

---

# Theory of Perception

Hermann Von Helmholtz

---

# About Hermann von Helmholtz

- Born on August 31, 1821 in Germany
- German physician and physicist.
- In physiology and psychology, known for:
  - Theories of vision
  - Visual perception
  - Empiricism
- In physics, known for:
  - Theory of conservation of energy
  - Work in electrodynamics
  - Chemical thermodynamics
  - Mechanical foundation of thermodynamics.



# History of Perception Theory

# “Projection” Theory

A stimulus causes its response directly.

# “Projection” Theory

A stimulus causes its response directly



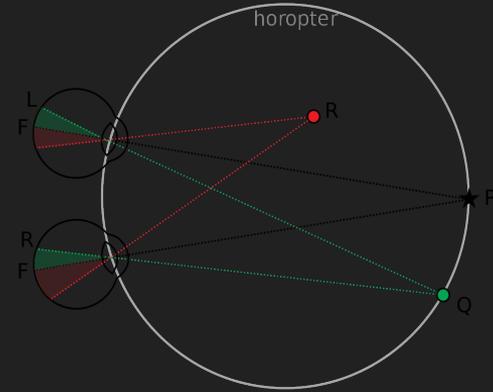
# Contradiction to “Projection Theory” -- Muller

What is Stereoscopic Binocular Vision?

# Contradiction to “Projection Theory” -- Muller

## Stereoscopic Binocular Vision

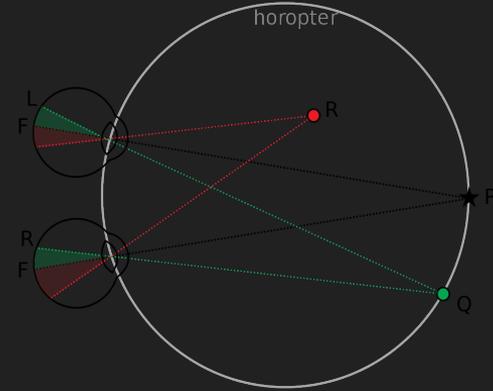
- Two images on our retinas are resolved into one image.
- How is it possible if the images are projected directly onto our nerves?



# Contradiction to “Projection Theory” -- Muller

## Stereoscopic Binocular Vision

- Two images on our retinas are resolved into one image.
- How is it possible if the images are projected directly onto our nerves?

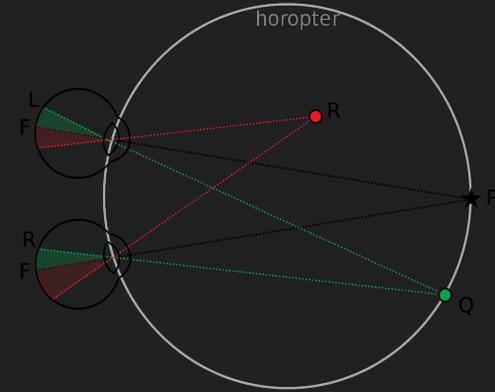


## Upside down projected image in Retina

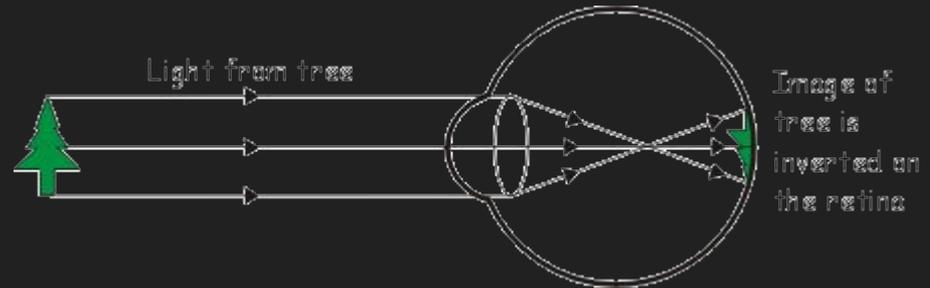
# Contradiction to “Projection Theory” -- Muller

## Stereoscopic Binocular Vision

- Two images on our retinas are resolved into one image.
- How is it possible if the images are projected directly onto our nerves?



