What kind of research are you doing

scientific research
or
pseudo-scientific research
?

Introduction

Should we eat fat?

We don’t know the answer to this very practical question,

because not being scientific is not being practical, e.g.

1913 Nikolay Anichkov: cholesterol into rabbits experiment; 1960s Ancel Keys: Seven Countries Study; 1970s John Yudkin: Pure, White and Deadly; 2015 Zoë Harcombe: Evidence from RCTs did not support the introduction of dietary fat guidelines in 1977 and 1983: a systematic review and meta-analysis

Introduction

Not being Scientific is Not being Practical, e.g.

1913 Anichkov: **misleading sample, because rabbits are herbivores**

1960s Keys: Seven Countries Study: **confirmation bias**

1970s Yudkin: Pure, White and Deadly: **ostracized - outside Ancel paradigm**

2015 Harcombe: Survey of RCTs: **doesn't consider totality of evidence**

Introduction

Not being Scientific is Not being Practical, e.g.

What is the relationship between eating fat, becoming fat, staying fat, and health?

How should fat be measured:
Height/Waist Ratio, Body Mass Index?
Visceral fat, Subcutaneous fat?

Are Sumo Wrestlers fat?

Kondo et al., (1994), Upper limit of fat-free mass in humans: A study on Japanese Sumo wrestlers. Am. J. Hum. Biol., 6: 613–618

Gosnell, M. (2007) Killer Fat: Not all fats are equal. Discovery Magazine, February 28.

Scientific vs. Non-scientific Research

Contents

Scientific Research - Outputs

- Advance the description, explanation, prediction, control, and change of complex phenomena

e.g. answer what and how questions about complex phenomena (i.e. description)

e.g. address why questions about complex phenomena (i.e. explanation)

e.g. set and achieve expectations about complex phenomena (i.e. prediction)

e.g. make effective interventions in complex phenomena (i.e. control)

e.g. improve complex phenomena (i.e. change)

* Complex phenomena: many variables x unpredictable interactions

Scientific Research - Outputs

- Advance the description, explanation, prediction, control, and change of complex phenomena

e.g. scope defined in specific terms

e.g. within scope, all variables / constructs defined in specific terms

e.g. relationships between variables / constructs defined in specific terms

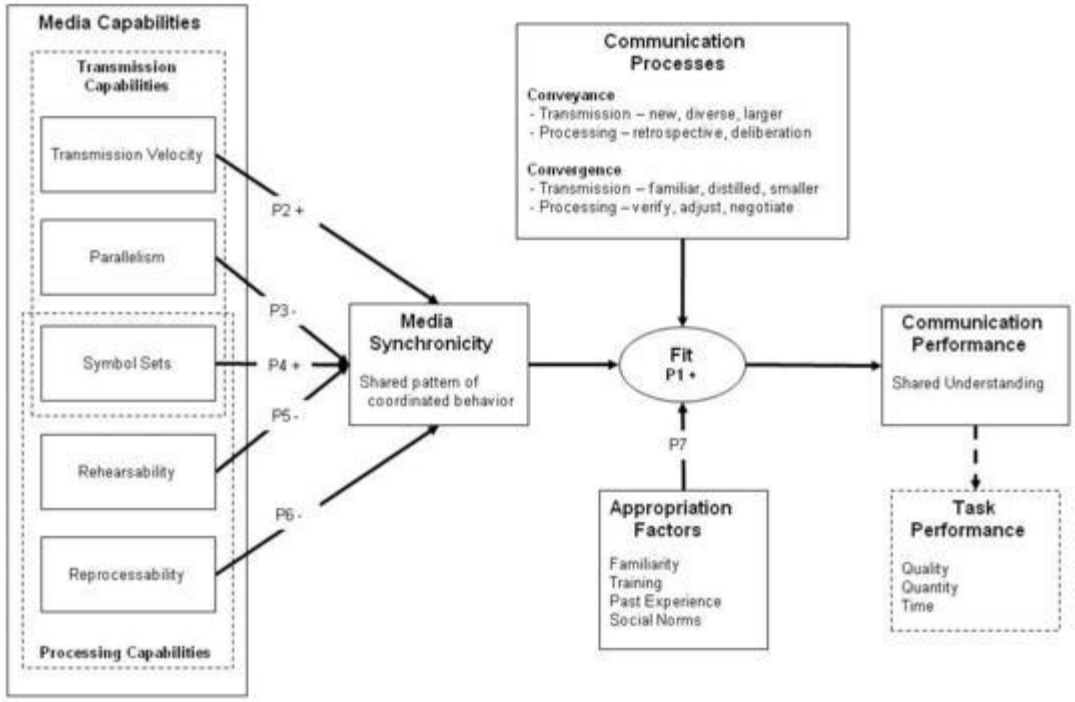
e.g. statements of relationships stated in such a form to enable empirical testing

