

Scientific Inquiry in the Digital Age

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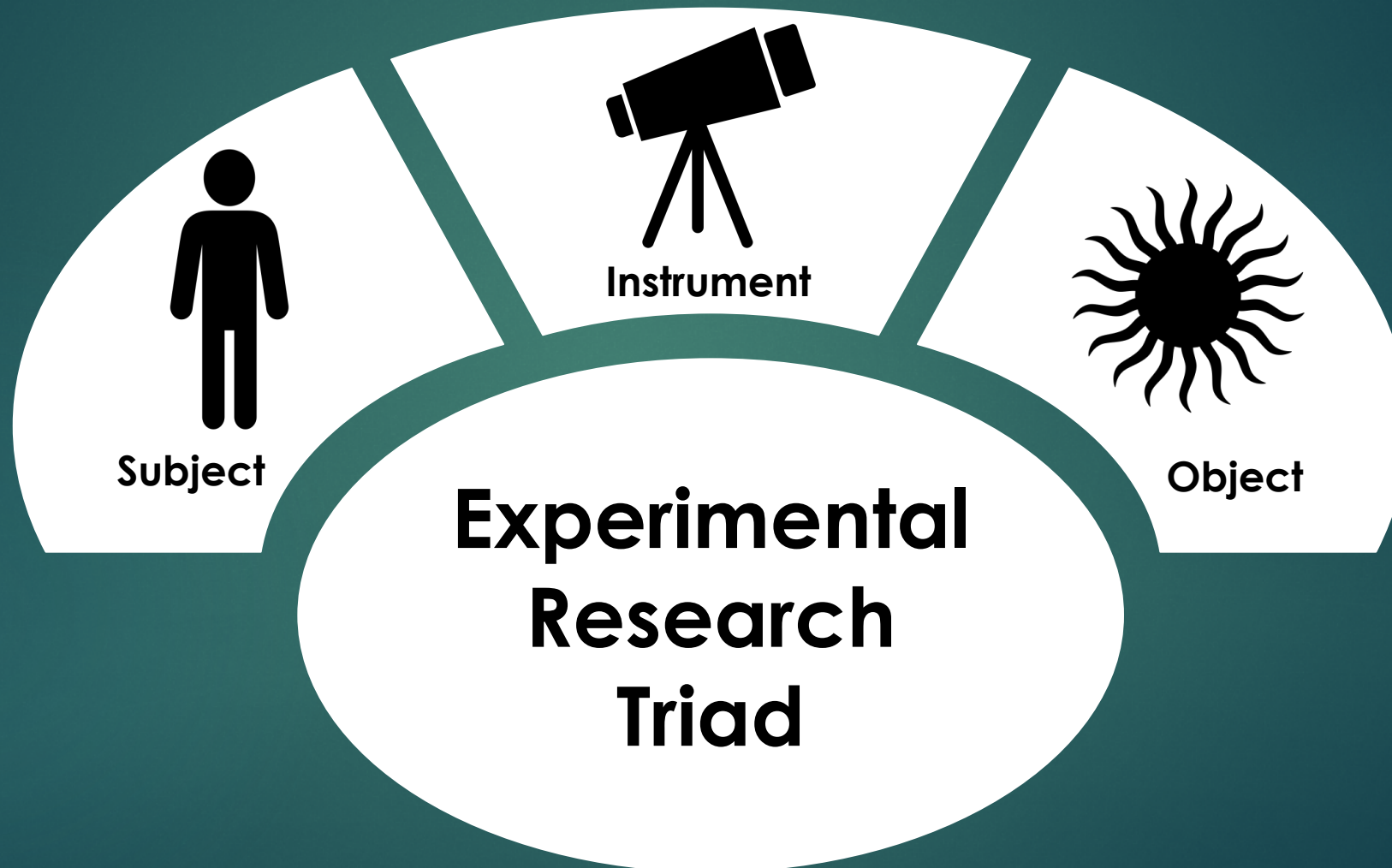


Outline

- **Experimental Research Triad**
- **Ages of Experimental Research**
- **Triad in Pre-digital Age**
- **Triad in Transitional Age**
- **Triad in Digital Age**
- **Symptoms and Phenomena of the Digital Age**
- **Digital Triad in Science Education Practices**
- **Conclusions**

