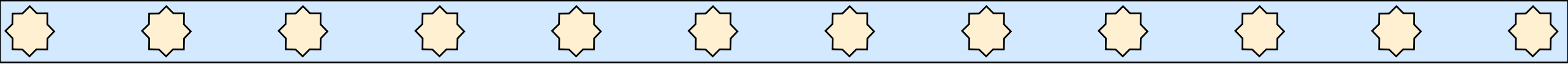


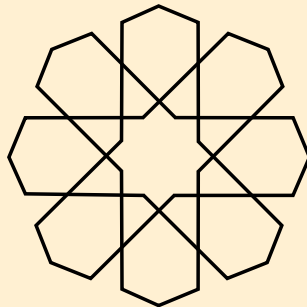
Scientific Method for Wikimedians

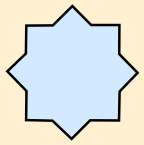
Knowledge & its types



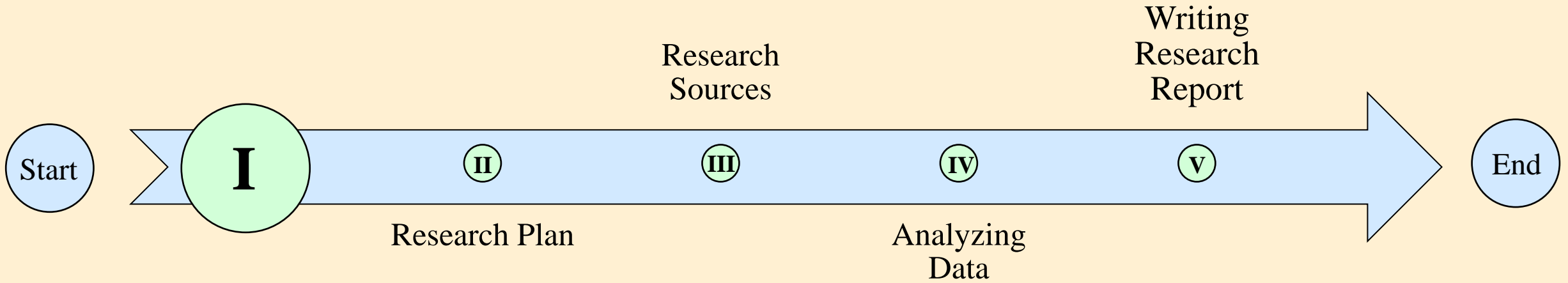
Michel BAKNI

2023





Course Structure



Part I: Knowledge & Scientific Method

Chapter 1: Knowledge & its types

Chapter 3: Research Methodologies

Chapter 2: Scientific facts

Chapter 4: Scientific Methods

Chapter 5: Research Question



Outlines

- ★ **Nature of the knowledge**
- ★ **Source of knowledge**
- ★ **Aspects of knowledge**
- ★ **Knowledge and science**
- ★ **Historical background**

I Nature of the knowledge

“ **The information, understanding and skills that you gain through education or experience** ”

Oxford Learner’s dictionaries

“ **Information and facts about something you know** ”

Cambridge dictionary

“ **The fact or condition of knowing something with familiarity gained through experience or association** ”

Merriam webster dictionary



Nature of the knowledge

Old English: *cnawlece* | early 12th century | be able to distinguish

Knowledge*



Proto-Indo-European

obscure origin

gno-

“To know”

