndike's Puzzle Boxes

4 Pavlov's Classical Conditioning

# Precursors to Experimental Psychology

- Philosophy and Associationism
- Natural Science
- Evolution

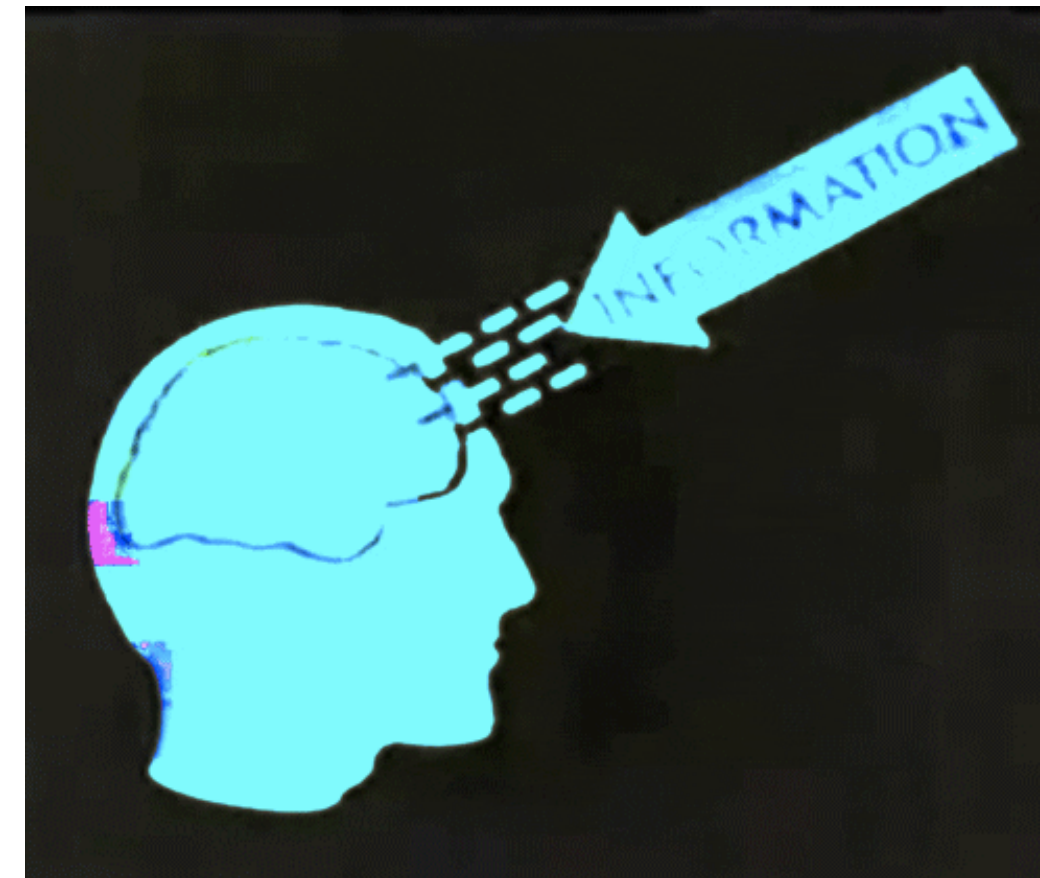
# Philosophy

For many centuries before Psychology, questions about cognition were posed by philosophers

# Epistemology

The branch of philosophy concerned with knowledge...

What is knowledge? How do we know something?



# Rationalism

**Rationalism** holds that knowledge is derived from logic and reason

Some rationalist philosophers include:

**René Descartes** (1596–1650)

**Baruch Spinoza** (1632–1677)

**Gottfried Leibniz** (1646–1716)

# Empiricism

Empiricism emphasized a role for observation and evidence collection in knowledge creation.

- e.g., suggests that people acquire knowledge through their sense organs
- Invites questions about how the process of knowledge acquisition works



# The Associationist School

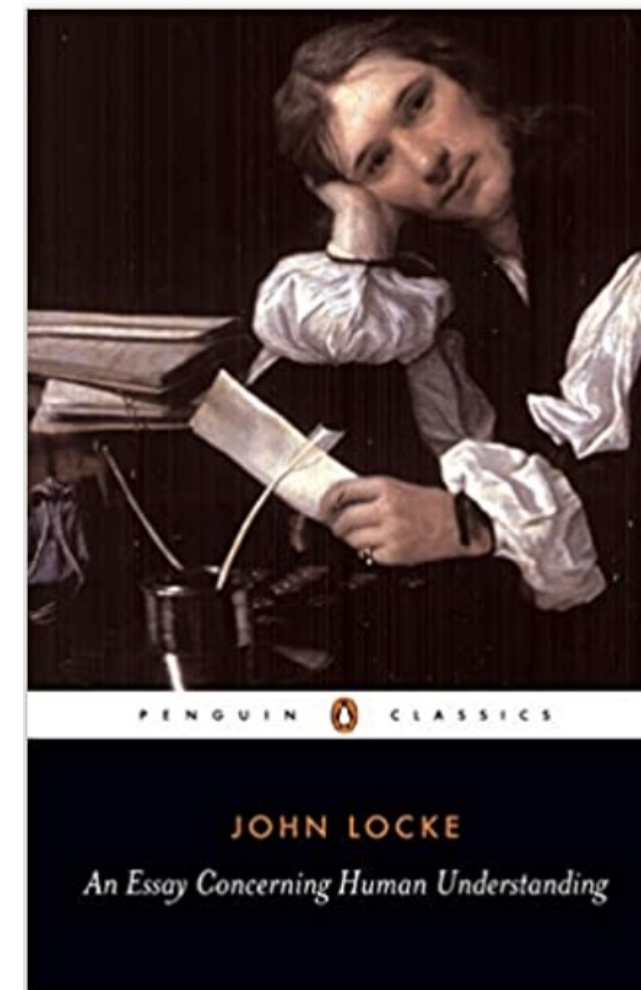
The Associationist School included empiricist philosophers who speculated further on the nature of mental processes that produced knowledge from experience.

# John Locke (1632 – 1704)

Discusses *Association of Ideas* as a non-rational process

Suggests some associations are “natural and good”, and maintained by reasoning

Suggests associations can also be arbitrary because they depend on a persons history of experience (scroll down for an excerpt)



[Read Chapter 33, An Essay Concerning Human Understanding](#)

# Excerpt

*From a wrong connexion of ideas. Some of our ideas have a natural correspondence and connexion one with another: it is the office and excellency of our reason to trace these, and hold them together in that union and correspondence which is founded in their peculiar beings. Besides this, there is another connexion of ideas wholly owing to chance or custom. Ideas that in them-selves are not all of kin, come to be so united in some men's minds, that it is very hard to separate them; they always keep in company, and the one no sooner at anytime comes into the understanding, but its associate appears with it; and if they are more than two which are thus united, the whole gang, always inseparable, show themselves together.*

# Principles of Association

Associationists proposed **principles** about factors that influence the formation of associations:

- **The principle of contiguity** states that strength of association depends on the proximity of events in space and time. Events that are closer to each other are associated more strongly.
- **The principle of similarity** states that more similar events will develop stronger associations than less similar events.
- **The principle of frequency** is that events that co-occur more frequently will be associated more strongly than less frequent events.
- **The recency principle** suggests stronger associations for recent events than more remote events.