## Upside down projected image in Retina



# “Law of Specific Sense Energies” -- Muller

- Each nerve is configured to receive a specific range of signals.

# “Law of Specific Sense Energies” -- Muller

- Each nerve is configured to receive a specific range of signals.



# “Law of Specific Sense Energies” -- Muller

- Each nerve is configured to receive a specific range of signals.



- Some organic correlation between the retinas of the eye.

# “Law of Specific Sense Energies” -- Muller

- Each nerve is configured to receive a specific range of signals.



- Some organic correlation between the retinas of the eye.
- One point in left retina index to one and only point in the right retina.

# “Law of Specific Sense Energies” -- Muller

- Each nerve is configured to receive a specific range of signals.



- Some organic correlation between the retinas of the eye.
- One point in left retina index to one and only point in the right retina.
- Two signals from corresponding points on the two retina are projected onto a signal point.

# Helmholtz's Stand of Theory of Perception

# Hermann Von Helmholtz's "Sign" Theory

Contradiction to the Muller's "Specific Nerve Energies".

# Hermann Von Helmholtz's "Sign" Theory

Contradiction to the Muller's "Specific Nerve Energies".

Specific Nerve Energies -- Muller

- Correspondence between sensation and object by means of an innate configuration of sense nerves.

# Hermann Von Helmholtz's "Sign" Theory

Contradiction to the Muller's "Specific Nerve Energies".

Specific Nerve Energies -- Muller

- Correspondence between sensation and object by means of an innate configuration of sense nerves.

Sign Theory

- Sensations symbolizes their stimuli, but are not direct copies of those stimuli.
- Correspondence between sensation and object by means of a series of learned, "unconscious inferences."

# Hermann Von Helmholtz's "Sign" Theory

- Spatial Position is an interpretation of our sensations and not the immediate result of the object.

# Hermann Von Helmholtz's "Sign" Theory

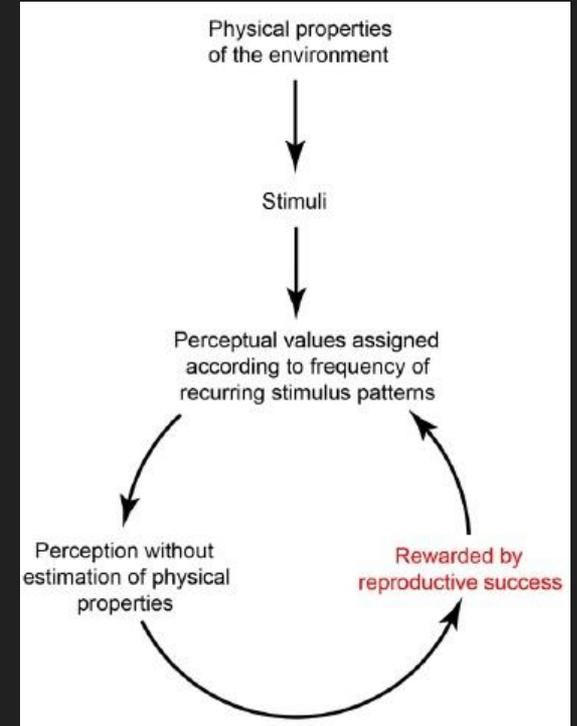
- Spatial Position is an interpretation of our sensations and not the immediate result of the object.
- This comes through experience and not innate to an individual.

# Hermann Von Helmholtz's "Sign" Theory

- Spatial Position is an interpretation of our sensations and not the immediate result of the object.
- This comes through experience and not innate to an individual.
- This theory is called "An empirical theory of spatial perception".

# Hermann Von Helmholtz's "Sign" Theory

- Spatial Position is an interpretation of our sensations and not the immediate result of the object.
- This comes through experience and not innate to an individual.
- This theory is called "An empirical theory of spatial perception".



# Helmholtz's Physiology of Perception

The quality of sensations belongs only to nervous system and we acquire our knowledge of spatial ordering through perceiving an unchanging sequence of sense impressions of the same object.