agnostic

ignorant

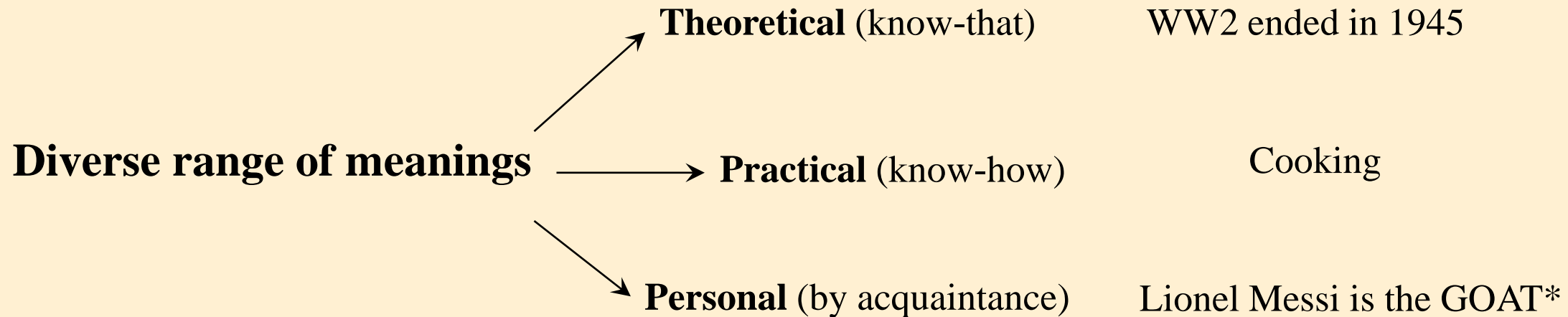
recognize

I Nature of the knowledge

★ What is the exact definition of the knowledge?

Huge disagreements No consensus Is there knowledge at all?

★ What is the problem?



*GOAT: Greatest of all time



II Source of knowledge: Indoctrination

★ Process of providing a person with ideas, attitudes ...

- ◆ Napoleon invaded Egypt in 1798
- ◆ Canada is located north of the United States

★ Related problems:

- ◆ Can be false
- ◆ Can be fictional
- ◆ Can be inaccurate
- ◆ Hard to verify
- ◆ Easy to manipulate

II Source of knowledge: Observation

★ Process of identifying patterns of phenomena using senses

◆ **Astronomy (before the Renaissance)**

◆ **River floods & agricultural seasons**

★ Personal & no interfering

★ Related problems:

◆ **Senses can be easily fooled**

◆ **Personal experience (biased)**

◆ **Might be dangerous**

II Source of knowledge: Experiment

★ Process of identifying patterns of human-made phenomena using senses/devices

◆ Teacher in a chemistry class

◆ Test of nuclear weapons

★ Repeatable & human is part of experiment

★ Related problems:

◆ Need preparation (what to measure & how)

◆ Personal experience (biased)

◆ Moral aspects (human, animals & earth itself)

II Source of knowledge: Observation Vs. Experiment

Criteria	Observation	Experiment
Perception	Sensory	Sensory
Neutrality	Might be biased	Might be biased
Human role	Passive	Active
Repeatability	Non-repeatable but usually periodic	Repeatable
Verifiability	Possible, but hard	Easy

**Experiment is not better than observation,
but obtained knowledge is more reliable**

II Source of knowledge: Reasoning

★ Process of using logic consciously to drawing conclusions seeking knowledge

◆ All French people speak French
Francois is French ⇒ Francois speaks French

◆ Aluminum expands by heat
Iron expands with heat
... ⇒ All metals expand with heat

★ Completely mental

★ New knowledge

★ Related problems:

