RESEARCH IN PHILOSOPHY OF SCIENCE AND ITS APPLICATIONS IN SCIENCE

2ND ANNUAL MEETING OF THE DANISH NETWORK IN PHILOSOPHY OF SCIENCE

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'Philosophy of Social Robotics': A New Variety of Philosophy of Science?

Johanna Seibt,

'Social robots' are programmable artefacts with physical capabilities and 'social intelligence,' i.e., they complete certain tasks in physical space in accordance with social rules for human interaction. Social robots are currently developed and employed in elderly care ("carebots"), cognitive and autism therapy, education, and public spaces, as "personal assistants," "pets," "trainers," "tutors," "guides," or "receptionists," as well as in military engagements ("warbots"). The research industry in social robotics is a fast growing area--according to a recent study of McKinsey, the market value of the social robotics sector will lie between 1.7- 4,5 trillion US $ per year. My aims in this talk are threefold. First, I will introduce the aims and tasks of philosophy of social robotics (PSR). Second, I will try to determine more precisely the status of PSR. Philosophy of social robotics is not so much a variety of philosophy of technology in the traditional sense of philosophical reflections on cultural change. Rather, since social robotics still is in the process of constituting itself as an interdisciplinary research area combining robotics, cognitive science, biology, psychology, anthropology, and social science, PSR is the study of scientific modeling in an interdisciplinary domain and in this sense belongs to philosophy of science. Third, I will argue that PSR may also be able to contribute important insights to the core issues in philosophy of science, in particular to our understanding of scientific explanation by modeling.

NEUROSCIENCE IN THE CRIMINAL JUSTICE SYSTEM – ETHICAL PERSPECTIVES

Jesper Ryberg, Roskilde University

Developments in neuroscience are escalating at an ever-increasing pace, providing a perpetual stream of new knowledge of the various processes that shape human cognition and emotion. The major advances in new neuroscientific research tools and technologies have prompted a lively discussion on how the new insights can and should be used outside the laboratories of neuroscientists. In recent years a particular attention has been directed to the question of how neuroscientific knowledge and technology should be used for the improvement of the work of the criminal justice system. The aim of this talk is to present an overview of some of the ethical challenges that arise from the use of neuroscience in the work of the criminal court.

BLACK BOXES ON WHEELS

METHODOLOGICAL AND ETHICAL PROBLEMS IN BIOLOGICAL ARTIFICIAL INTELLIGENCE

Martin Mose Bentzen (PhD), Assistant Professor, Technical University of Denmark

The possibility of using biological neurons as part of robotic systems is studied in the emergent field within Artificial Intelligence called biological AI- It is hoped that biological AI can remedy the well-known problem that robots based on conventional computer technology are not very good at adapting to surprising or unusual situations, at least not when compared to biological organisms. It is also hoped that biological AI can have applications within human enhancement and medicine, both directly, e.g. by enabling us to design neural prosthetics, and indirectly, by teaching us more about the biological principles of the brain. The research setup to be studied in this talk involves neuron cultures grown in vitro which are then used to control robots. In this talk, following an introduction to the technical aspects of the research, I discuss methodological and ethical problems for Biological AI. Kevin Warwick and colleagues claim to have shown how to control a mobile robot with a biological brain. However, the terms `brain' and ´control' are questionable as used here. Firstly, is it correct to call a neuron culture grown on a two-dimensional array a brain? This issue I will not focus much on in this paper, but only note that the actual brain of a mammal is a highly complex, functionally organized, three-dimensional object, far from the much simpler (and yet so hard to comprehend) two-dimensional cultures grown for the purpose of current biological AI. What I will mostly focus on in this talk, is the claim the researchers make that they have made this brain (or neuron culture) control a robot. I will do this by trying to understand what can be meant by control in this context, from a philosophical perspective. Secondly, I will examine what can be meant by meaningful behaviour in this context, where the researchers claim to have a grip on `the manifestation of neuronal activity as meaningful behaviour'. Thirdly, I will look at what kind of learning we can say is taking place in these cultures, and what kind of training of such cultures is possible. Fourthly, the researchers claim that their research which involves growing neuron cultures provides an ethical advantage. Supposedly, this perceived advantage comes from a comparison to research which uses actual animals to control robots, as the latter research is more invasive. I will argue that even if we find this comparison mildly acceptable, the research introduces several hitherto unknown ethical complications into current robotics, which makes it hard to speak of an advantage.