# Putting the claims to the test

Associationist claims are specific enough that they can be evaluated with evidence. As a result, it becomes possible to use the scientific method to assess claims about associations and cognition.

Some basic claims include:

1. People have associations between concepts
2. New associations can be learned
3. Some associations are stronger than others

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# Cattell's Experimental Psychology

James McKeen Cattell (early mental tester from last chapter) also conducted experimental psychology research

General goal was to use experiments to test theories of cognitive processes, especially those related to the formation of associations

# Mental Chronometry

Mental chronometry involves measuring the amount of time necessary to complete a task or mental operation



# Naming Time research

Cattell, J. M. (1886). The time it takes to see and name objects. *Mind*, 11(41), 63–65. <https://doi.org/10/b6fr5r>

Question? - what were his questions?

Methods? - what were his methods?

Results? - what did he find?

Let's take a quick look at the paper

# Question

## **Big questions...**

How long does it take for a person to will or think something?

What processes are occurring during the temporal interval?

## **Specific question..**

How long does it take to see and name an object, like a specific color or a letter?

# Method

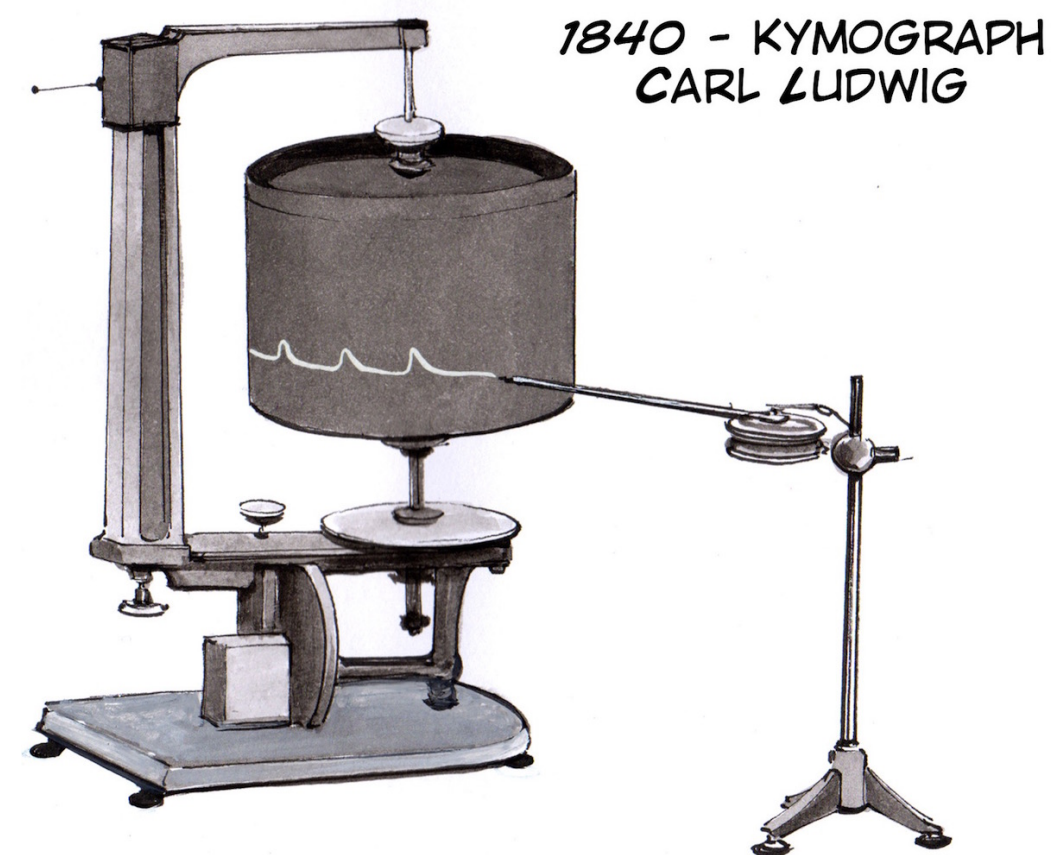
Cattell “hacked” a kymograph

Presented stimuli on a rotating drum

Visible through a slit in a screen

Measured the rate participants could read stimuli as they passed through the slit

## Kymograph



# Results

Participants took 200 to 333 ms to read each letter, when slit was 1cm in diameter

Letter naming speed increased when slit is wider (can preview upcoming letters)

*"Of the nine persons experimented on four could read the letters faster when five were in view at once, but were not helped by a sixth letter; three were not helped by a fifth and two not by a fourth letter. This shows that while one idea is in the centre, two, three or four additional ideas may be in the background of consciousness."*

*"Other experiments I have made show that we can recognise a single colour or picture in a slightly shorter time than a word or letter, but take longer to name it. This is because in the case of words and letters the association between the idea and name has taken place so often that the process has become automatic, whereas in the case of colours and pictures we must by a voluntary effort choose the name."*

# Association time research

Cattell, J. M. (1887). Experiments on the association of ideas. *Mind*, 12(45), 68–74. <https://doi.org/10/dgbv2m>

# Question

## **Big Questions**

How are concepts formed without words? What mental processes take place when an object is named? Are there differences when using a familiar or second-language?

## **Specific questions**

How long does it take to recall an association, such as saying the name of an object?



# Method and Results

## II.

A great part of our time is spent in calling to mind things we already know. Memory is no transcendental process outside of space and time; this paper shows just how much time it takes to remember, and we have every reason to believe that the time passes while certain changes in the brain call forth other changes. I give below the time it took B and C to remember certain facts, examples of the necessary associations with which the mind is continually busy. A well-known city was given, and the subject named the country in which it is situated; a month was given, and the season to which it belongs was named, and in like manner the preceding or following month; an eminent author was given, and the subject named the language in which he wrote; a distinguished man, and his calling was named. In the last two cases below, the subject respectively added and multiplied numbers of one place. At first sight this mental operation may seem to consist of a mathematical calculation, and to be altogether different from the others; it is however not unlike them, being essentially an act of memory.

