

CIC0203 - COMPUTAÇÃO EXPERIMENTAL - TA (2021.1 - 35T23)

Conceitos Fundamentais

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Computação Experimental

- Experimentação e experimento científico
- Importância da Modelagem
- Causalidade
- **O que é a computação?**
- Experimento estatístico
 - Teoria e prática de um experimento estatístico
- Experimento Computacional
 - Teoria e prática de um experimento computacional
- Exemplos de uso de experimentação estatística em contextos gerais, inclusive computacionais

Experimentação

Experimento (Wikipedia)

<https://en.wikipedia.org/wiki/Experiment>

- An experiment is a **procedure carried out** to support or refute a **hypothesis**.
- Experiments provide insight into **cause-and-effect** by **demonstrating** what outcome occurs when a particular factor is **manipulated**.
- Experiments vary greatly in goal and scale, but always rely on **repeatable procedure** and **logical analysis** of the results.

um experimento..



- Procedimento
 - Hipótese
- Causa e efeito
- Demonstração
- Manipulação de fatores
- Repetição de procedimento
 - Análise lógica

Variedade de situações que podem ser consideradas um experimento
<https://en.wikipedia.org/wiki/Experiment>

- A **child may carry out basic experiments** to understand how things fall to the ground, while teams of scientists may take years of systematic investigation to advance their understanding of a phenomenon.
- Experiments and other types of **hands-on activities** are very important to student learning in the science classroom.
- Experiments can raise test scores and help a student become **more engaged and interested** in the material they are learning, especially when used over time.

overall process of scientific investigation [Barton, 1999, p. 2]

After H. Andrews

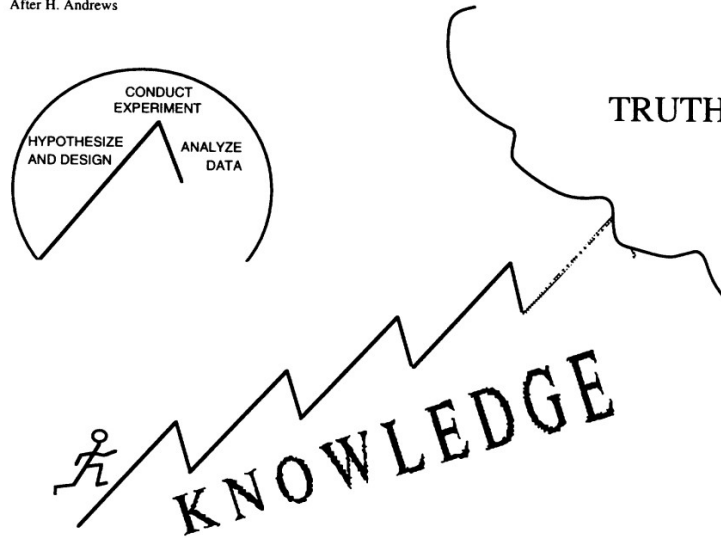


Figure 1.1. The role of experiment design in the pursuit of knowledge.

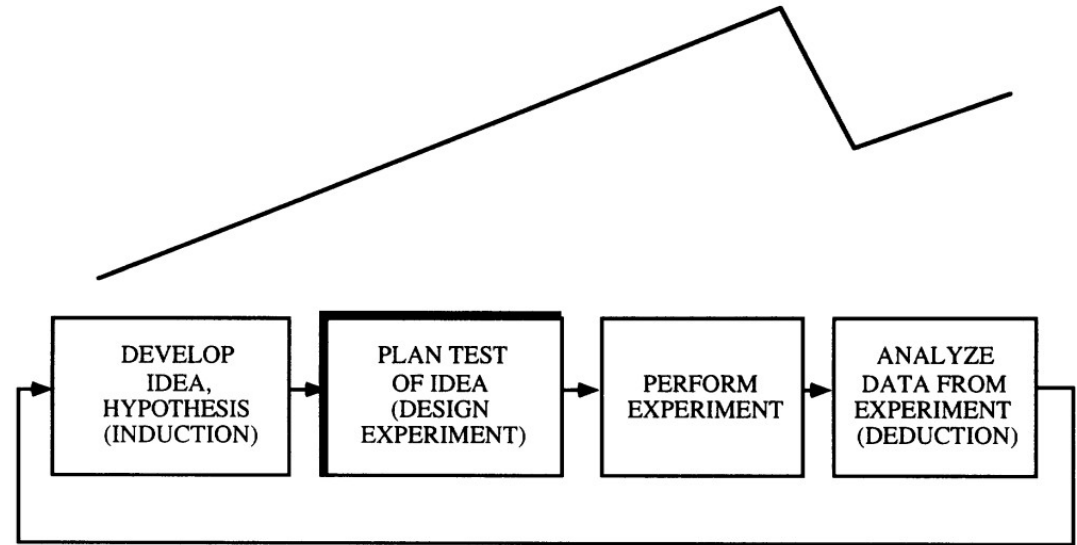


Figure 1.2. The scientific pursuit of knowledge is a cycle.

Experimentos informais versus formais

<https://en.wikipedia.org/wiki/Experiment>

- Experiments can vary from personal and informal natural comparisons (e.g. tasting a range of chocolates to find a favorite), to highly controlled (e.g. tests requiring complex apparatus overseen by many scientists that hope to discover information about subatomic particles).
- Uses of experiments vary considerably between the **natural** and **human sciences**.