THE LIMITS OF SCIENCE AND THEIR ROLE IN (PHILOSOPHY OF) SCIENCE EDUCATION

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The limits of science are closely related to key issues in the philosophy of science, such as the nature of science, demarcation criteria and reductionism. And yet, the limits of science do not seem to be a central topic in philosophy of science courses (as judged e.g. from major textbooks in the field), and even less so in science education generally. Of course, there are what seem to be obvious reasons for this: philosophy of science courses usually focus on themes more aligned with traditional concerns in the field; and general science education focus on actual science training. The purpose of this talk is to suggest that, nevertheless, the question of the limits of science is an important topic both within philosophy of science proper and in science education.

Although the limits of science can be approached from many different perspectives (see e.g. Carrier et al 2000), I will exemplify the discussion by considering whether there are limits to what natural science can explain. In particular, I will focus on physics and the related issues of reductionism and the (problematic) idea of a theory of everything. Given that physics has been claimed to underlie – in one way or another – the rest of science, it constitutes a good case for discussing limits. I will argue that there are, indeed, limits to what physics can explain, and thus to the scope of physical theories. But I will also suggest that the study of such limits, in physics and elsewhere, may well be appreciated by science students at all levels. Not only because limits of the scope of science can be seen as an opportunity of pushing against the limits (i.e. they should not be seen as stopping blocks for research but rather as invitations to keep asking questions). But also, and relatedly, because such limits may point to awe and wonder (and therefore aesthetics) in connection with science. As I will discuss, both of these points have been noted as important driving forces for scientists. At a more general educational level, it is worth pointing out that a focus on the limits of science may serve to counteract an excessive scienticism.

With respect to philosophy of science courses for scientists, it may not always be easy to capture the interest of students (see e.g. Grüne-Yanoff 2014). In this context, it is relevant that the question of limits has a double nature: it can be both critical of the scope of science and yet emphasize some of its fascinating aspects. I think the distinction between what we (think we) know, what we don't know, and what we (perhaps) cannot know should be interesting to science students (see also e.g. Barrow 1998). I thus suggest that philosophy of science courses for scientists, through an emphasis on the limits of science (and their relation to aesthetics), may contribute not only to a better understanding of science but also to enhance the motivation for studying both science and philosophy of science in the first place.

REFERENCES:

- Barrow, J.D. (1998). *Impossibility: The limits of science and the science of limits.* Oxford: Oxford Univesity Press.
- Carrier, M., Massey, G. and Ruetsche L. (eds), (2000). *Science at Century's End: Philosophical Questions on the Progress and Limits of Science*. Pittsburgh: University of Pittsburgh Press.
- Grüne-Yanoff, T. (2014) "Teaching Philosophy of Science to Scientists: Why, What and How". *European Journal for Philosophy of Science*, Volume 4, Issue 1, 115-134.

No Cause for Epistemic Alarm: Collaborative Science, Knowledge and Responsibility

Søren Harnow Klausen, University of Southern Denmark (harnow@sdu.dk)

New forms of radical collaboration – notably ”big science”, multi-authorship and ghostwriting – have brought renewed attention to the social nature of science. They have been thought to raise new and pressing epistemological problems, especially because they appear to have put in jeopardy the transparency accountability and responsibility associated with traditional scientific practice. Against this worried stance, I argue that the new practices can be adequately accounted for within a standard (externalist) epistemological framework. While radical collaboration may carry serious practical problems and risks, and requires critical attention to the way science is organized and communicated, it raises no fundamentally new problems – and it may even serve as an example of a less restrained and more fruitful, albeit calculatedly risky, mode of conduct, that could enhance scientific creativity.

