

Experimental Physics

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May 9, 2025

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Outline

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Introduction

In 1923, Felix Auerbach claimed that:

X-rays are not a natural phenomenon... they were invented by Röntgen.

This provocative view highlights the artificial character of experiments:

- Experiments create, not just observe.
- Knowledge arises from human-made phenomena.

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- Is experiment a valid path to knowledge?
- Can making replace observing?

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A third man who unites science and art.

- Rejected by both theorists and artisans.
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18th–19th centuries: Experimentalists faced epistemic tension.

- Is experimental knowledge real science?
- Is manual manipulation compatible with scholarly traditions?

Over time, head and hand work gained legitimacy in science.

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The Role of Instruments

New fields like electricity relied on instruments.

- Vacuum tubes modeled auroras.
- Volta's battery revealed microphysical phenomena.

Devices created phenomena that otherwise could not be observed.

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- Is knowledge from artificial settings valid?
- What is the scope of lab-based insights?

State and industrial support helped labs enter universities.

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From Artisans to Scientists

Late 19th century: experimentalists joined academia.

- "Scholars of the crafts"
- Lab knowledge gained equal status to textual knowledge

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Experimental chairs were created in universities.

- Helmholtz and Maxwell promoted sensory experience
- Physics teaching emphasized tools and hands-on work

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Reflections on Experience and Theory

Debates persisted over theory vs. experience. Joseph Dietzgen (1869):

Even the lowest art of experiment is connected to theory.

Materialist and idealist views of knowledge needed mediation.

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By 1900, physics was seen as a technical science.

- It created artificial phenomena.
- It required intentional acts.

Otto Wiener: Instruments extend human senses.

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Auerbach: theory builds from experience.

- Not a test of theory, but its foundation.
- Like a dynamo: small experience sparks large knowledge.

Abstract structures must always check back with reality.

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If the world contradicts theory, the world must be wrong.

Theory and experience became increasingly specialized.

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Conclusion

Conclusion: An Epistemological Shift

By the 20th century, experiment became central to science.

- Instruments enabled new phenomena.
- Sensuous experience gained epistemic legitimacy.

Experimental physics unified knowing and doing.

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References

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- [1] H. Otto Sibus. “What Kind of Science Is Experimental Physics?” In: *Science* 306.5693 (Oct. 2004), pp. 60–61. ISSN: 1095-9203. DOI: [10.1126/science.1093598](https://doi.org/10.1126/science.1093598).

Thank you!

Questions or comments?