Experimental Research Triad

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Ages of Experimental Research

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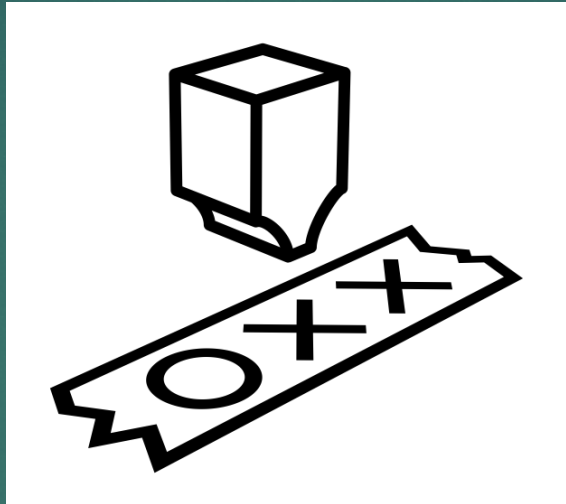
Pre-digital age



End XVI century

No ICT
experimental
science

Transition age



Mid-End XX century

ICT enhanced
experimental
science

Digital age

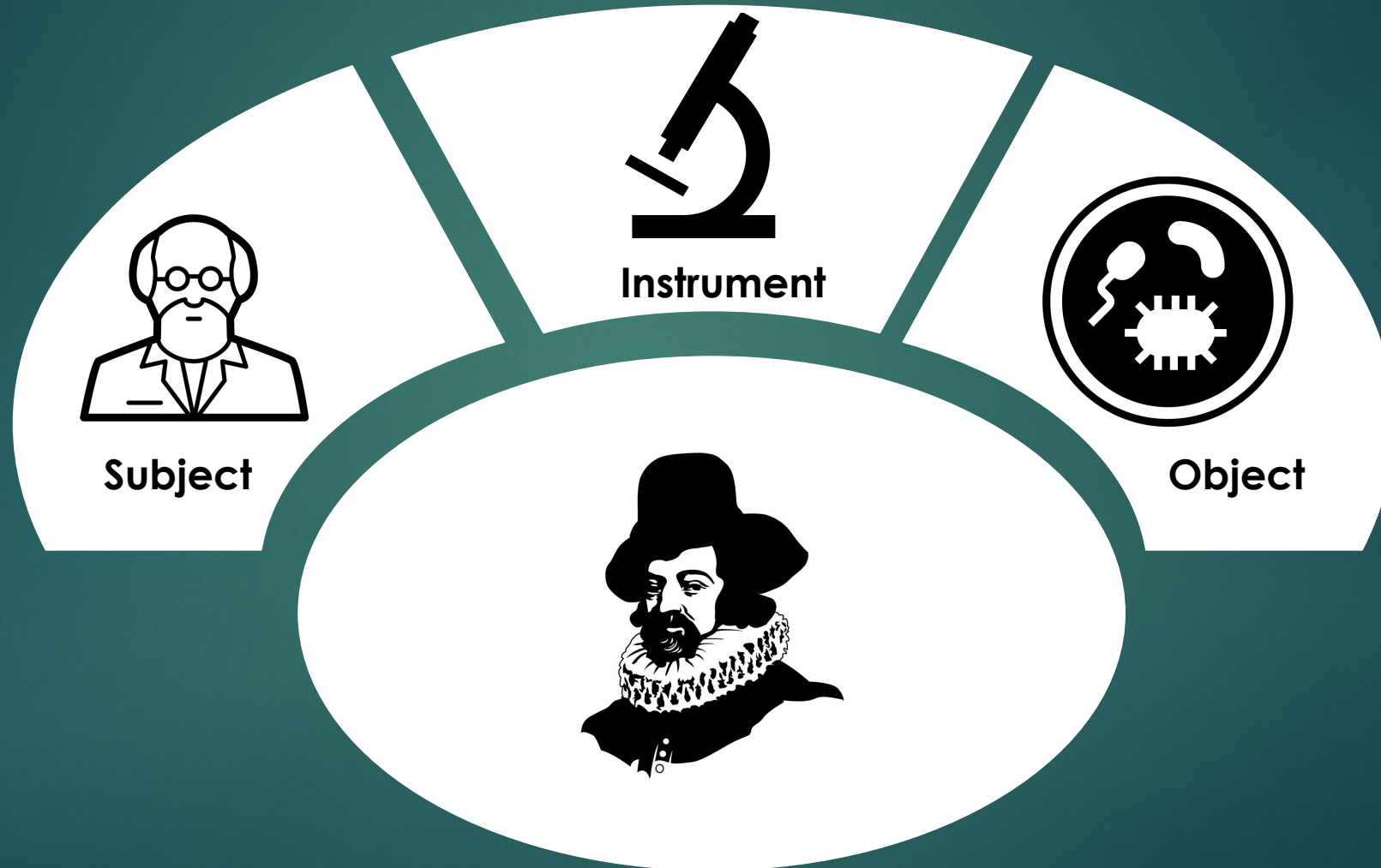


Beggining of XXI

ICT dependent
experimental
science

Experimental Triad in Pre-digital Age

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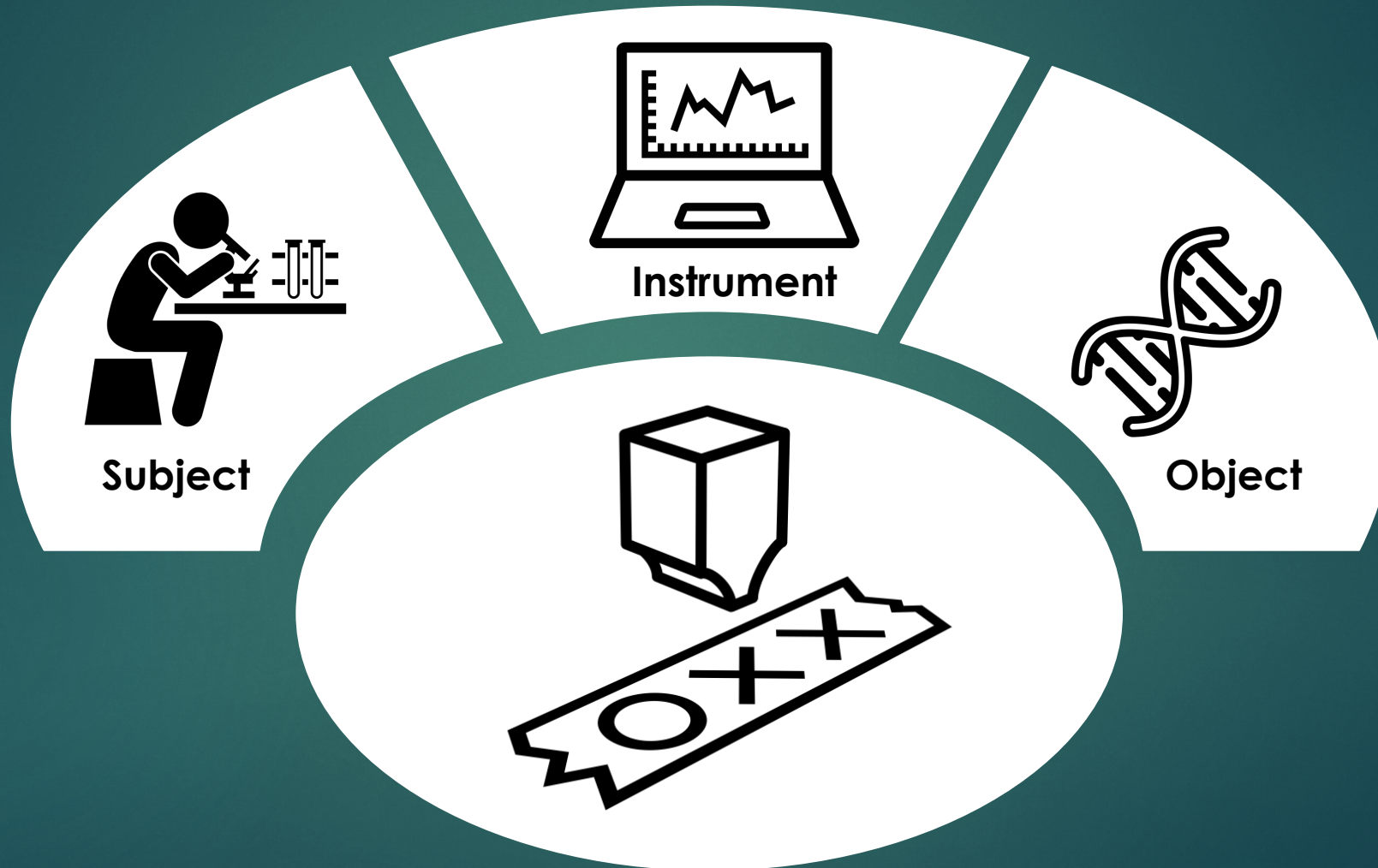