			<i>City-Country (52).</i>						
B	348	53	333	35	C	462	120	413	65
			<i>Month-Season (26).</i>						
	415	55	410	31		310	63	306	16
			<i>Month-Following Month (26).</i>						
	345	45	327	25		389	172	384	61
			<i>Month-Preceding Month (26).</i>						
	763	245	619	129		832	233	815	160
			<i>Author-Language (78).</i>						
	417	80	402	53		350	57	337	32
			<i>Man-Calling (78).</i>						
	465	89	440	62		368	95	326	53
			<i>Addition (52).</i>						
	221	46	223	23		336	77	299	36
			<i>Multiplication (52).</i>						
	389	71	369	38		544	225	507	158

# Summary so far

Associationist ideas from philosophy provided some starting points for theorizing about how cognition works

Early experimental psychologists conducted experiments to measure association formation processes

Association learning was also soon studied in non-human animals



# Roadmap

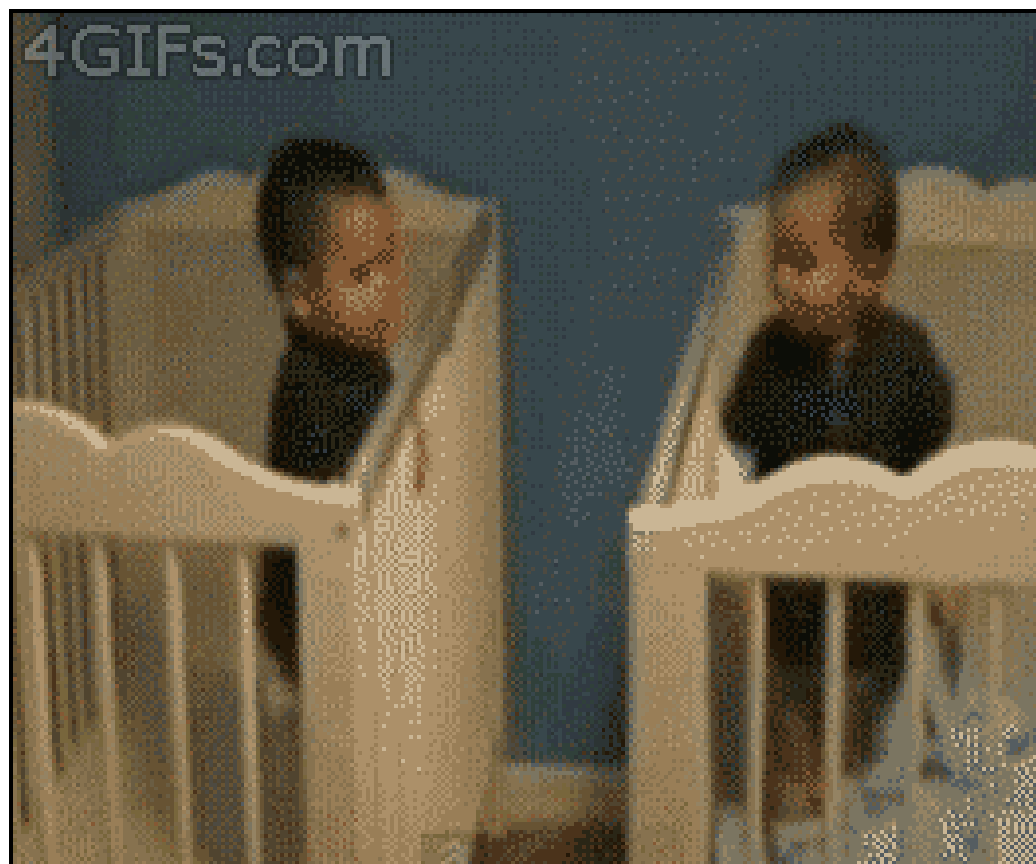
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# Human and Animal Cognition



# Edward Thorndike (1874-1949)

Student of Cattell

One of the first psychologists to apply experimental laboratory techniques to ask questions about association learning in animals

Later focused on Educational Psychology

Also a leader in the eugenics movement



# Animal intelligence

Published his animal cognition research in a doctoral thesis

Thorndike, E. L. (1898). Animal intelligence: An experimental study of the associative processes in animals. *The Psychological Review: Monograph Supplements*, 2(4), i–109.

<https://doi.org/10/bk48z2>

# Puzzle box research

“Escape Rooms” for animals

Thorndike investigated how cats, dogs, and chicks learned to escape from puzzle-box contraptions

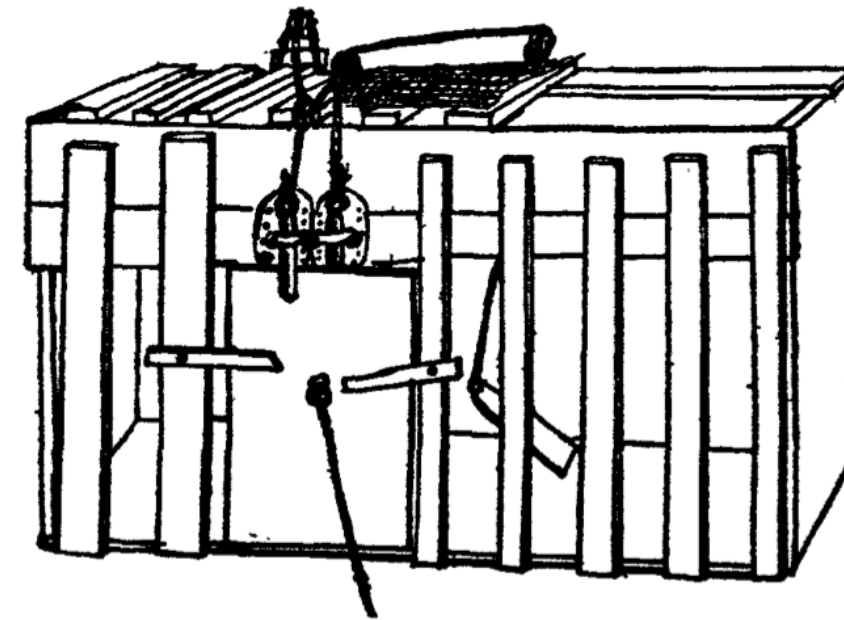


FIG. 1.

# The subjective experience of kittens

*"We say that the kitten associates the sound 'kitty kitty' with the experience of nice milk to drink, which does very well for a common-sense answer. It also suffices as a rebuke to those who would have the kitten ratiocinate about the matter, but it fails to tell what real mental content is present. Does the kitten feel "sound of call, memory-image of milk in a saucer in the kitchen, thought of running into the house, a feeling, finally, of 'I will run in?'" Does he perhaps feel only the sound of the bell and an impulse to run in, similar in quality to the impulses which make a tennis player run to and fro when playing? The word association may cover a multitude of essentially different processes, and when a writer attributes anything that an animal may do to association his statement has only the negative value of eliminating reasoning on the one hand and instinct on the other. To give to the word a positive value and several definite possibilities of meaning is one aim of this investigation."*



# Testing ideas about animal cognition

*"Surely every one must agree that no man now has a right to advance theories about what is in animals' minds or to deny previous theories unless he supports his thesis by systematic and extended experiments. My own theories... will doubtless be opposed by many. I sincerely hope they will, provided the denial is accompanied by actual experimental work. In fact I shall be tempted again and again in the course of this book to defend some theory, dubious enough to my own mind, in the hope of thereby inducing some one to oppose me and in opposing me to make the experiments I have myself had no opportunity to make yet."*

# Basic results

Animals could learn to escape from the boxes

Animals got faster at escaping with practice

Further questions...

- How were the animals solving the problem?
- How were they getting faster?
- What kinds of associations were involved?