# Helmholtz's Physiology of Perception

The quality of sensations belongs only to nervous system and we acquire our knowledge of spatial ordering through perceiving an unchanging sequence of sense impressions of the same object.

Example of holding a pen...

# Helmholtz's Physiology of Perception

The quality of sensations belongs only to nervous system and we acquire our knowledge of spatial ordering through perceiving an unchanging sequence of sense impressions of the same object.

Example of holding a pen...



# Helmholtz's Physiology of Perception

Perceived properties such as separation in space are inferences from:

- Experience
- Properties of sense organs.

Our awareness of distinction of spatial position is learned, not innate.

# Nativism vs. Empiricism

Ewald Hering vs. Hermann von Helmholtz

# Nativism vs. Empiricism

Ewald Hering vs. Hermann von Helmholtz

How to explain the perception of depth?



# Nativism vs. Empiricism

Nativism - The disposition to have spatially organized visual experience is inborn and does not depend upon a process of learning.

# Nativism vs. Empiricism

Nativism - The disposition to have spatially organized visual experience is inborn and does not depend upon a process of learning.



# Nativism vs. Empiricism

Empiricism - At least some of the spatial organization found in the visual experience of the adult is the result of learning.

# Nativism vs. Empiricism

Empiricism - At least some of the spatial organization found in the visual experience of the adult is the result of learning.



# The “Horopter” Problem

Horopter - A set of points that the eye perceives as equidistant from the perceiving subject when the eye is focusing on a single point.

# The “Horopter” Problem

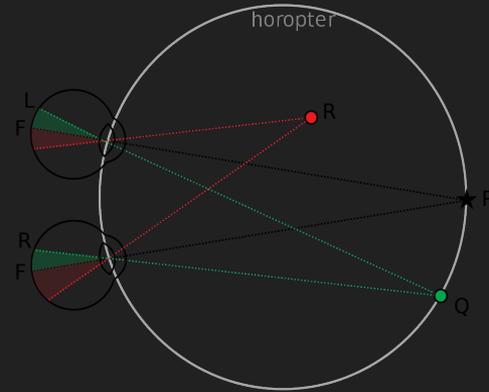
Horopter - A set of points that the eye perceives as equidistant from the perceiving subject when the eye is focusing on a single point.

However, they are not really equidistance.

# The “Horopter” Problem

Horopter - A set of points that the eye perceives as equidistant from the perceiving subject when the eye is focusing on a single point.

However, they are not really equidistance.



# The “Horopter” Problem

How does one explain the brain’s resolution of two images into one?

# The “Horopter” Problem

How does one explain the brain’s resolution of two images into one?

Helmholtz - Brain adjusts the retinal images by a process of “unconscious inferences”.

# The “Horopter” Problem

How does one explain the brain’s resolution of two images into one?

Helmholtz - Brain adjusts the retinal images by a process of “unconscious inferences”.

Hering - Disposition inborn in human children, not acquired.

# Today's Psychology and Neuroscience

# Consequence of Hermann's Theory

- Is our access to the objective properties direct or constructed?

Donald Hoffmann -- The interface theory of Perception



# References

Patton, Lydia. "Hermann Von Helmholtz." *Stanford Encyclopedia of Philosophy*, Stanford University, 13 Dec. 2018, [plato.stanford.edu/entries/hermann-helmholtz/](https://plato.stanford.edu/entries/hermann-helmholtz/).

Purves, et al. "Will Understanding Vision Require a Wholly Empirical Paradigm?" *Frontiers*, Frontiers, 13 July 2015, [www.frontiersin.org/articles/10.3389/fpsyg.2015.01072/full](http://www.frontiersin.org/articles/10.3389/fpsyg.2015.01072/full).

Epidemic, Deception. "Donald Hoffman: Consciousness and The Interface Theory of Perception." *YouTube*, YouTube, 13 Jan. 2015, [www.youtube.com/watch?v=TSBbGr0pELQ&t=561s](https://www.youtube.com/watch?v=TSBbGr0pELQ&t=561s).