◆ Hard & need training to use

◆ Can be easily misleading

II Source of knowledge: Reasoning

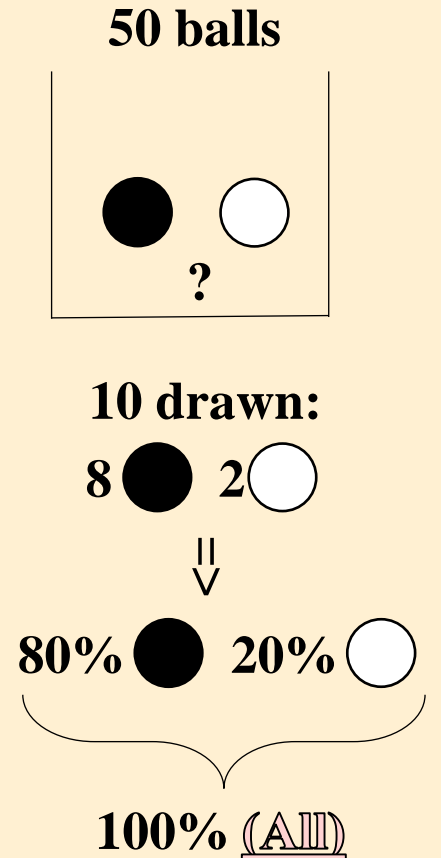
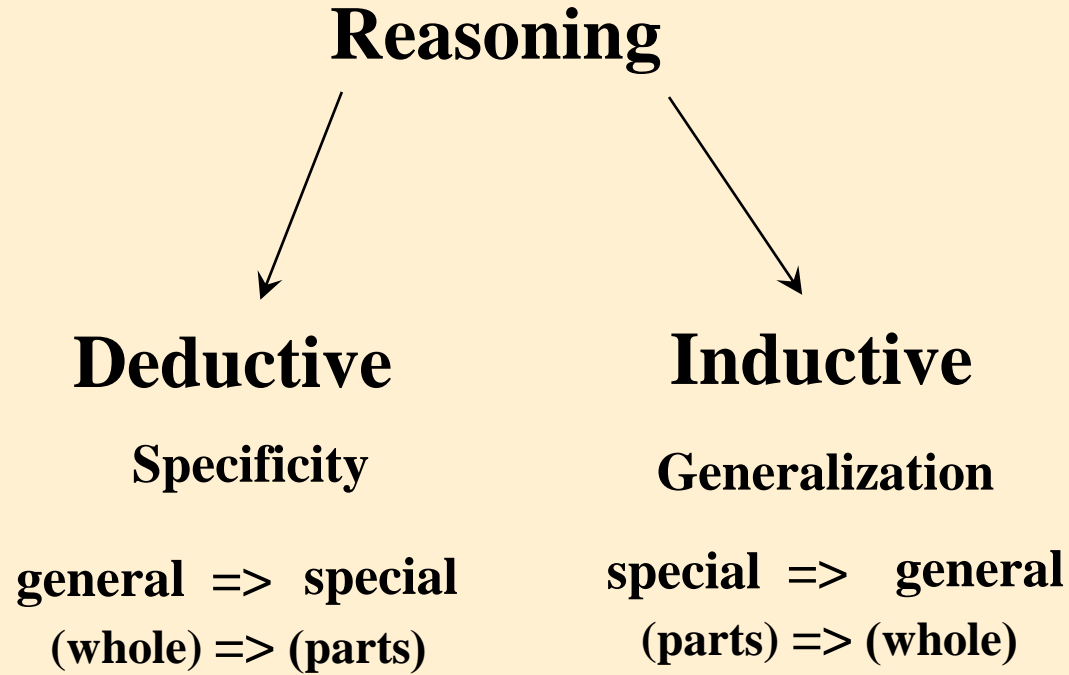
All triangles
sum of angles
180°