# Possible stages of association

*There might be in an association, such as is formed after experience with one of our boxes, the following elements:*

- 1. Sense-impression of the interior of the box, etc.*
- 2. Discomfort and desire to get out.*
- 3. Representation of oneself pulling the loop.*
- 4. Fiat comparable to the human "I'll do it."*
- 5. The impulse which actually does it.*
- 6. Sense-impression of oneself pulling the loop, seeing one's paw in a certain place, feeling one's body in a certain way, etc.*
- 7. Sense impression of going outside.*
- 8. Sense impression of eating, and the included pleasure. Also between 1 and 4 we may have*
- 9. Representations of one's experience in going out,*
- 10. Of the taste of the food, etc.*

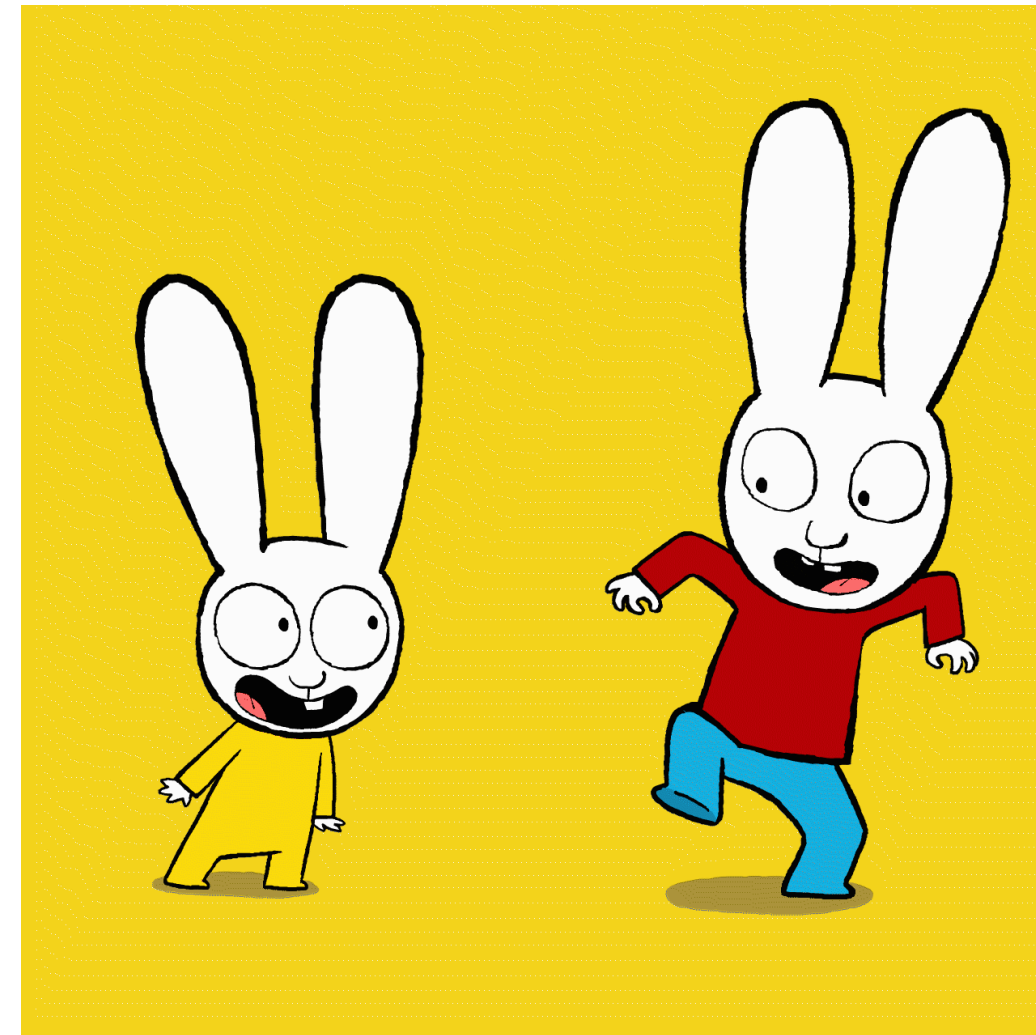
# Experimental questions

Thorndike conducted several experiments designed to test hypotheses about animal learning.

# Imitation Learning

**Question:** can animals learn how to escape a puzzle box by watching another animal escape?

**Result:** Cats, dogs, and chicks did not benefit from the opportunity for imitation learning



# General concept learning

**Question:** Can animals generalize their learning? If they learn to escape from one box, do they show benefits when trying to escape from similar boxes?

**Results:** Thorndike evidence of positive transfer

His animals learned to escape from a new puzzle box faster when it was similar to a puzzle box they had learned previously.

# Interpreting positive transfer

What does evidence of generalization, or positive transfer mean about the underlying cognitive processes involved?

## **General Concept Formation**

Animals learn abstract concepts about the puzzle boxes, and they use human-like reasoning processes to figure out how to escape from novel boxes

## **Incidental Transfer**

Thorndike favored the view that animals were not learning general concepts, and instead were learning about specific details of the puzzle box that happened to transfer well to similar boxes.

# Further questions

Thorndike entertained questions about associations that ought to be studied in the future. Some of these questions included:

1. Delicacy and permanence of associations: How fragile are some associations, how long do associations last after they have been formed?
2. Complexity of associations (Thorndike intended to rank intelligence of animals as a function of the complexity of associations they could acquire)
3. Number of associations: How many associations do different animals have?
4. Inhibition of instinct by habit: Can an animal learn to override an instinctual behavior through associative learning?
5. Role of attention: does the formation of an association depend on attending to sense-impressions?

# Physiology and Psychology

At the same time as Thorndike, Ivan Pavlov was also investigating associative learning processes in animals

Pavlov was interested in the physiological/brain mechanisms that enabled association formation

