Feyerabend contribution to modern computational microphysics

(Extended Abstract)

Steven Meyer
Tachyon Design Automation, San Francisco, CA, USA
smeyer@tdl.com

This paper argues Paul Feyerabend was an important contributor to mid 20th century physics, and that his criticism of Von Neumann's formalism anticipated import problems in modern computational microphysics. In summer and fall 1967, Feyerabend was invited to present courses on modern physics at Stanford and UC Berkeley (Lakatos archive Feyerabend correspondence June-July 1967, folders 13/272a 114, 118, 120). In September 1967, Feyerabend wrote a letter to Imre Lakatos opposing mathematical formalism in quantum physics (QP) and attached notes for a paper "On the Solidity of Facts" that discussed formal mathematics in physics (6 Sep 1967, 13/272a unnumbered would be about 127 and 127a). The material is both notes for Feyerabend's course and suggestions to Lakatos on his quasi-empirical theory of mathematics (*Proofs and Refutations*. Lakatos, I., 1976).

Feyerabend's 1960s study of microphysics is discussed. As Feyerabend described in his last interview "I was still a methodology freak ... it made sense to argue for certain procedures in science" in *The Worst Enemy of Science.* Preston J. et. al. (eds), 2000, p. 162. Feyerabend's physics discussed here differs from the later Feyerabend portrayed by Kurt Szovils in "Feyerabend and Physics", *ein philosoph aus wien.* Stadler, F. & Fischer, K. (eds). 75-97.

Formalist computational microphysics is widely accepted especially Von Neumann's axiomatization of QM. For example, computer scientist Aaronson in "NP-complete Problems and Physical Reality" argues that "NP-complete mathematical problems .. eventually [will] be seen as a principle of physics" (arXiv:quant-ph/0502072v2, p. 17).

On 6 Sep 1967, Feyerabend wrote to Lakatos:

> I shall have to say a few very critical things about Von Neumann, NOT about his subjectivism, but about the disservice he did to physics by trying to make the theory precise.

It is important because all modern computational physics assumes Von Neumann's axiomatization as proven knowledge. In the Solidity notes, Feyerabend wrote "simple and straight forward arguments are preferable to complex derivations," and "increase of **mathematical rigour** is not always desirable." In an earlier 27 Dec. 1964 letter to Lakatos (13/272a 14), Feyerabend wrote: "the search for certainty is indeed **literally** a Kinderkrankheit." This paper discusses the Lakatos correspondence and Solidity draft in the context of Feyerabend's defense of Bohr and in the context of skepticism toward Bell's inequality and toward entanglement in general. Intellectual threads from the work of the founders of modern physics that Feyerabend continued in an anti-formalist manner are discussed.

1. Thread 1: methodology as important microphysics problem

In the Berkeley physics course volume 4 section 1.19 on QP methodology, it is asked: "Let us now think critically about the above speculations [electron is primitive]: do they really make any sense? In asking our questions we have clearly made many assumptions which reflect our prejudices." The thread discusses various methodological books by microphysicists including David Bohm's *Causality and Chance in Modern Physics.* 1957. and Werner Heisenberg's *Physics and Philosophy.* 1958. Feyerabend was a colleague of Bohm at Bristol in the mid 1950s. Feyerabend wrote an important review of Bohm's book which Bohm answered. Thread is modern because of attempts to explain the recent CERN Linear Hadron Collider discovery of a (Higgs?) Boson at about 125 BEV that involves finding only a few collisions per year using computer logic.

2. Thread 2: Lakatos (and Polya) quasi-empirical logic

Feyerabend was strongly influenced by Imre Lakatos and wrote detailed letters with suggestions on improving Lakatos' papers. Feyerabend wrote: "Russell's [logic] program ought to have overcome Hilbert's even without Godel" (Feyerabend to Lakatos 27 Dec. 1964, 13/272a 19).

Moving to the modern era, Julia Floyd explicitly rejects Feyerabend's anti formalist view when she writes Feyerabend [also Popper] "missed the multifariousness of the ways in which modern formal logic would serve as a new lens for philosophy, illuminating and distorting its questions in new kinds of ways" ("Feyerabend on Wittgenstein" in *ein phisoph aus Wien*, p. 111). Feyerabend strongly opposed this methodological view in the 1960s.

3. Disconnected modern thread: Finslerian anti-formalism

Paul Finsler's work in formal logic was seemingly unknown to Feyerabend and the founders of modern physics in spite of Finsler being well known contributor to the geometry of general relativity in spite of Finsler teaching at ETH. In the 1990s, Finsler's work was revived in *Finsler set theory: platonism and circularity.* Booth, D & Ziegler, R. (ed.), 1996. The history is tied back to Feyerabend because of the book *Revolutions in Mathematics.* Gillies, D. (ed.), 1992. The second book connects back to Feyerabend through Kuhn's influential *The Structure of Scientific Revolutions*.

In the mid 20th century, formalism was not taken so seriously so Feyerabend's QP course was not unusual. But after one half century of the dominance of computer methods (see my arXiv:1208.3739v1 [cs.OH]), Feyerabend's anti-formalist microphysics disproves much of current dogma in computational microphysics including showing that macro world quantum computer experimental observations may be actually mathematical illusions.