e.g. statements specify exactly how people can accomplish something in practice

* construct: a concept for which there is not a single observable referent, and for which there exist multiple referents, but none all-inclusive; e.g. evolution, Dark Matter, moods

Scientific Research - Outputs

- Advance the description, explanation, prediction, control, and change of complex phenomena through definition of relationships between variables / constructs defined in specific terms: for example, Media Synchroncity Theory (Dennis, Fuller and Valacich, 2008)



Scientific Research - Practices

- Well-defined ontologically, epistemologically, and methodologically

e.g. Interpretivism (describe and explain open systems)

e.g. Positivism (describe, explain, predict closed systems)

e.g. Critical Realism (describe, explain, predict open systems)

e.g. Design (control and change open systems)

* ontological: nature and relations of being (e.g. three-domain categorization of reality)

* epistemological: nature of knowledge (e.g. probabilistic causation)

* methodological: system of methods, principles, and rules (e.g. Randomized Control Trials)

Scientific Research - Practices

- Threats to validity and reliability are identified and addressed through actions

  E.g. threats such as demand characteristics, participant error, participant bias, experimenter expectancy effects, observer error, observer bias, selection bias, setting individuality, construct effects, causal ambiguity, confounding, etc…….

  E.g., actions such as apply Occam's Razor, analyses of researcher bias, analyses of participant bias, don't use research instruments you don't understand, don't ask leading questions, pilot research instruments with impartial third parties, separate groups in quasi-experiments, negative case analysis, etc……

* Occam's Razor: among competing hypotheses, the one with the fewest assumptions should be selected; i.e. everything should be as simple as possible, but not simpler

Scientific Research - Inputs

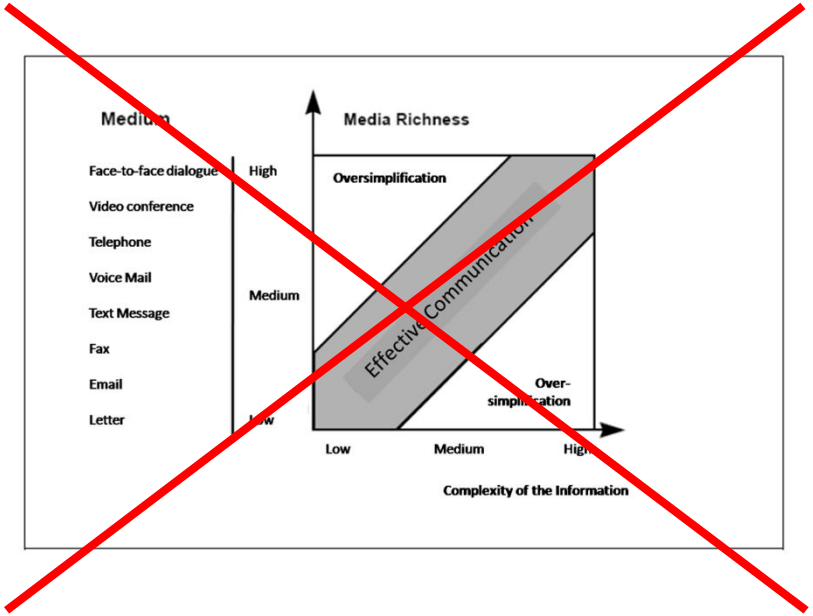
- Existing scientific knowledge
- Debate about existing scientific knowledge
- Identified gaps in existing scientific knowledge
- Curiosity about complex phenomena
- Need to better address complex phenomena
- Imagination