&

ABC is
triangle

⇓

sum of ABC's
angles is
180°



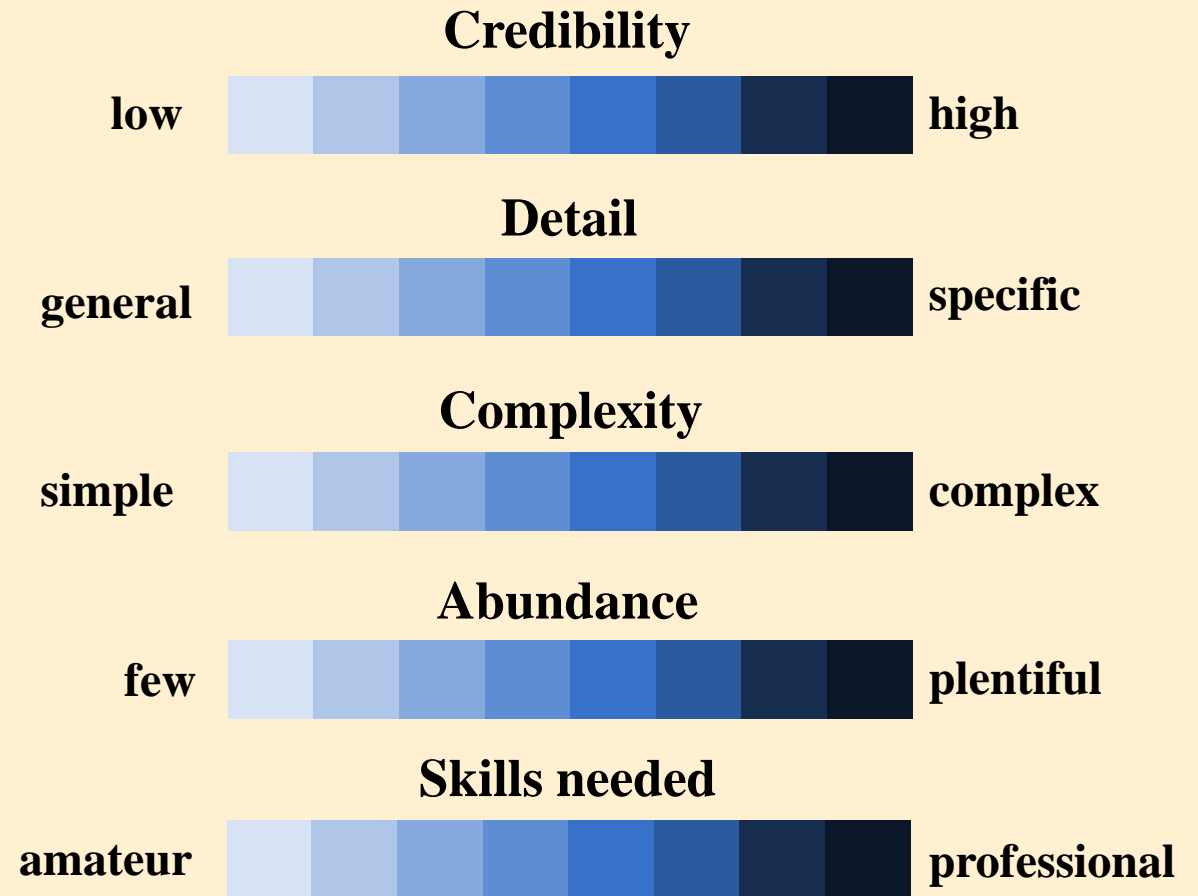
IV Aspects of knowledge

★ Information Piece

- ★ Complex to describe
- ★ Several aspects
- ★ Black/white not sufficient

★ Knowledge aspects:

- ★ Degree of credibility
- ★ Degree of detail
- ★ Degree of complexity
- ★ Degree of abundance
- ★ Skills needed (difficulty)