Controle durante experimentos científicos

<https://en.wikipedia.org/wiki/Experiment>

- Experiments typically include controls, which are designed to minimize the effects of variables other than the single independent variable. This **increases the reliability of the results**, often through a comparison between control measurements and the other measurements.
- Scientific controls are a part of the scientific method.
- Ideally, **all variables** in an experiment are controlled (accounted for by the control measurements) and none are uncontrolled. In such an experiment, if all controls work as expected, it is possible to conclude that the experiment works as intended, and that results are due to the effect of the tested variables.

Pesquisa e Evidência Empírica

https://en.wikipedia.org/wiki/Empirical_research

- Empirical research is research using empirical evidence.
- It is also a way of gaining knowledge by means of **direct** and **indirect observation** or **experience**.
- Empiricism values some research more than other kinds.
- Empirical evidence (the record of one's direct observations or experiences) can be analyzed quantitatively or qualitatively.
- **Quantifying** the evidence or **making sense of it in qualitative form**, a researcher can answer empirical questions, which should be clearly defined and answerable with the evidence collected (usually called data).
- **Research design** varies by field and by the question being investigated. Many researchers combine qualitative and quantitative forms of analysis to better answer questions which cannot be studied in laboratory settings, particularly in the social sciences and in education.

Modelos e Hipóteses

<https://en.wikipedia.org/wiki/Experiment>

- In the scientific method, an experiment is an empirical procedure that **arbitrates competing models or hypotheses**.
- Researchers also use experimentation to test existing theories or new hypotheses to support or disprove them.
- An experiment usually tests a hypothesis, which **is an expectation about how a particular process or phenomenon works**.

Modelos Científicos

https://en.wikipedia.org/wiki/Scientific_modelling

- Scientific modelling is a scientific activity, the **aim of which is to make a particular part or feature of the world easier to understand, define, quantify, visualize, or simulate** by referencing it to existing and usually commonly accepted knowledge.
- It requires selecting and identifying relevant aspects of a situation in the real world and then using different types of models for different aims, such as conceptual models to better understand, operational models to operationalize, mathematical models to quantify, computational models to simulate, and graphical models to visualize the subject.

Modelos como substitutos para experimentação

https://en.wikipedia.org/wiki/Scientific_modelling

- Models are typically used when it is either impossible or impractical to create experimental conditions in which scientists can directly measure outcomes.
- Direct measurement of outcomes under controlled conditions (see Scientific method) will always be more reliable than modeled estimates of outcomes.
- Within modeling and simulation, a model is a task-driven, purposeful simplification and abstraction of a perception of reality, shaped by physical, legal, and cognitive constraints. It is task-driven because a model is captured with a certain question or task in mind.
- Simplifications leave all the known and observed entities and their relation out that are not important for the task.
- Abstraction aggregates information that is important but not needed in the same detail as the object of interest.
- Both activities, simplification, and abstraction, are done purposefully. However, they are done based on a perception of reality. This perception is already a model in itself, as it comes with a physical constraint. There are also constraints on what we are able to legally observe with our current tools and methods, and cognitive constraints that limit what we are able to explain with our current theories. This model comprises the concepts, their behavior, and their relations informal form and is often referred to as a conceptual model. In order to execute the model, it needs to be implemented as a computer simulation. This requires more choices, such as numerical approximations or the use of heuristics.[13]

Implementação de modelos por simulação

https://en.wikipedia.org/wiki/Scientific_modelling

- A **simulation** is a way to implement the **model**, often employed when the model is too complex for the analytical solution.
- A simulation shows how a particular object or phenomenon will behave. Such a simulation can be useful for testing, analysis, or training in those cases where real-world systems or concepts can be represented by models.
- A **steady-state simulation** provides information about the system at a specific instant in time (usually at equilibrium, if such a state exists).
- A **dynamic simulation** provides information over time.

Os Três Pilares do Método Científico

https://en.wikipedia.org/wiki/Scientific_modelling

- Despite all these epistemological and computational constraints, simulation has been recognized as the third pillar of scientific methods:
 - Theory building
 - Simulation
 - Experimentation

Tipos de Modelos

Wikipedia

Types [\[edit source \]](#)

- Analogical modelling
- Assembly modelling
- Catastrophe modelling
- Choice modelling
- Climate model
- Continuous modelling
- Data modelling
- Discrete modelling
- Document modelling
- Econometric model
- Economic model
- Ecosystem model
- Empirical modelling
- Enterprise modelling
- Futures studies
- Geologic modelling
- **Goal modelling**
- Homology modelling
- Hydrogeology
- Hydrography
- Hydrologic modelling
- Informative modelling
- Macroscale modelling
- Mathematical modelling
- Metabolic network modelling
- Microscale modelling
- Modelling biological systems
- Modelling in epidemiology
- Molecular modelling
- Multiscale modelling
- NLP modelling
- Phenomenological modelling
- Predictive intake modelling
- Predictive modelling
- Scale modelling
- Simulation
- Software modelling
- Solid modelling
- Space mapping
- Statistical model
- Stochastic modelling (insurance)
- Surrogate model
- System architecture
- System dynamics
- Systems modelling
- System-level modelling and simulation
- Water quality modelling

Exercícios de Fixação

- Registre, no glossário do documento base da disciplina, em língua portuguesa, uma definição e um exemplo, devidamente referenciados no grupo Zotero, para um termo qualquer apresentado nos slides anteriores, relativos à experimentação científica.