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Can the Physicists' Description of Reality Be Considered Complete?

Brian D. Josephson

Department of Physics,

University of Cambridge

http://www.tcm.phy.cam.ac.uk/~bdj10

alternative title/subtitle:

Can biology lead to new phenomena and insights in physics?

Main thesis: there exist two complementary approaches to understanding nature

There are 2 different mindsets/cultures, related to:

a. regular physics

b. complex systems, including biology

<u>Complex systems differ significantly from systems studied in 'regular physics'</u>

Physics approach:

- reductionistic
- quantitative
- predictive

Systems methodology:

- Approximations: forms and patterns

Division between those who have understood this, and those who have not

Understanding of this issue does not filter back!

The idea that regular physics may be limited seems to be unacceptable to those concerned

Human mechanisms depend on precision

Biological mechanisms depend on ‘being good enough for the purpose’ and ‘first approximations’

•How are bioprocesses connected with physics?

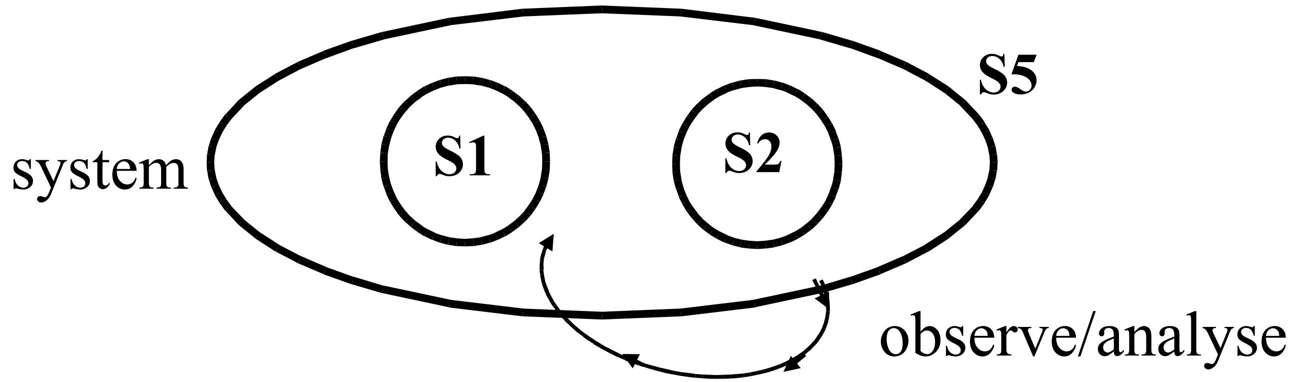
Naive view: deducible emergence

But also observational emergence (Baas)

Biosystems are good at getting things
roughly right

… and then improving things where appropriate

Conventional deducibility lost



In the Baas approach, the behaviour of various combinations is observed and analysed, and adjustments are made in accord with the outcome of the analysis (observational emergence.

The outcome

Behaviour that is well-defined;
ambiguous means

Final cause

Adaptation

Symbolism

Meaning

Bohr’s idea:

Complementarity

Relevance to life

Delbruck’s claim: life has as its basis phenomena sufficiently macroscopic that quantum aspects are irrelevant

Counter-proposal: focussing on ‘reproducible phenomena’ has effect of sweeping quantum aspects under the rug

Life may find it <u>beneficial</u> to make use of quantum effects

In which case, it will probably find ways to make use of them (e.g. quantum computation for efficiency)

So Bohr may have been right after all!

But there is a bigger issue here, viz. that of descriptive adequacy

Biosystems are normally too complicated for regular physics (using current methodologies) to be able to handle them.

Analogy 1: $\sqrt{2}$

This has no meaning until the real number concept is developed

Analogy 2 (Kadanoff): no series expansion based on a normal metal can yield superconductivity

Science can adapt

but cultural shift
needed

- inhomogeneous content
- equations only part of the picture
- reductionism ultimately problematic

Enslavement to QM with its measurement rules is a process of putting on blinkers, looking only where there is illumination and we can see clearly

Analogy: doing optics with white light produces the problem of variable refraction and blurring fringes

So we might react by experimenting only with monochromatic light (so no waveforms!

The AUD64K question: does this matter?

- omitting biocognitive aspects of nature similar to omitting condensed-matter aspects
i.e., acting as if large part of nature does not exist

Further, this aspect of nature may impinge on ‘regular physics’

Basic idea (Stapp, Wigner, etc.): mind, outside realm of QM, underlies collapse of wave function

focussed mind may be able to accomplish more (cf. coherence)

nonlocal mind, global action

universal mind? Mathematical realm, music

Is space primary or derived?

the multiverse (Deutsch)

Beyond the trap of string/M theory (?):

•The Anomalies Perspective

Under suitable conditions, ‘anomalies happen’

Anomalies cannot be inferred by extrapolation (cf. Kadanoff)

Problem of the ‘untamed anomaly’, outside our existing (but not necessarily future) concepts

Conclusion

We label nature in accord with what we know about it and the concepts at our disposal

Every century or so, we may need to update our concepts

Time for a change?