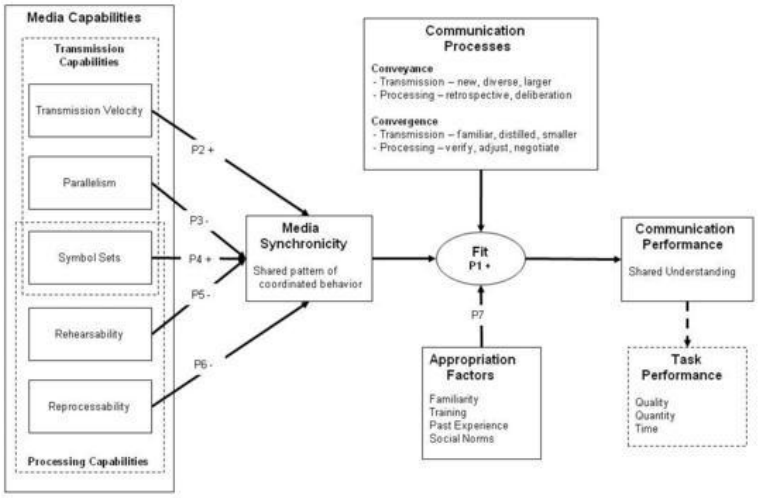
Every great advance in science has issued from a new audacity of imagination. What are now working conceptions, employed as a matter of course because they have withstood the tests of experiment and have emerged triumphant, were once speculative hypotheses (Dewey, 1929)

Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution (Einstein, 1931)

Scientific Research - Inputs

- Existing scientific knowledge + Debate about existing scientific knowledge + Identified gaps in existing scientific knowledge: for example, tests of Media Richness Theory revealed it to have little predictive value; and that led to formulation of Media Synchronicity Theory





Non-scientific Research

Freedman, D.H. (2010) **Lies, Damned Lies, and Medical Science**. The Atlantic.

Ioannidis JPA (2005) **Why Most Published Research Findings Are False**. PLoS Med 2(8): e124.

Shun-Shin MJ, Francis DP (2013) **Why Even More Clinical Research Studies May Be False: Effect of Asymmetrical Handling of Clinically Unexpected Values**. PLoS ONE 8(6): e65323.

The Reproducibility Project (2015) "**A large portion of replications produced weaker evidence for the original findings**". Science, Vol. 349 No. 6251

Non-scientific Research - Inputs

- Funding bias
- Conflicts of interest
- Predetermined conclusions
- Ignorance of scientific knowledge
- Hype
- Group think
- Magnification (cognitive “mountains” constructed from real world “molehills”)
- Irrational escalation

e.g.