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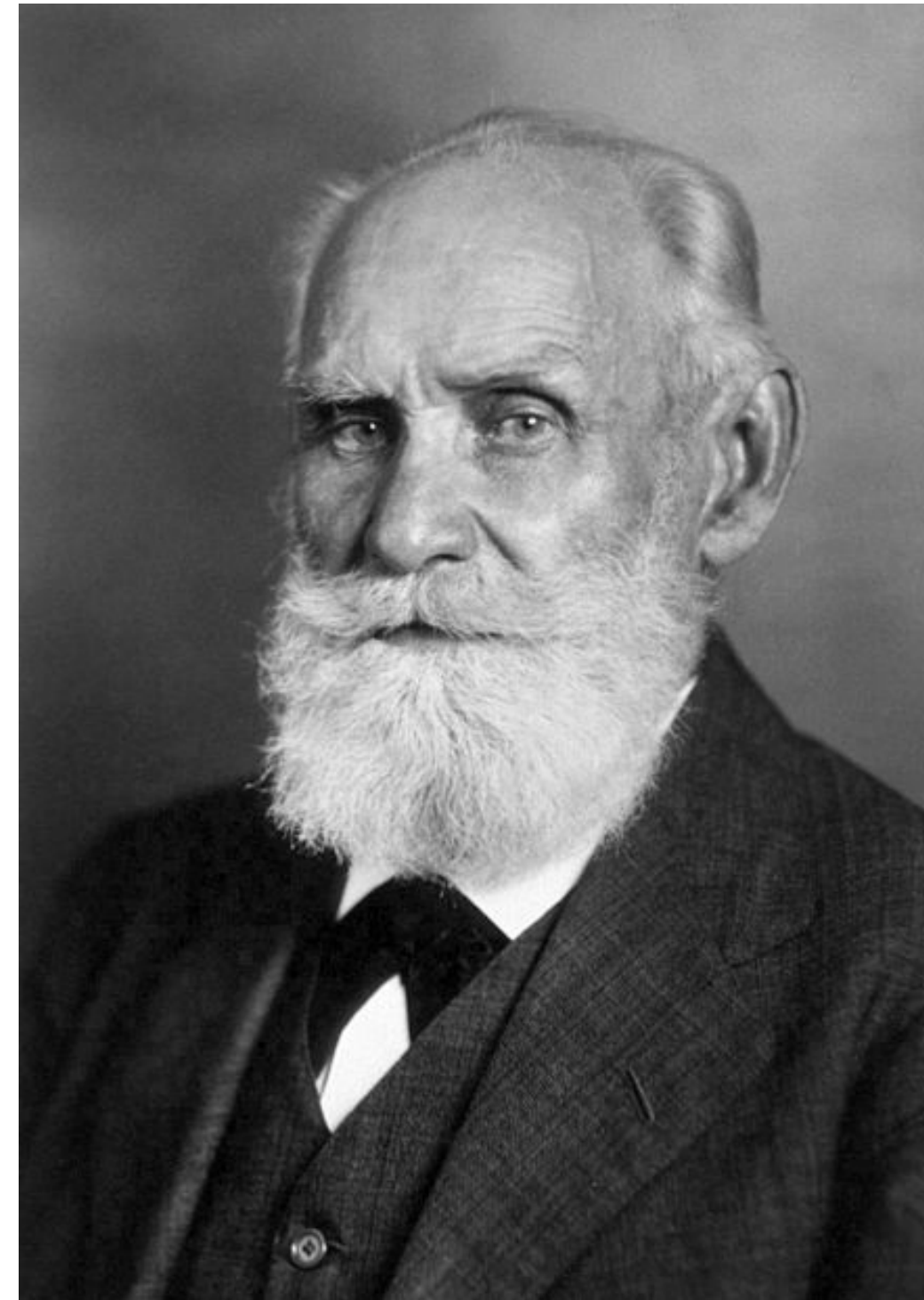