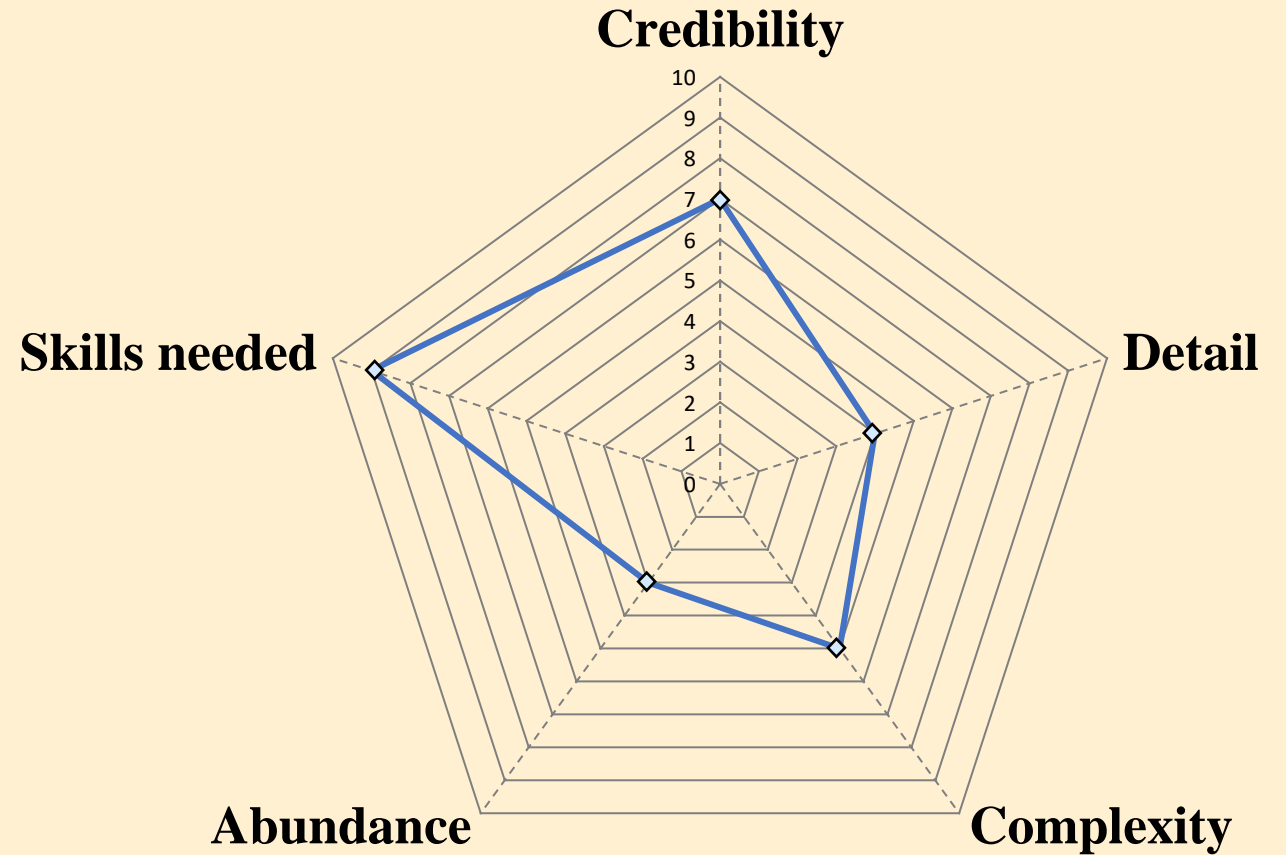


IV Aspects of knowledge

★ Radar diagram

- ★ Scale: 10
- ★ Circumradius (Axis) : 5
- ★ Lower the value => Smaller effect
- ★ Higher the value => larger effect

★ Independent axes



IV Knowledge and science

“ Knowledge about the structure and behaviour of the natural and physical world, based on facts that you can prove, for example by experiments ”

Oxford Learner’s dictionaries

“ The study of the physical world, by collecting information and testing it ”

Cambridge dictionary

“ Knowledge or a system of knowledge covering general truths or the operation of general laws especially as obtained and tested through scientific method ”

Merriam webster dictionary

I Nature of the knowledge

Old English: *scyence* | mid 14th century | to know

*science**



Proto-Indo-European

skei-

“To cut | to split | to divide”

conscience

schism

schizophrenia

IV Knowledge and science

★ What is the exact definition of the science?

“ Science, to put its warrant as concisely as possible, is the organized, systemic enterprise that gathers knowledge about the world and condenses the knowledge into testable laws and principles. ”