Experimental Triad in Pre-digital Age

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Research Subject	Instrument of Research	Object of Research
Classical researcher who uses instruments for experimentations	Experimental facilities based on analogous transformation of energy	Natural objects or phenomena

Experimental Triad in Transitional Age 7

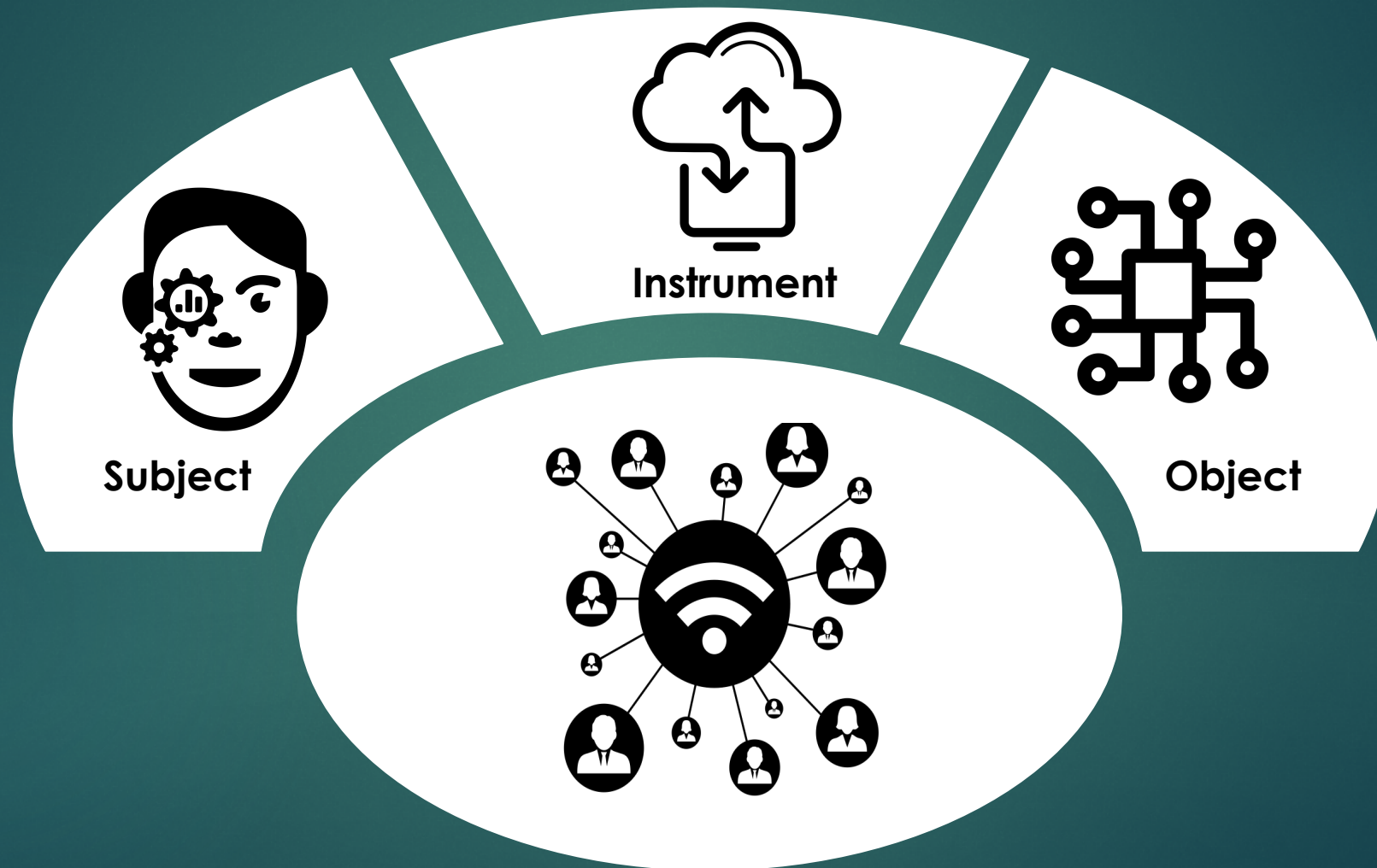


Experimental Triad in Transitional Age 8

Research Subject	Instrument of Research	Object of Research
Researcher who uses ICT for experimentations	Computer based Laboratories	Natural objects or phenomena

Experimental Triad in Digital Age

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Experimental Triad in Digital Age