# Ivan Pavlov (1849 - 1936)

Russian Physiologist

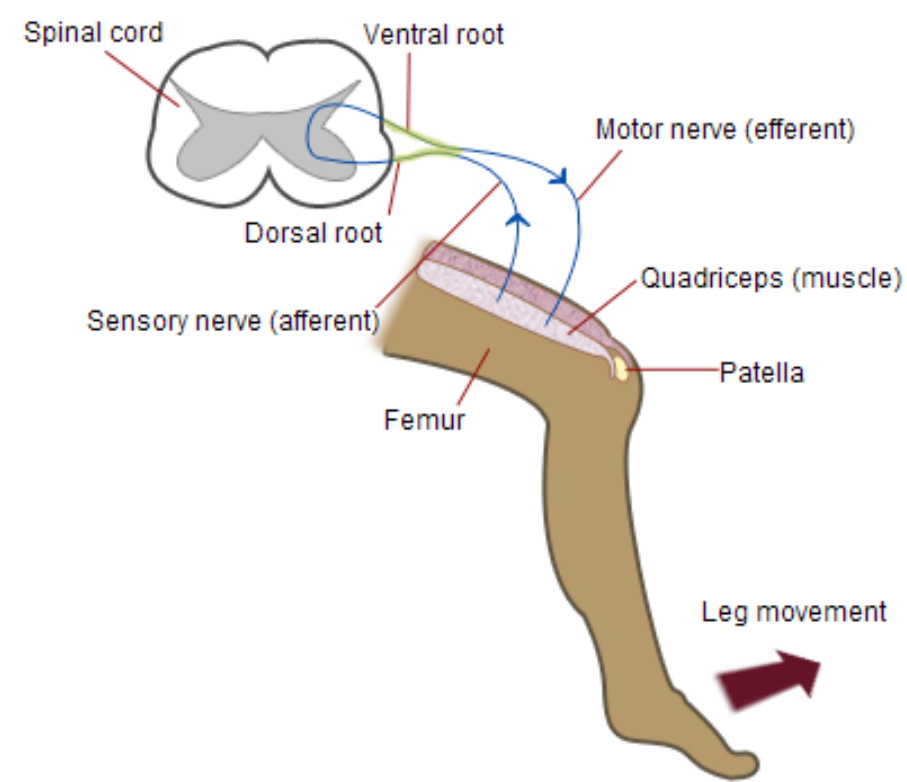
Discovered Classical  
Conditioning

Won Nobel prize in 1904

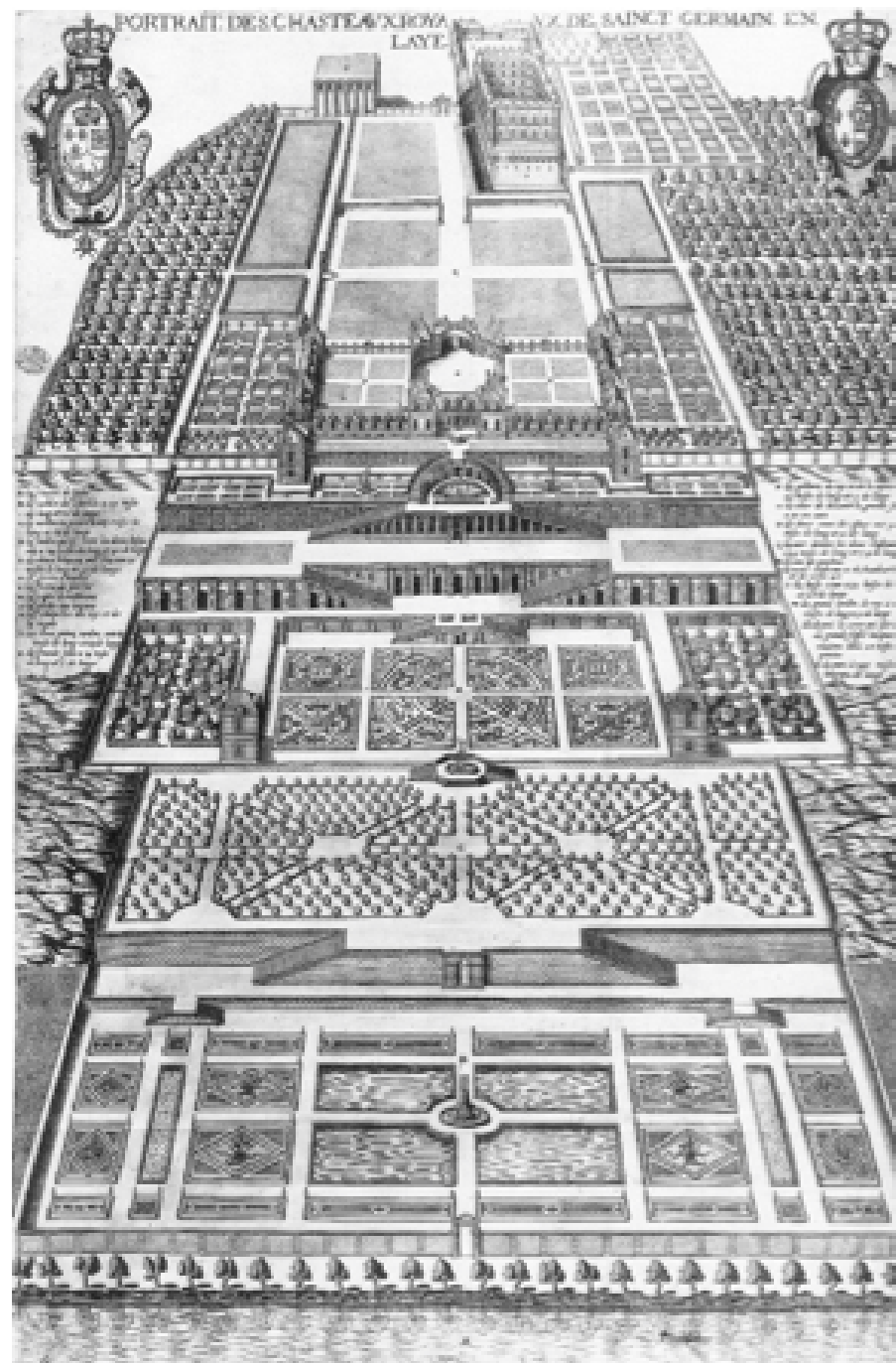


# Descarte's Reflexes

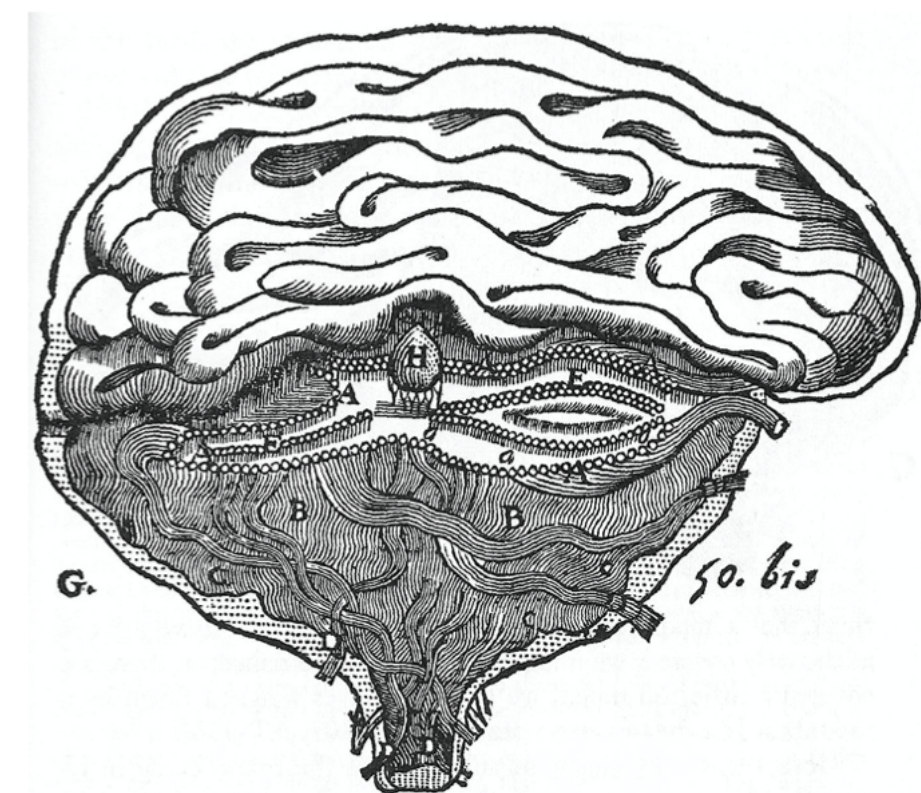
Knee reflex



Garden at St. Germain, with incredible plumbing



The brain as a complicated web of plumbing



# Pavlov's Liquids

*“Our starting point has been Descartes’ idea of the nervous reflex. This is a genuine scientific conception, since it implies necessity. It may be summed up as follows: An external or internal stimulus falls on some one or other nervous receptor and gives rise to a nervous impulse; this nervous impulse is transmitted along nerve fibres to the central nervous system, and here, on account of existing nervous connections, it gives rise to a fresh impulse which passes along outgoing nerve fibres to the active organ, where it excites a special activity of the cellular structures. Thus, a stimulus appears to be connected of necessity with a definite response, as cause with effect. It seems obvious that the whole activity of the organism should conform to definite laws.”*

# Classical Conditioning

A procedure to demonstrate acquisition or learning of a **new** stimulus-response pathway/association

Terms

UCS = Unconditioned Stimulus

UCR = Unconditioned Response

CS = Conditioned Stimulus

CR = Conditioned Response

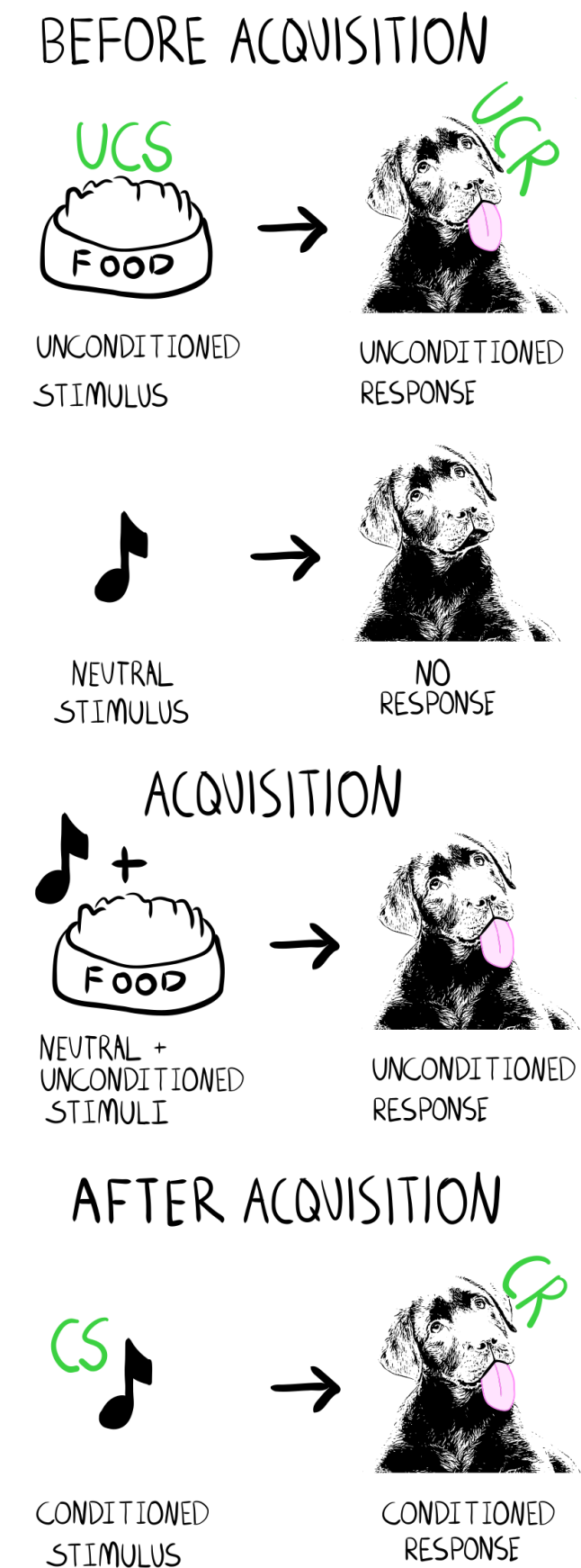


# Simple Acquisition

Repeatedly pairing a reward stimulus (food) with a neutral stimulus (tone), causes an animal to begin salivating in response to the neutral stimulus

Before acquisition the food caused salivation

After acquisition the tone causes salivation



# Explaining Acquisition

What kind of association was learned?