p. 53

Consilience : the unity of knowledge

Wilson, Edward O

ISBN: 978-0-679-76867-8

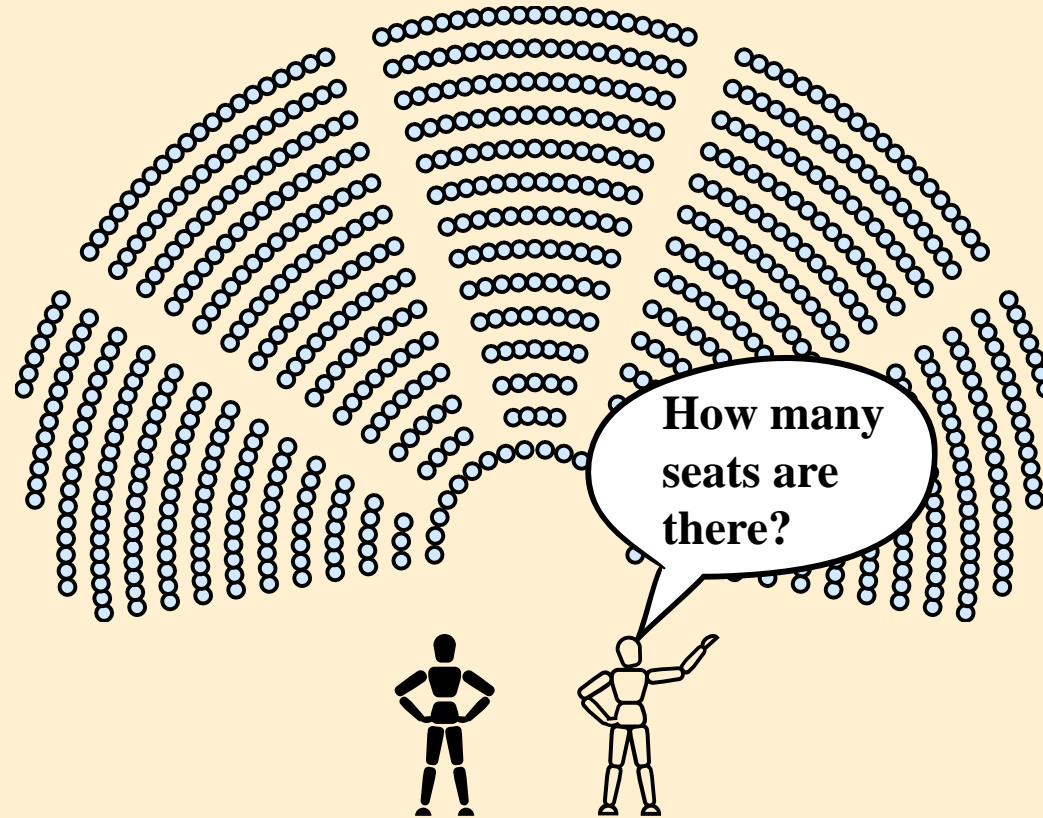
IV Knowledge and science

Answer 1

Based on my experience, I think there are 700 seats.

Systematic

Testable



Answer 2

Find out how many lines are there, multiply it by the number of seats within each row.

Systematic

Testable

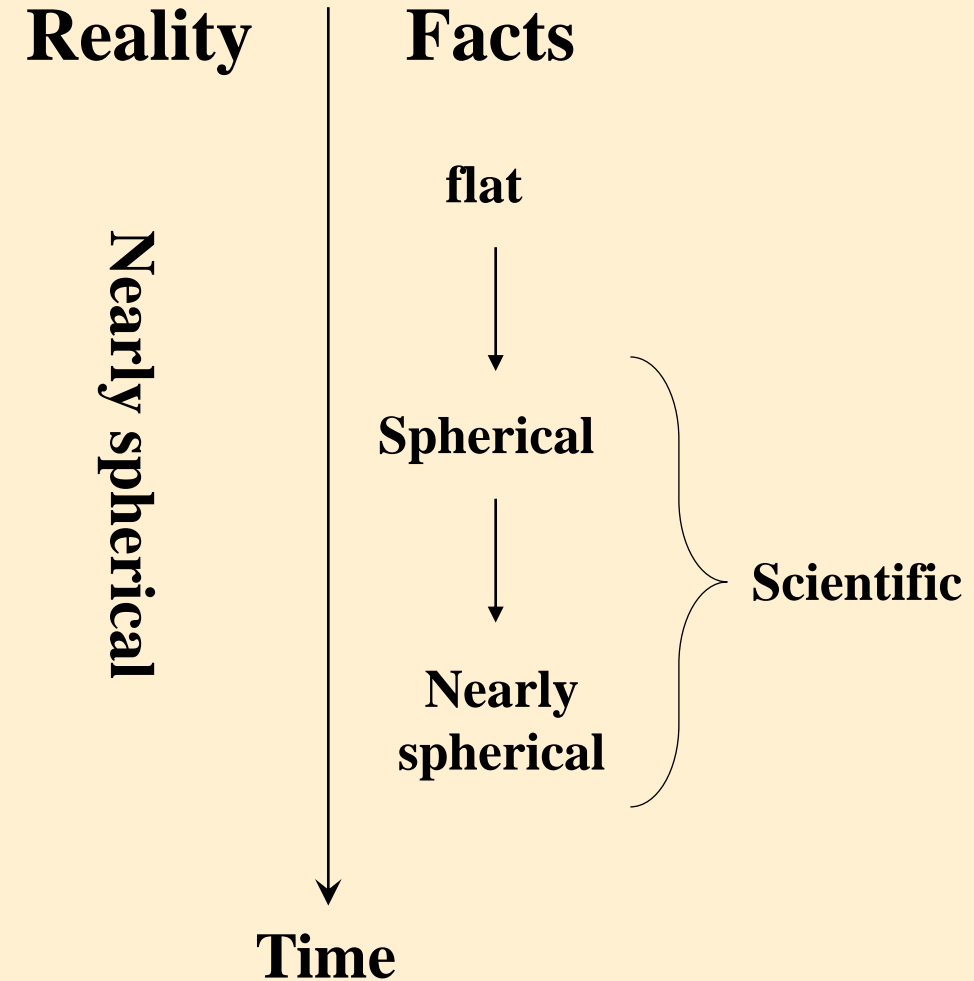
IV Knowledge and science: Reality & Scientific facts