THEORETICAL FERTILITY MCMULLIN-STYLE

Samuel Schindler, Centre for Science Studies, Aarhus University

A theory's fertility is one of the standard theoretical virtues. But how is it to be construed? In current discourse theoretical fertility is usually understood in terms of novel success: a theory is fertile if it manages to make successful novel predictions. A different construal of theoretical fertility, which hasn't played a major role in recent discussions, can be found in Ernan McMullin's work. My assessment of McMullian fertility is divided. Although I will defend McMullian fertility as a genuine virtue against Daniel Nolan's attempt to reduce it to novel success, I will question the realist rationale offered for it by McMullin.

Responsible Research and Innovation – From policy concept to scientific practice

David Budtz Pedersen, *Co-Director & Research Fellow, Humanomics Research Centre, University of Copenhagen (davidp@hum.ku.dk)*

Recently, debates about how to promote Responsible Research and Innovation (RRI) have intensified, triggered by an increased realisation of the potentially desirable and undesirable outcomes of new technologies. The European Union and the European Member States have decided an action plan to implement a new governance framework for responsible research and innovation. In November 2014, the Rome Declaration was published encouraging policymakers and scientists to strengthen responsibility in research and innovation. The declaration underlines that "decisions in research and innovation must consider the respect of human dignity, freedom, democracy, equality, rule of law and the respect of human rights". In this presentation I revisit some of the key conditions for the RRI debate in Europe and Denmark, and discuss which conceptions of responsibility are likely to become codified as "soft law" and eventually made compulsory in public research institutions. The presentation reviews different approaches to responsibility ranging from (a) "demarcation" (keep the social out of science) to (b) "reflexivity" (anticipate intended and untended impacts), (c) "contribution" (prioritise science in the public interest) and (d) "integration" (include societal actors and concerns) (Glerup and Horst 2014). From an analytical perspective, the paper raises two main concerns regarding the RRI framework: (1) There is a risk that RRI policies turn into de-facto governance (Rip 2010) that does not include the relevant resources necessary for qualifying and distributing responsibilities in the long term. (2) The different ways in which scientific personal is already framing responsibility, and the different normative orientations which sit behind those practical framings, is non-trivial, and should be taken into careful consideration. In other words, there is a real challenge in translating the RRI framework from a policy concept to real scientific practice.

References

- Budtz Pedersen, D. (2014). "Ansvarlig forskning og innovation – hvad er det?. *Videnskab.dk*.
- http://videnskab.dk/kultur-samfund/ansvarlig-forskning-og-innovation-hvad-er-det
- Glerup, C. & Horst, M. (2014) "Mapping social responsibility in science". *Journal of Responsible Innovation* vol. 1 (1): 31-50. http://www.tandfonline.com/toc/tjri20/1/1#.VKvEh97DqXg
- Rip, A. (2010). "De Facto Governance of Nanotechnologies". In: *Dimensions of Technology Regulation* (ed. Goodwin et al).
- Rome Declaration (2014). http://www.sis-rri-conference.eu/media-room/press-accreditation-registration-for-pr-and-communications-officers/

COMPUTERS, HOPES AND MATHEMATICS

Mikkel Willum Johansen, Assistant Professor at IND, University of Copenhagen

In 1958 Herbert Simon and Alan Newell predicted that "within ten years a digital computer will discover and prove an important new mathematical theorem (Simon and Newell 1958, p. 7)." As we now know, the prediction did not hold good; although progress has been made and at least one important has been proved (but not found) by a computer, mathematics has turned out to be surprisingly difficult field for computers. Although computers have turned out to be a valuable tool for mathematics researchers, they are only that – a tool. When it comes to finding and proving new theorems computers are considered to be (roughly) at the level of first year university students (Beeson, 2003). The surprising infectiveness of computers in the field of mathematics is an interesting case that can teach us valuable lessons both about human cognition and about the nature of mathematics and mathematical research. In my talk I will point out what research practices and cognitive strategies that seem to give human mathematicians an advantage relative to computers. At least two different factors can be pointed out: 1) human mathematicians form higher order concepts and use them for higher order reasoning, and 2) human mathematicians have the ability to integrate knowledge from several domains (both mathematical and extra-mathematical) when they attack a mathematical problem. I will base my analysis on case studies and on qualitative studies of the practice of working mathematicians.