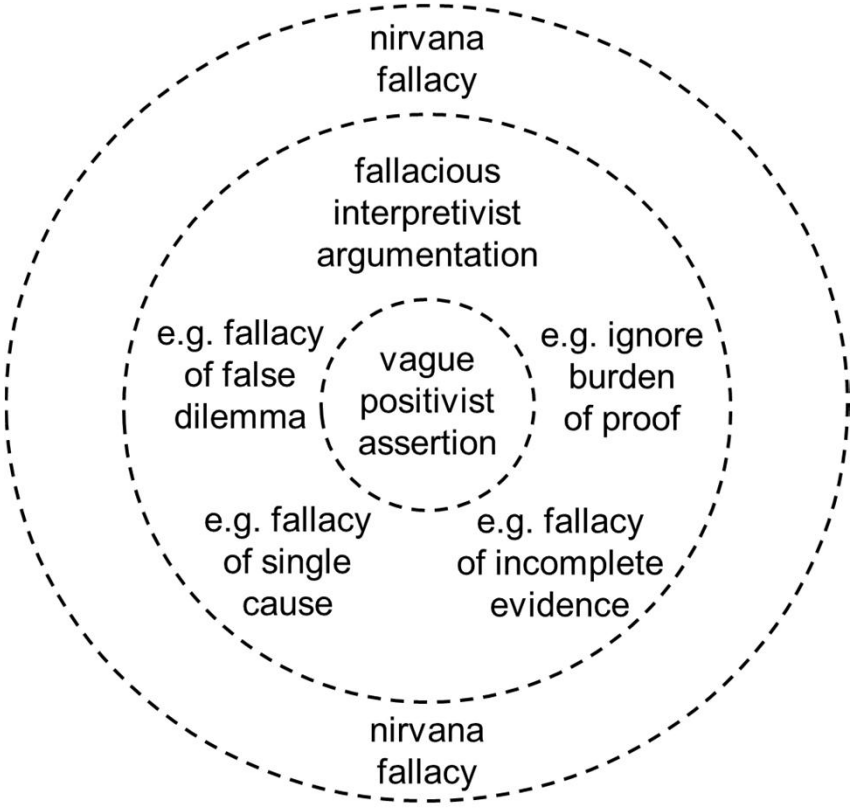
“AR (Augmented Reality) likely to alter industries”

“Big Data is next frontier for innovation, competition, and productivity”

“BIMs can revolutionize building design and construction”

Non-scientific Research - Practices

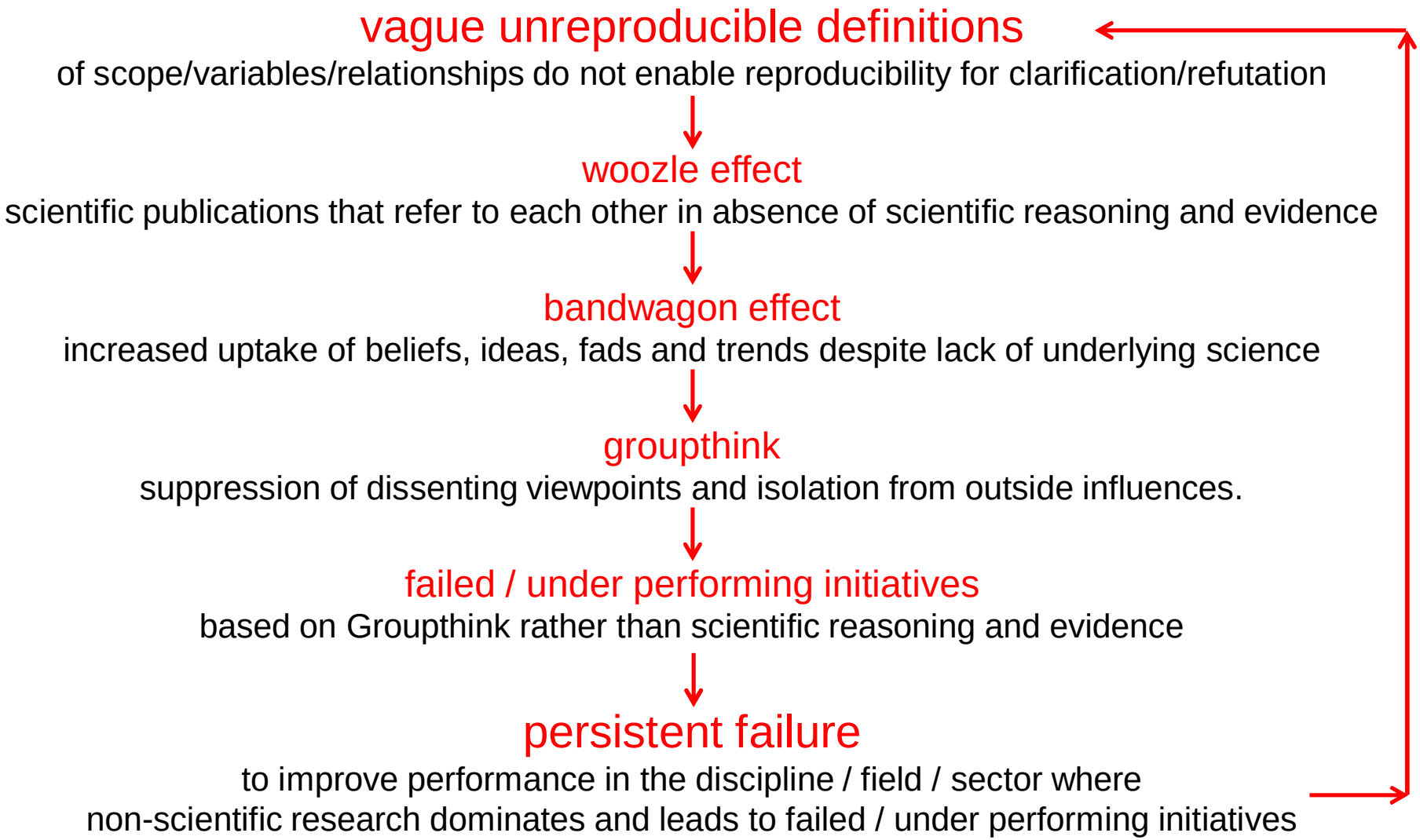
- Ontological, epistemological, and methodological confusion
- Over-reliance on confirmation rather than refutation
- Threats to validity and reliabilty not identified and not addressed
- Webs of fallacious argumentation



