

# A priori prejudice in Weyl's unintended unification of gravitation and electricity

Afriat, Alexander (2007) A priori prejudice in Weyl's unintended unification of gravitation and electricity.

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## Abstract

It is almost always claimed that Weyl deliberately unified gravitation and electricity in the rectification of general relativity he attempted in 1918. In fact the unification, as Bergia and Ryckman have pointed out and a couple of passages show, was the unintended outcome of apparently gratuitous a priori prejudice. But what prejudice? The evidence suggests that the theory came straight out of Weyl's sense of mathematical 'justice,' which led him to put the direction and length of a vector on an equal footing. Levi-Civita had discovered that the parallel transport determined by Einstein's covariant derivative was not integrable — while length, far from depending on the path taken, remained unaltered. For Weyl this was unfair: both features deserved the same treatment. He remedied with a connection that made congruent transport (of length) just as path-dependent as parallel transport. This 'total' connection restored justice through a length connection it included, an inexact one-form Weyl couldn't help identifying with the electromagnetic 4-potential  $A$ , whose 4-curl  $F=da$ , being closed (for  $dF=ddA$  vanishes everywhere), provides Maxwell's two homogeneous equations. Source-free electromagnetism (up to Hodge duality at any rate) thus came, quite unexpectedly, out of Weyl's surprising sense of mathematical justice.

Admittedly there were also intimations, from the beginning, announcing an 'infinitesimal' agenda of sorts; but it was largely unmotivated back then, and too vague to produce the theory on its own — in fact it may even have been suggested by the theory. The agenda would take shape over the next years, acquiring justification and grounding; Ryckman has found roots in Husserl, and connected, or even identified it with a 'telescopicism' opposed to distant comparisons. But his compelling reconstruction of the agenda and its philosophical background rests largely on a couple of texts from a subsequent 'context of justification.'

'Mathematical justice' has, in the context of discovery, a more substantial (though sometimes thinly disguised) presence than the infinitesimal agenda. It is also logically stronger, being enough — together with a handful of simple and natural operations — to yield all of electromagnetism away from sources.

**Keywords:** general relativity, electromagnetism, a priori, Weyl, unification

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**ID Code:** 3447

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