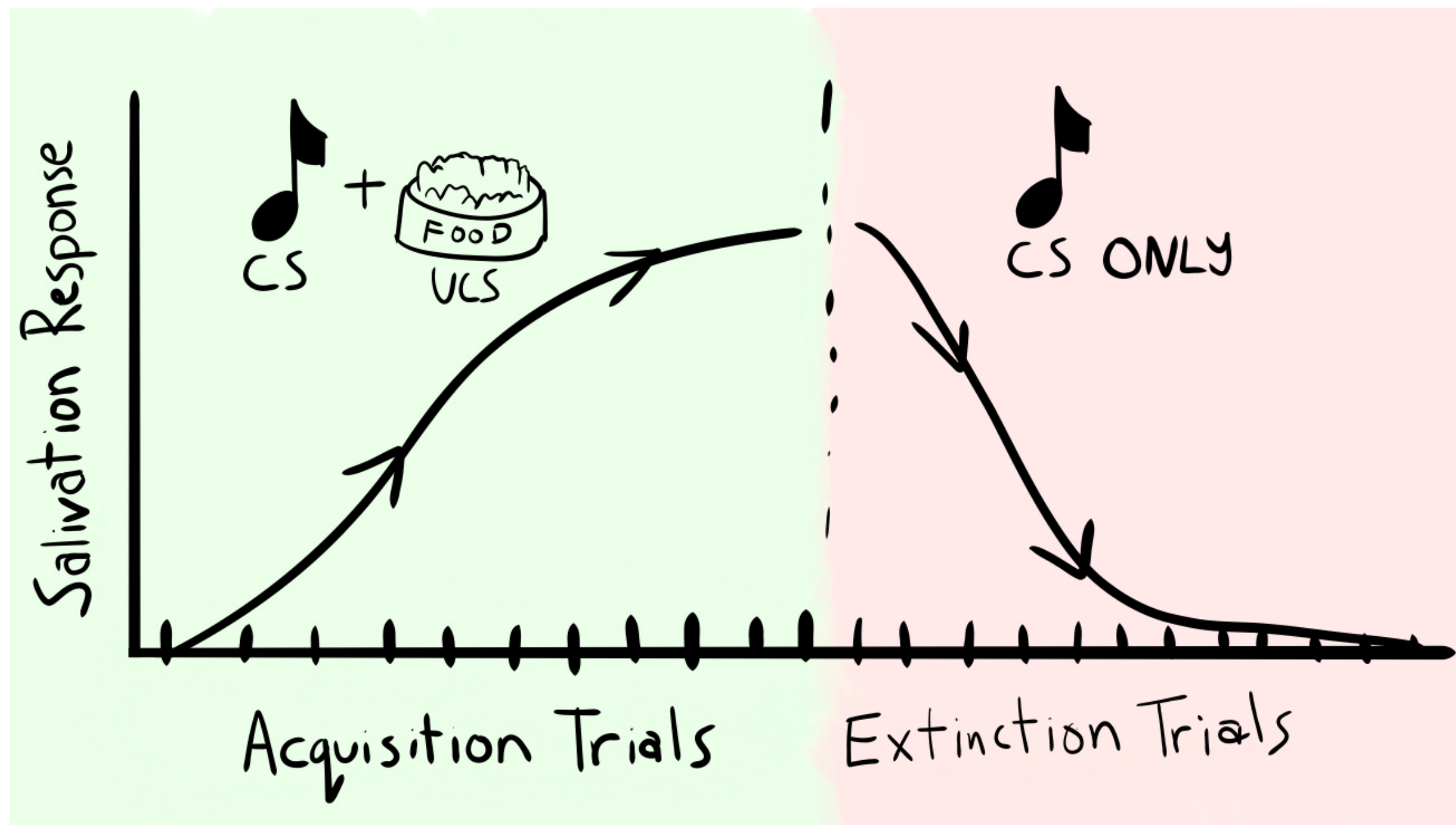
Did the tone make the animal expect to receive food, and the expectation for food evoked salivation?

Does the tone cause the animal to “mentally simulate” eating food?

Does the tone directly cause salivation without causing an expectation for food?

# Extinction

Can newly learned associations become unlearned?



# Explaining Extinction

Did the original association between tone and food become weakened or eliminated during extinction?

Did the animal learn to suppress its expectation for food?



# Spontaneous Recovery

Spontaneous recovery is the observation that an extinguished S-R association can suddenly re-appear spontaneously



# Conditioning in humans

Siegel, S., & Allan, L. G. (1998). Learning and homeostasis: Drug addiction and the McCollough effect. *Psychological Bulletin*, 124(2), 230–239. <https://doi.org/10.1037/0033-2909.124.2.230>

# Conditioning and Drug tolerance

Siegel, S., Hinson, R. E., Krank, M. D., & McCully, J. (1982). Heroin “overdose” death: Contribution of drug-associated environmental cues. *Science*, 216(4544), 436–437.