★ Reality: What exists, as it is!

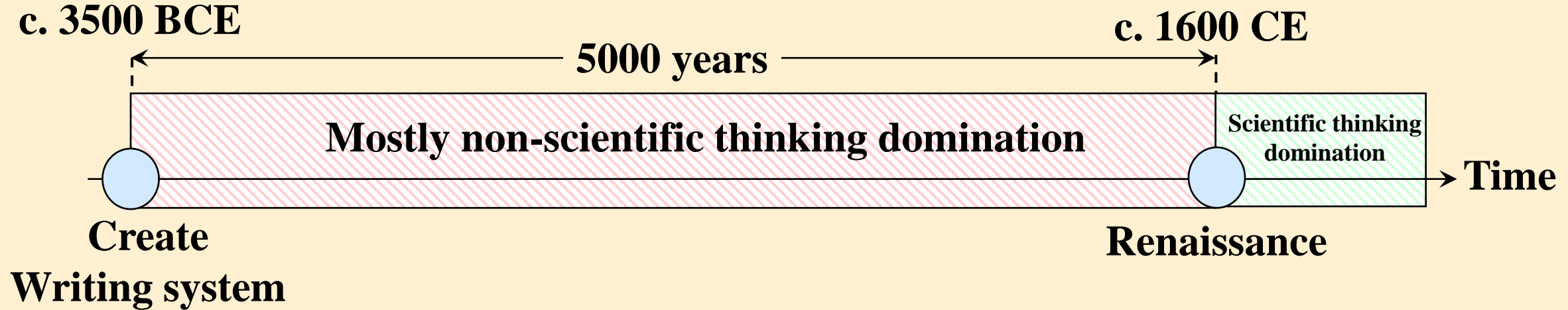
- ★ It exists, even if we don't know that
- ★ Example: Radio waves

★ Scientific facts: our best understanding of reality

- ★ Can be wrong
- ★ Can be inaccurate
- ★ Changeable



IV Historical background



- ★ **Non-scientific thinking: make it work (results first)**
- ★ **Scientific thinking: how-it-work (method first)**

$$(a+b)^2 = a^2 + b^2 + 2ab$$

IV Historical background: Alhazen

- ★ Known for contribution in Optics
- ★ Early pioneer in scientific method

“ The duty of the man who investigates the writings of scientists, if learning the truth is his goal, is to make himself an enemy of all that he reads, and ... attack it from every side. He should also suspect himself as he performs his critical examination of it, so that he may avoid falling into either prejudice or leniency ”

Alhazen

Alhazen
965 – c. 1040



[unknown PD]