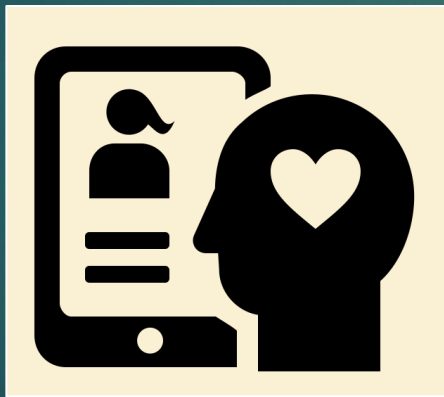
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Research Subject	Instrument of Research	Object of Research
Hyper-connected Researcher	Instruments based on mobile and wearable technologies	Hybrid Cyber-Physical Systems

Symptoms and Phenomena of the Digital Age

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Reality/Virtuality



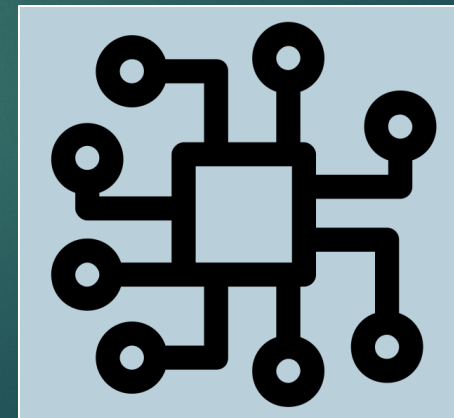
Digital Personality

Scarcity/Abundance



Data Intensive Science

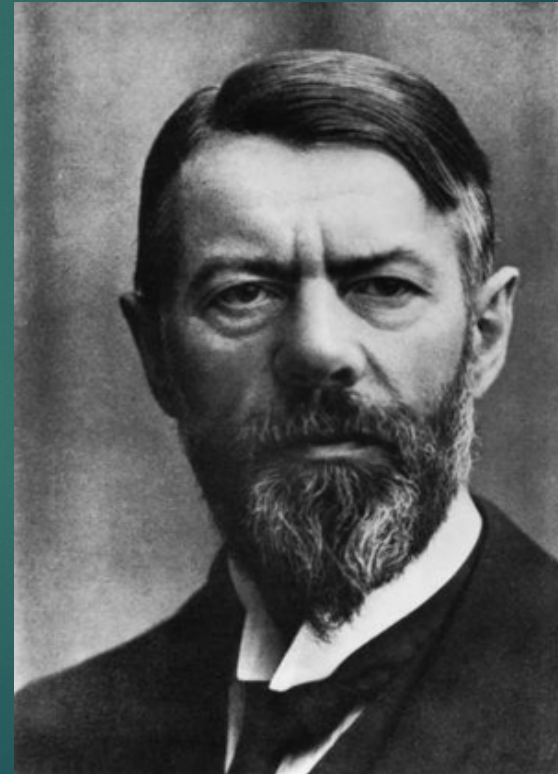
Human/Artefact/Nature



Cyber Physical Systems

THE FATE OF OUR TIMES IS CHARACTERISED BY RATIONALISATION
AND INTELLECTUALISATION, AND, ABOVE ALL, BY THE
"DISENCHANTMENT OF THE WORLD"

Max Weber
(1864- 1920)