<https://doi.org/10.1126/science.7200260>

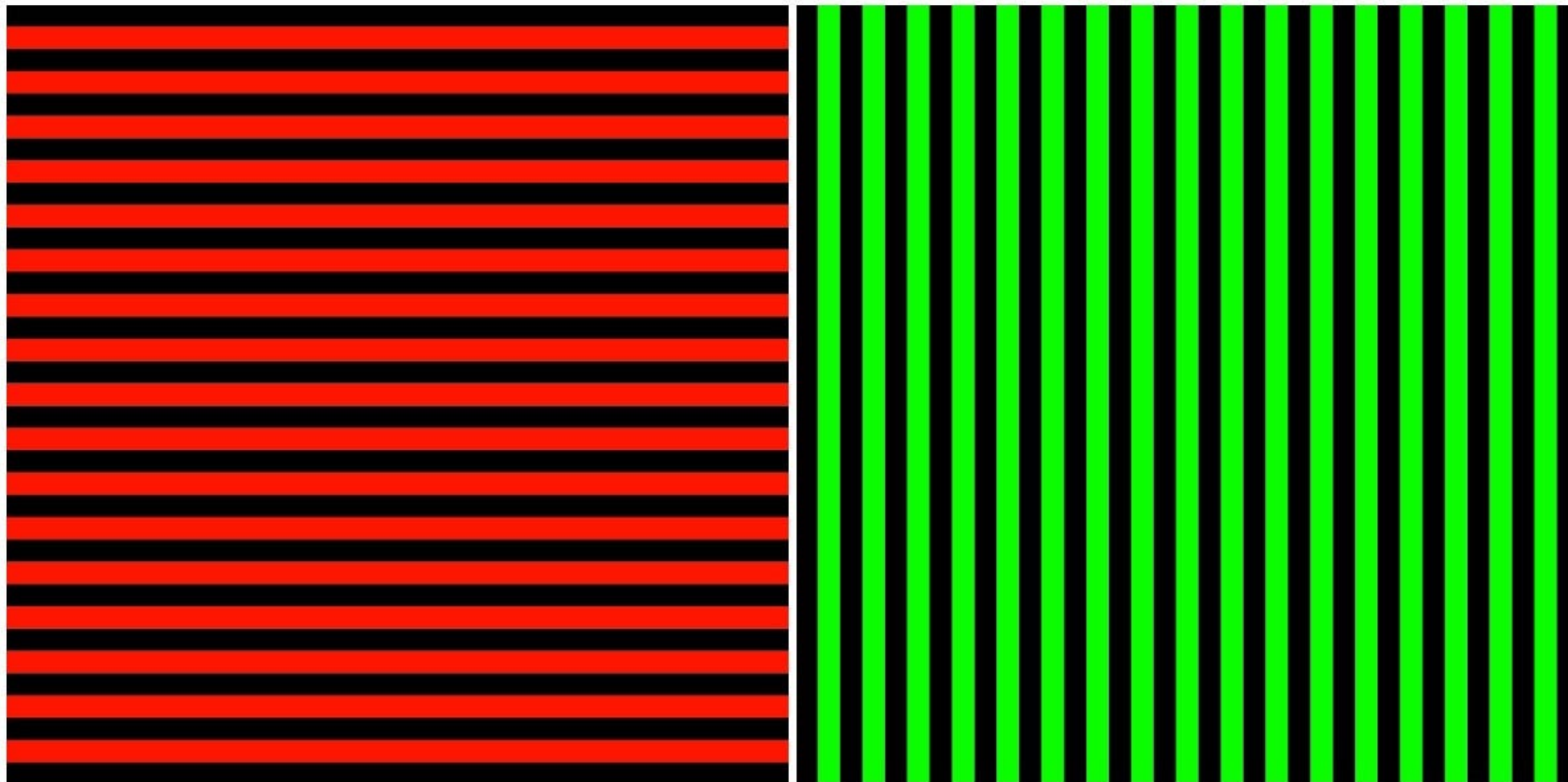
# Conditioning and Perception

McCollough, C. (1965). Color adaptation of edge detectors in the human visual system. *Science*, 149, 1115-1116.

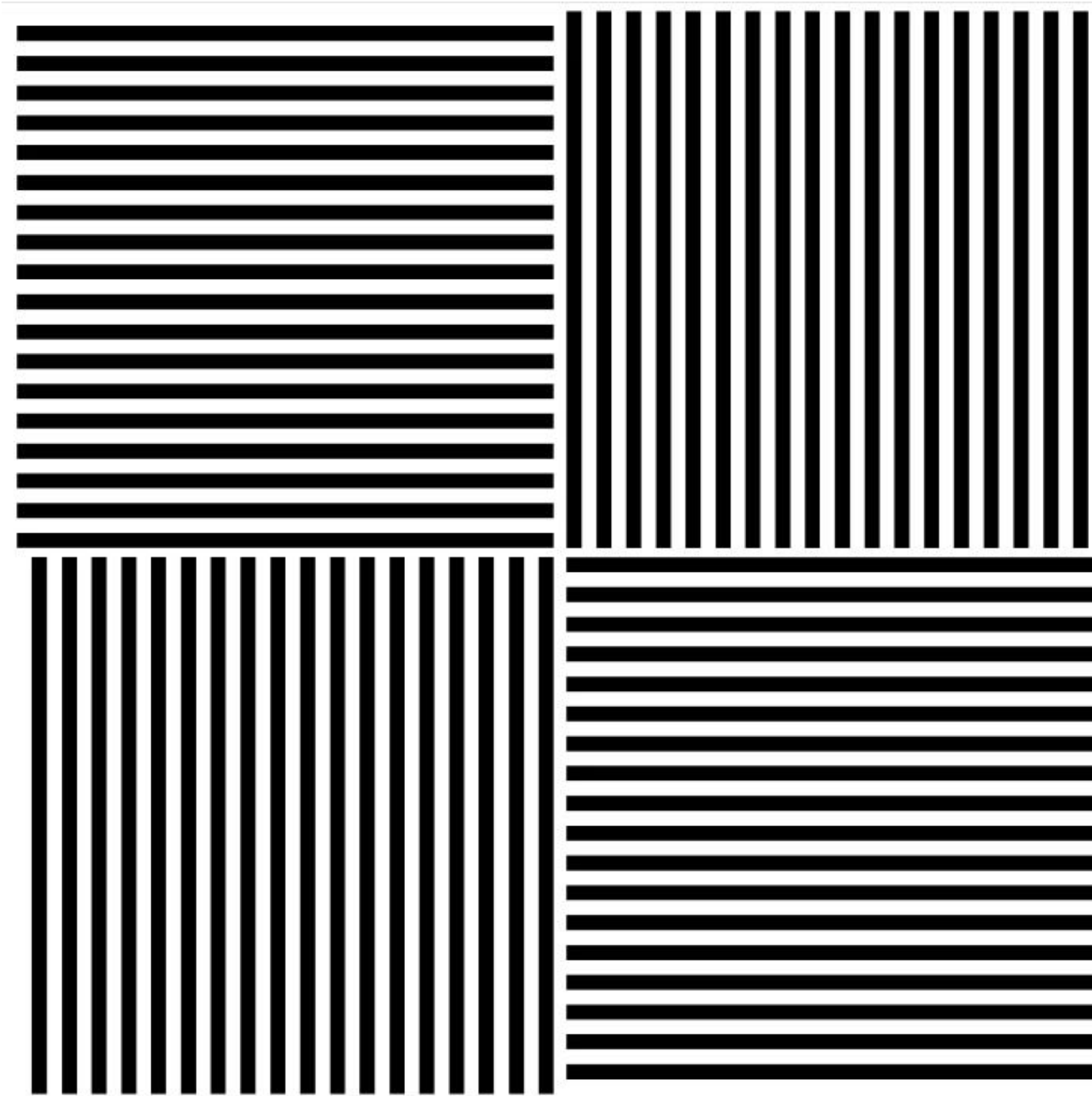
Allan, L. G., & Siegel, S. (1986). McCollough effects as conditioned responses: Reply to Skowbo. *Psychological Bulletin*, 100(3), 388–393. <https://doi.org/10.1037/0033-2909.100.3.388>

# McCollough inducer

Alternate looking directly at the red lines then green lines for about 1 minute or more



# McCollough tester



# What's next

Finish the readings and mini-lectures for this module, and then complete the quiz and/or assignments by the due date.