IV Historical background: Bacon

★ **Lord High Chancellor of England (James VI)**

★ **Known for his book: Novum Organum (The new way)**

◆ Man-made barriers mislead the reasoning

◆ Barriers = idols = a thing that is loved and admired very much

◆ 4 idols:

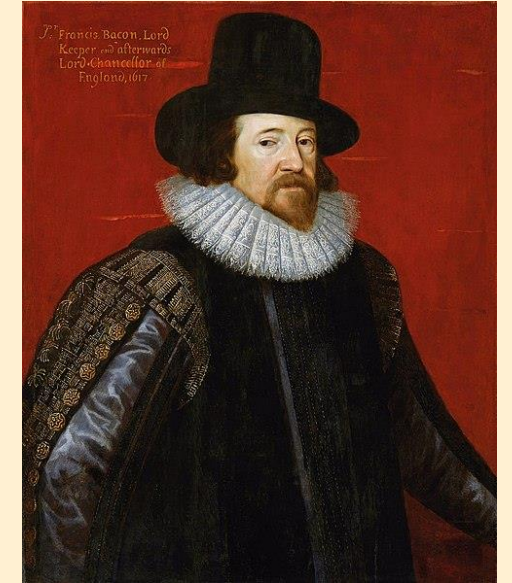
1. Idols of the Tribe

2. Idols of the Cave

3. Idols of the Market

4. Idols of the Theatre

Francis Bacon
1561 – 1626



[Van Somer PD]

IV Historical background: Bacon

1. Idols of the Tribe

- ★ Tribe = humankind
- ★ Shared among all humans

2. Idols of the Cave

- ★ Cave = Plato's Cave = Particular individual

Examples

Atheist, Nationalist & Socialist perspectives
Lionel Messi fans & Real Madrid

Examples

Tendencies to overgeneralize

Jump to conclusions

Influence of emotions on judgments

[4edges CC BY SA 4.0]



IV Historical background: Bacon

3. Idols of the Market

- ★ Market = society
- ★ Interactions between humans
- ★ Use of the language

4. Idols of the Theatre

- ★ Theatre = Human heritage
- ★ Actors = Great figures

Examples

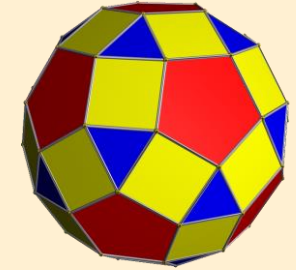
Too simple

Earth

Home

Where are
you from?

Too complex



[Stella software
CC BY SA 4.0]

Rhombicosidodecahedron

20 regular triangular faces,
30 square faces, 12 regular
pentagonal faces

Example

Pythagorean vision theory

IV Historical background: Descartes

- ★ Insisted on the rejecting any ideas that can be doubted
- ★ Known for his book: **Discourse on the Method**
- ★ Created 4 rules for his method:

“ ... The true method by which to arrive at the knowledge ... ”

Part II: Principal rules of the
Method

René Descartes
1596 – 1650



[Frans Hals PD]

“ I think, therefore I am ”

IV Historical background: Descartes

4 rules of Descartes method

Certitude (Doubt)

Never to accept anything for true if you did not clearly know to be such

Analysis

Divide each of the difficulties under examination into as many parts as possible, for its adequate solution

Synthesis

Start with the simplest and easiest objects to know, and ascend as it were, step by step, to the knowledge of the more complex;

Total induction

Assure that nothing was omitted.

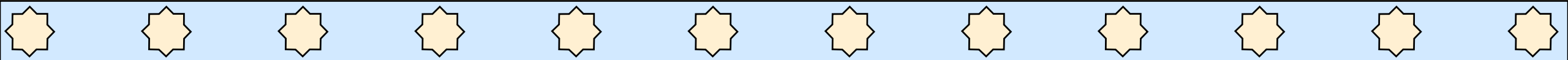
Course Title: Scientific Method for Wikimedians

Course Creator: Michel BAKNI

Video Title: Knowledge & its types

Film Editing : Sandra HANBO

Date: January 2023



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Scientific Method for Wikimedians - Knowledge & its types