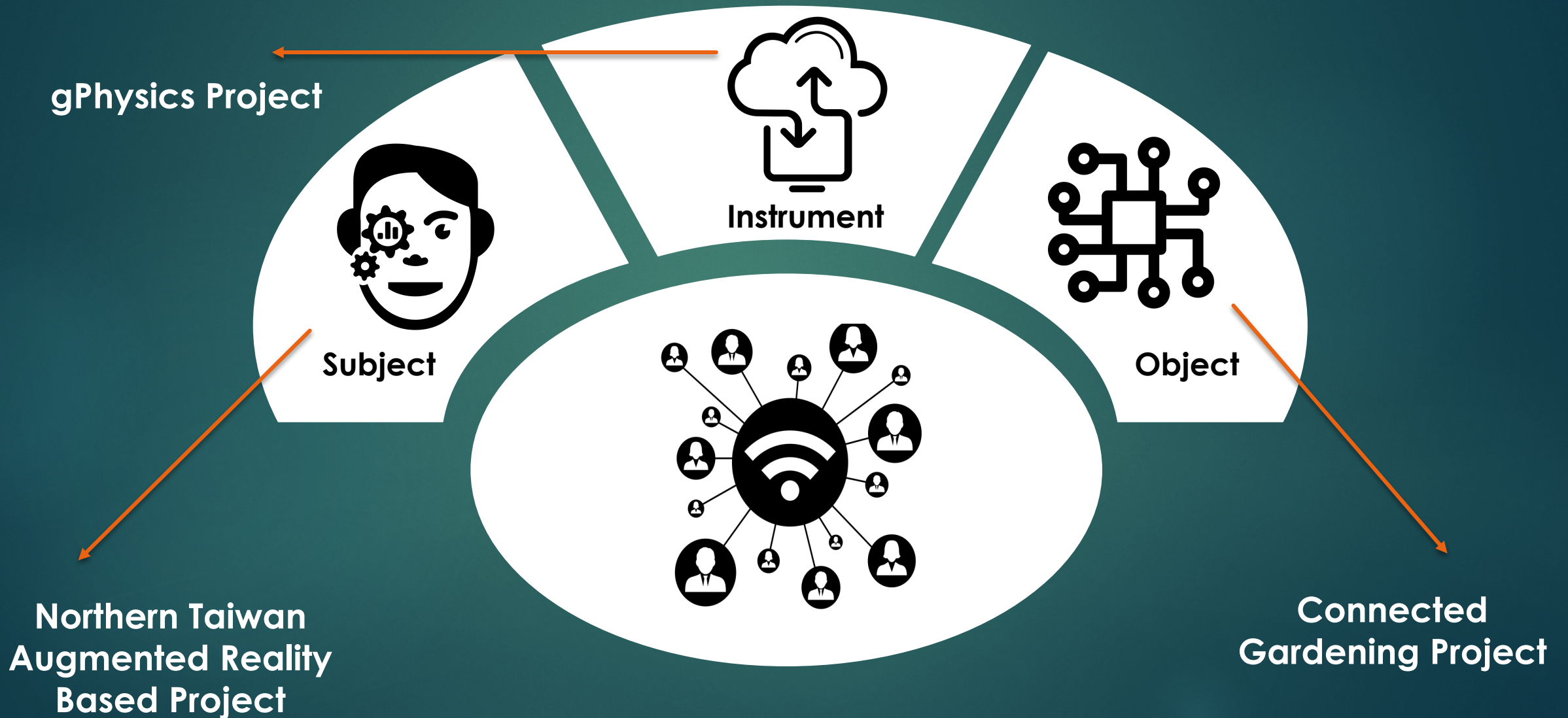


In Digital Age:

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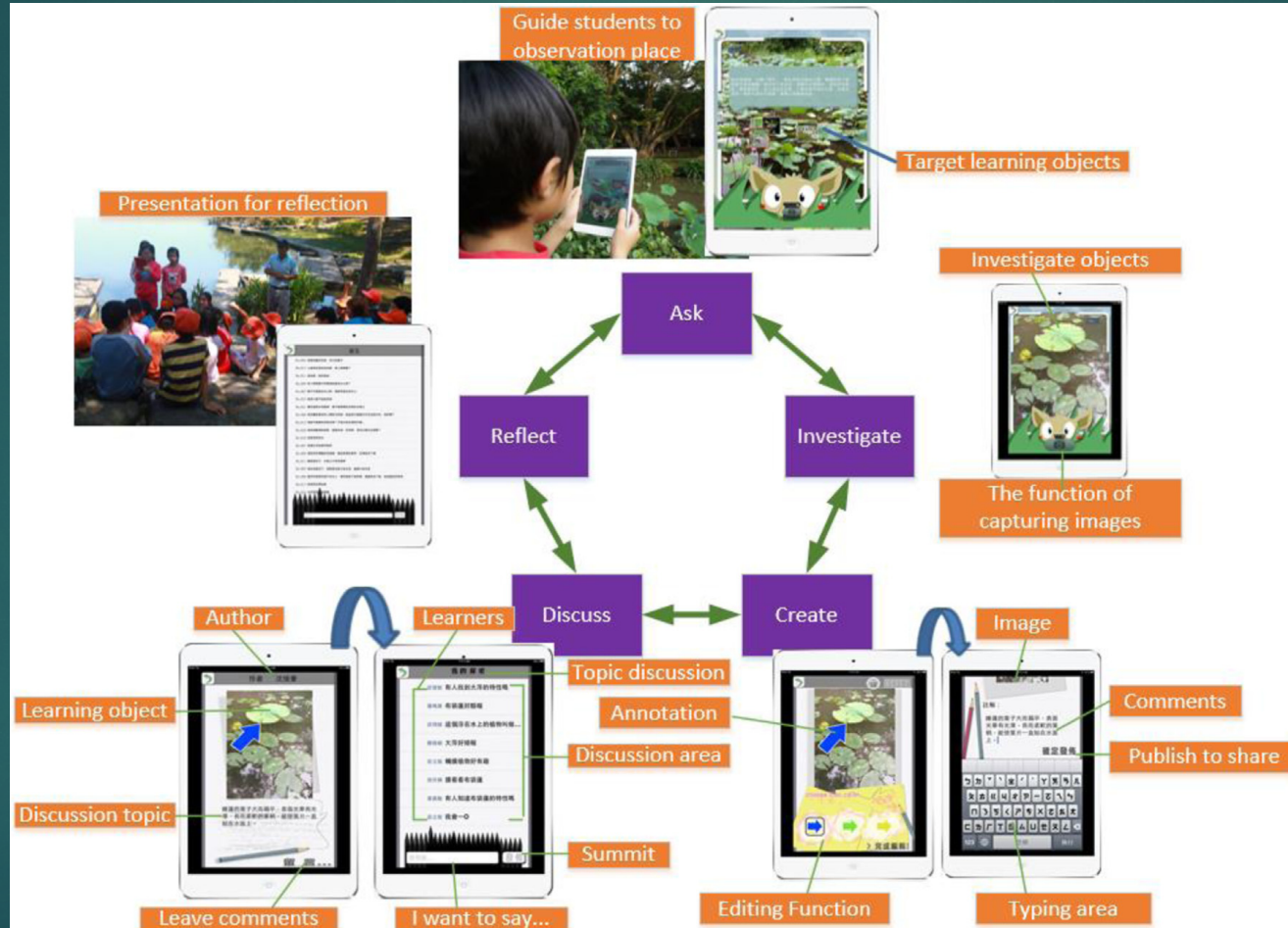
- People started enchanting the world
- The enchanted world is more sophisticated than the nature
- Science – disenchantment vs. Technology - enchantment

Digital Triad in Science Education



Northern Taiwan Augmented Reality Based Learning Project

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An example of a new research subject

gPhysics – Google Glass for Wearable - Technology Enhanced Learning

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An example of a
new research
instrument

Connected Gardening Project

17



An example of a
new research
object

Zuiker and Wright, 2015

Conclusions

- ▶ The subject-instrument-object triad is the core foundation of experimental science
- ▶ The experimental digital triad is different from the classical triad of the pre-digital epoch
- ▶ Each component of the digital triad is enriched by:
 - ▶ Intensive communication as a feature of the research subject
 - ▶ Virtualization as a feature of the research instrument
 - ▶ The hybrid features of the emerging research objects
- ▶ A number of innovative educational projects confirm the digital transformation of the triad