Non-scientific Research - Practices

- Nirvana Fallacy: sweeping positive effects are asserted as being available by proponents of an option. By contrast, other options are asserted to be certainly imperfect
- Positivistic assertion: reduces complex reality to flat conjunction of cause and effect which is expressed in terms that cannot be tested
- Ignoring burden of proof: when debating an issue, there is a burden of proof on the person asserting a claim. Hence, if people claim that that something is revolutionary, it is for them to prove it
- Cherry picking: also known as fallacy of incomplete evidence, proponents look only where there assertions are not challenged, and ignore other cases that are contradictory
- Assertion of single cause: this is oversimplification of causation, in which one simple cause of an outcome is claimed, although there are many factors involved in an outcome
- False dilemma: one choice is asserted to be the only good choice available, and to not take up that choice will lead to certain failure.

Non-scientific Research - Outputs



PhD Research

independent original scientific research culminating in a new and significant contribution to scientific knowledge

- Develop and demonstrate understanding of scientific research methodologies
- Develop and demonstrate skills in application of scientific research techniques (at least three techniques without total reliance on participants' self-reporting)
- Develop and demonstrate skills in critical appraisal and scholarly debate (discussion based on causal reasoning and case evidence – not assertions)
- Conduct critical analysis of topics in field
- Present research in peer-reviewed publications