LITERATURE

- Beeson, M. (2003): "The mechanization of mathematics". pp 77–134 of: *Alan Turing: Life and Legacy of a Great Thinker*. New York: Springer.
- Simon, H. A. and Newell, A (1958): "Heuristic Problem Solving: The Next Advance in Operations Research". *Operations Research*, v.6 n.1: 1-10.

CAUSAL SPECIFICITY IN BIOLOGY

Gry Oftedal

Causal specificity in biology has in recent philosophical discussions mainly been defined as fine-tuning; the fine-grained modulation of an effect through fine-grained changes in a cause, and the typical example of fine-tuning is considered to be the relation between DNA, RNA and protein sequences in protein synthesis. I will introduce an alternative definition of biological specificity, which I hold to be more true to the most frequent use of the concept in biology, namely specificity understood as direct non-redundancy. Direct non-redundancy concerns whether or not there are back-up causes for the most proximate cause of a relevant effect, for instance in enzyme reactions, protein recognitions events, and DNA-RNA relations. I analyze these two concepts of specificity and relate them to each other and to the concept of biological information. I rehearse the question whether specific biological relations should be considered more informational or more important causes than others. I suggest a definition of biological specificity which includes both enzyme/substrate relations, antibody/antigen relations, transcription factor binding, protein-protein recognition as well as DNA-RNA relations, namely «specificity as direct non-redundancy»:

A cause C is (totally) specific in relation to an effect E on a causal background if C is a direct cause that cannot be traded for other causes in which changes would be followed by parallel corresponding changes in the effect as for changes in C.

This definition is based on the direct relation that exists between molecules that bind via structural complementarity and that such a relation can exclude other factors from binding. The definition concerns total specificity and opens up the possibility for gradual specificity understood as a measure of how many causes C can be traded for and still have parallel changes happening in E for interventions on these other causes. If C can only be traded for one or a highly restricted set of alternative causes, we could still say there is relatively high specificity, while if C can be traded for a larger range of causes, there is low specificity. If C cannot be traded for any cause at all, there is total specificity. I will show how features of specificity and redundancy have implications for the relevance of specificity as a characteristic that introduces asymmetries among causal relations.

ON LIMITS AND BOUNDARIES IN PHYSICS AND COSMOLOGY

– *IS A FINAL THEORY OF EVERYTHING (T.O.E.) POSSIBLE*

Svend Erik Rugh

For almost twenty five years I have, not least with my former Ph.D. supervisor Holger Bech Nielsen - discussed the so-called ”Random Dynamics” project conceived by Holger Bech Nielsen, and a host of collaborators. See e.g. ref. [1]. I would like – here - to explain, to a general audience (of philosophers of science), various ideas in this interesting project (described, by now, in a rather large body of literature). The project attempts to put into language – and examine - whether various regularities – and not least, natural laws – are in possession of some degree of [to be further categorized in successive stronger forms of] “structural stability” (against variations of the framework, including underlying deeper laws, in which those regularities are suspended). I would consider the project as an important attempt to locate (various forms of) principal boundaries for the project which drift (ref.[2]) towards such ambitious goals as putting into language “A Theory of Everything”, a T.O.E. (dreamt of by many theoretical physicists). In its most ambitious version (the boundaries of which are to be located), Holger’s project could be conceived of as an attempt to derive “everything from nothing” ! (ref.[3])