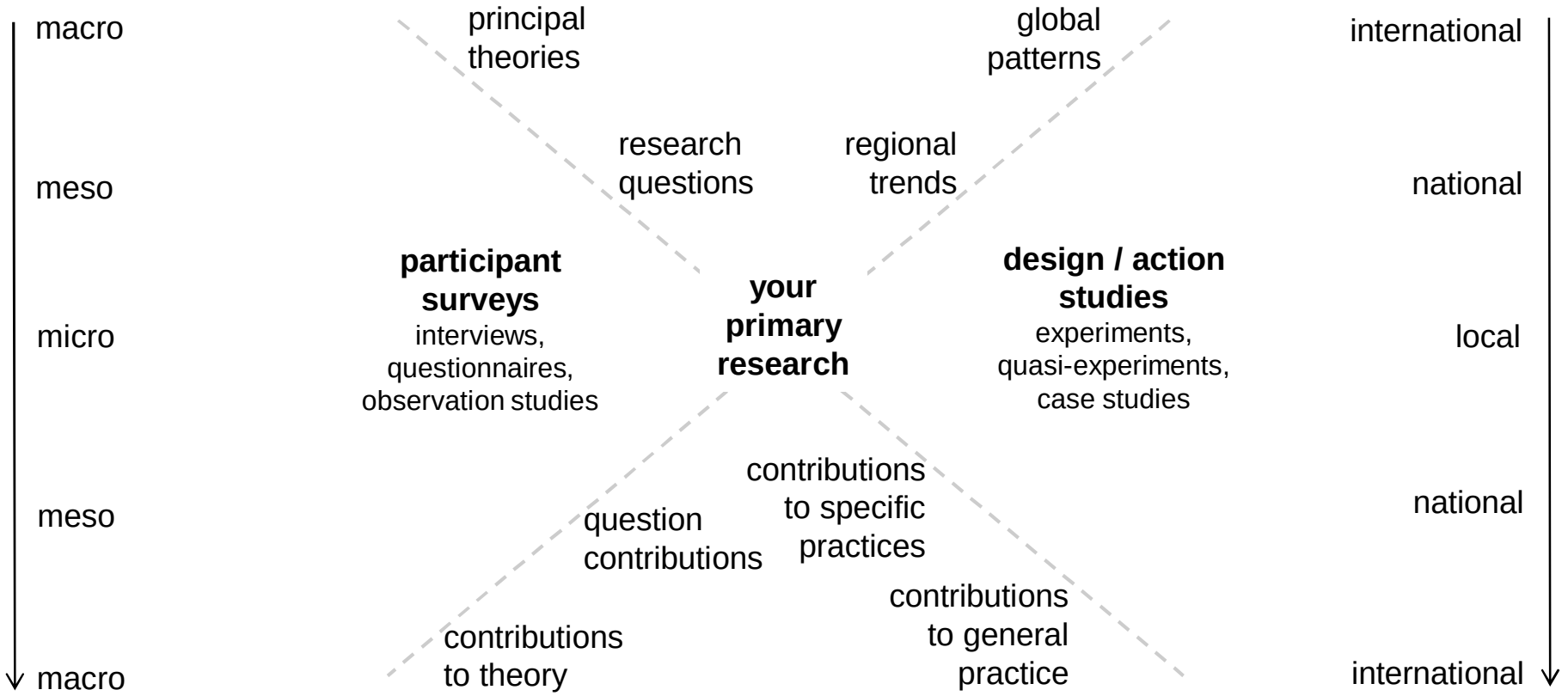
PhD Research

independent original scientific research culminating in a new and significant <u>contribution to scientific knowledge</u>

- Critique existing theory by revealing omissions, limitations, etc.
- Re-contextualization of an existing theory: what works - what doesn't - and why
- Combining two or more existing theories: what is useful - what isn’t - and why
- Empirically-based critical analytical account of a phenomenon of interest

PhD Research

independent original scientific research culminating in a new and significant contribution to scientific knowledge



Conclusions

Not being Scientific is Not being Practical

because

performance improvement cannot be built upon

vague and/or bias definitions of scope, variables / constructs, and relationships

which cannot advance

description, explanation, prediction, control, and change of complex phenomena

Conclusions

The first principle is that you must not fool yourself - and you are the easiest person to fool. So you have to be very careful about that (Feynman, 1974).