In addition, I would like to sketch some entirely different attempts at locating some principal boundaries for physics and cosmology. I am here imagining to present some ideas in projects undertaken with Henrik Zinkernagel (some of these projects have already been reported, e.g. ref.[4]). For example, (1) the examination of the conception of “vacuum” (in the realm of quantum (high energy) physics and cosmology) [do we have a case of “underdetermination of theory by experiment” ?] (2) Our studies of how the notion of “cosmic time” – in all standard text books – are (uncritically) extrapolated to such early “eras” (“early times”) that the concept (in our assessment) appears to lose its “physical basis” (underpinning), and this “gradual loss of physical underpinning” happens more and more severely as we approach the very early stages in the evolution of our Universe (as envisioned in contemporary standard cosmology). I will attempt to discuss, more generally, how we attempt to locate (think about) in which ways concepts (and theories) need a “physical basis” (“underpinning”) in order to be elevated from (a network of) “mathematical symbols” (or mathematical theories) to a “status” of “physical concepts” operating within theories we may - with some justification - call “physical theories”.

References:

1. C.D.Froggatt and H.B.Nielsen “Origin of Symmetries” World Scientific (1991).
2. Plato “Symposion” (~ 400-350 f.Kr).
3. H.B.Nielsen and S.E.Rugh “Complexity Measure for Natural Laws” (unfinished draft, ~50 pp, 1998)
4. S.E. Rugh and H. Zinkernagel “On the physical basis of cosmic time”, Studies in the History and Philosophy of Modern Physics **40**, p. 1-19 (2009).

Time	Activity
Fri 9:00-9.30	Arrival and coffee
Fri 9.30-10.45	Johanna Seibt (45 + 30 min): 'Philosophy of Social Robotics': A New Variety of Philosophy of Science?
Fri 10.45-12.00	Jesper Ryberg (45 + 30 min): Neuroscience in the Criminal Justice System – Ethical Perspectives
Fri 12.00-13.00	Lunch
Fri 13.00-14.30	Advanced training in philosophy of science Kristian Hvidtfelt Nielsen: "Socio-scientific issues as a means of producing literacy in science and in science studies" General discussion of challenges and experiences
Fri 14.30-14.45	Coffee
Fri 14.45-16.05	Contributed papers(25 min talk; 15 min discussion) Martin Mose-Bentzen: Black boxes on wheels: Methodological and ethical problems in biological artificial intelligence Henrik Zinkernagel: The limits of science and their role in (philosophy of) science education
Fri 16.05-16.45	Upcoming conferences SPSP2015 (submission closed), EPSA2015 (deadline papers March 1), ISHPSSB2015 (deadline papers Jan 15), CLMPS2015 (submission closed), IHPST2015 (deadline papers Feb 28), as well as PSA2016 and SPSP2016 (CfP not announced yet). Discussion of paper and symposia proposals, mentoring possibilities, writing workshops, etc.
Fri 16:45-18:00	Søren Harnow Klausen (45 + 30 min): No Cause for Epistemic Alarm: Collaborative Science, Knowledge and Responsibility
Fri 18-20	Dinner and break
Fri 20.00-	Planning of activities in the network's focus area "New trends in general philosophy of science"

Sat 8.00-9.00	Breakfast
Sat 9.00-10.15	Samuel Schindler (45 + 30 min): Theoretical fertility
Sat 10.15-10-55	Contributed paper (25 min talk, 15 min discussion): David Budtz: Responsible Research and Innovation – From policy concept to scientific practice
Sat 10.55-11.10	Coffee
Sat 11.10-12.00	Peter Sandøe: Teaching RCR from BA to senior level
Sat 12.00-13.00	Lunch
Sat 13.00-15.00	Contributed papers (25 min talk, 15 min discussion): Mikkel Willum Johansen: Computers, hope, and mathematics Gry Oftedal: Causal specificity in biology Sven Erik Rugh: On limits and boundaries in physics and cosmology: is a final theory of everything possible
Sat 15.00-15.20	Wrap-up and evaluation