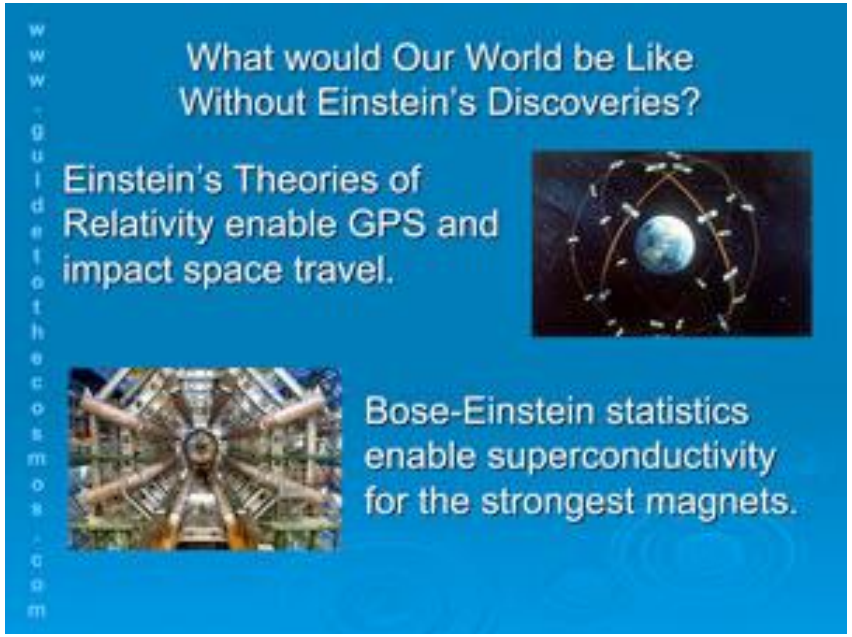
Think About and Act Upon the following:

- how have your research questions been defined?;
- how have research questions limited what can be 'found?';

- how could the design of your study 'construct' the data and the findings?;
- how could your methods of analysis “construct” the data and the findings?;

- how could the research question be investigated differently?;
- to what extent would this give rise to a different understanding of the phenomenon under investigation?

Conclusions



e.g. slide by Piccioni, R.L.: without application of Einstein's two Relativity Theories, the GPS units in our cars, phones, etc. would be useless

BEING

SCIENTIFIC

IS BEING

PRACTICAL

Some References

Dennis, A.R., Fuller, R.M. and J.S. Valacich (2008) Media, Tasks, and Communication Processes: A Theory of Media Synchronicity. MIS Quarterly, 32(3), 575-600.

Fox, S. (2014) Getting real about BIM: critical realist descriptions as an alternative to the naïve framing and multiple fallacies of hype. *International Journal of Managing Projects in Business*, 7(3), 405-422.
Fox, S. (2013) Getting real about ICT: applying critical realism to the framing of information and communication technologies. *Management Research Review*, 36(3), 296-319.
Fox, S. and Do, T. (2013) Getting real about Big Data: applying critical realism to analyse Big Data hype. *International Journal of Managing Projects in Business*, 6(4), 739-760.
Fox, S. (2013) The innovation big picture: including effectiveness dependencies, efficiency dependencies, and potential negative effects within the framing of new technologies. *Technology in Society*, 35(4), 306–314.
Fox, S. (2012) Improving new product development by screening manufactured goods for potential disbenefits and negative consequences. *Journal of Manufacturing Technology Management*, 23(5), 615 – 633.
Fox, S. (2012) Getting real about innovations: Formulating innovation descriptions that can reduce ontological uncertainty. *International Journal for Managing Projects in Business*, 5(1), 86-104.
Fox, S. (2010) The importance of information and communication design for manual skills instruction with augmented reality. *Journal of Manufacturing Technology Management*, 21(2), 188-205.
Fox, S. (2008) Evaluating potential investments in new technologies: balancing assessments. *Critical Perspectives on Accounting*, 19(8), 1197-1218.

Freedman D.H. (2010) Lies, Damned Lies, and Medical Science, The Atlantic

Ioannidis, J. (2005) Why Most Published Research Findings Are False. PLoS Med 2(8): e124. doi:10.1371/
Ioannidis, J. (2012) Scientific inbreeding and same-team replication: Type D personality as an example. Journal of Psychosomatic Research, 73(6), 408-410.

Robson, C. (2011) Real World Research 3rd edition. John Wiley & Sons Ltd. Chicester, UK.

Shun-Shin MJ, Francis DP (2013) Why Even More Clinical Research Studies May Be False: Effect of Asymmetrical Handling of Clinically Unexpected Values. PLoS ONE 8(6): e65323. doi:10.1371/journal.pone.0065323

for more information

foxstephenjohn@gmail.com