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The Axiomatic Foundations of the Theory of Special Relativity—Reply toStiegler

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We appreciate that Stiegler in his article (Stiegler, 1972) is thanking us for 'some remarks in connection with the Palacios theory'. In spite of this he has omitted to mention a great deal of previous literature on the same and related subjects (Voigt, 1887; Lorentz, 1904; Poincaré, 1905; Ives, 1937; Palacios, 1961, 1966, 1968, 1970; Gordon, 1962; Keswani, 1965, 1966; Podlaha, 1966; Podlaha & Navratil, 1967; Podlaha, 1969, 1971). However, we consider that Stiegler's paper shows so deep a misunderstanding of the Palacios (1960, 1961, 1966, 1970) and related transformations (Voigt, 1887; Podlaha & Navratil, 1967; Podlaha, 1971, 1973), with which he deals, that we feel it necessary to point out his errors.

There are, surely, several possibilities how to derive (Gordon, 1962; Podlaha & Navratil, 1967; Podlaha, in press) or achieve (Podlaha, 1969) the transformation (S, 3.3.2) (S means Stiegler's notation). And although we do not see any advantage in Stiegler's way (Stiegler, 1972), which tries to avoid the linearity at the derivation (pages 404-412) from his axioms A1-A4, we do not wish to criticise it. However, we cannot avoid discussing Stiegler's subsequent errors:

(i) The transformation (S, 3.3.2) is only an element of a whole set of linear transformations leaving the Maxwell equations invariant (Podlaha, in press). In Palacios theory there exist just one privileged inertial frame S which must not be interchanged with the frames $S', S'', \ldots$ (Palacios, 1966, 1970). The transformation T^{ik} for the transition $S^i \to S^k$ is, therefore, not identical with the transformation T^{ki} valid for the transition $S^k \to S^i$. Therefore, for the transition $S' \to S$ we have to write (in Stiegler's notation)

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$$x' = \frac{1}{\sqrt{\lambda}} k(x + vt) \tag{1}$$

$$y' = \frac{1}{\sqrt{\lambda}} y \tag{2}$$

$$\dots$$

instead of (S, 3.3.2). For this reason also, the transformation (S, 3.3.2) must not be applied for the transition $S' \to S''$, therefore Stiegler's equations (S, 3.6.2) are wrong.

(ii) As was already recognised by Poincaré (for a detailed analysis of the Poincaré work see Cuvaj (1970)) the transformation formulae for E, D, H, B reads

$$E'_x = QE_x \tag{3}$$

$$E'_y = Qk\left(E_y - \frac{v}{c} B_z\right) \tag{4}$$

etc. However, as we have already emphasised in an earlier paper (Podlaha, 1973), the function $Q = Q(v)$ *is independent of* $\sqrt{[\lambda(v)]}$ (in Stiegler's notation). Therefore, from $\sqrt{[\lambda(v)]} = 1$ it does not follow that $Q(v) = 1$. Hence, axiom A5 (Stiegler's notation) has nothing to do with the transformation equations for E, D, H, B and Stiegler's considerations on pages 417 and 418 are completely confused.

(iii) Further, the equations (S, 3.6.8) are valid only for the transition $S \to S'$. For the transition $S' \to S''$ should be written

$$E''_x = PE'_x \tag{5}$$

$$E''_y = Pk\left(E'_y - \frac{v}{c} B'_z\right) \tag{6}$$

etc. where $P(v)$ is, in general, *quite a different* function from $Q(v)$. If S'' is moving with respect to S' with the velocity $-v$ then

$$E''_x = P(-v)E'_x \tag{7}$$

$$E''_y = P(-v)k\left(E'_y + \frac{v}{c} B'_z\right) \tag{8}$$

etc. Then

$$E''_x = P(-v)E'_x = P(-v)Q(v)E_x \tag{9}$$

and because of $E''_x = E$ it follows

$$P(-v)Q(v) = 1 \tag{10}$$

Stiegler's deduction and equation (S, 3.6.12) is, therefore, very wrong, for two reasons:

(a) $\lambda(v)$ in equation (S, 3.6.12) is not identical with $\lambda(v)$ in equation (S, 3.6.1);

(b) the factor in the equations (S, 3.6.8) differs not only by the fact that v is interchanged for $-v$. Also *the functional form of the factor* in equations (S, 3.6.10) is generally different from that of the factor in equations (S, 3.6.8). Let us note that a similar error was also made by Einstein in his paper (1905).

(iv) As can be shown on the basis of the analysis of the Thorndyke-Kennedy experiment (Podlaha, 1969), the function $\sqrt{\lambda}$ has in the case of the transition $S \to S'$ the form

$$\sqrt{[\lambda(v)]} = \frac{1}{(1 - v^2/c^2)^{(1/2)+\gamma}} \tag{11}$$

From (11) it is easily seen that $\sqrt{\lambda}$ has the same value for both $+v$ and $-v$. The equation

$$\lambda(v) = \lambda(-v) \tag{12}$$

holds *always*, also in the case when the axiom A5 were not valid. The axiom A5 formulated and analysed by us in 1967 (Podlaha & Navratil, 1967) has, in fact, nothing to do with Stiegler's indiscernibility of right and left. Therefore, Stiegler's considerations of this art, especially paragraph 3.7 of Stiegler's paper, are wrong. By the way, as is known, equation (S, 3.7.1) is not an equation for the aberration of light but an equation for the transversal Doppler effect.

Let us note further, that independently on the validity of equation (S, 3.7.1) it still holds

$$Q(v) = Q(-v) \tag{13}$$

i.e. also for the function $Q(v)$ no left-right asymmetry appears. Regarding the equation

$$E'_x = Q(v)E_x \tag{14}$$

we can see that the violation of equation (13) would mean that the measured value of E'_x depends on whether the observer in the frame S turns his face to the front or to the back.

However, from the non-existence of the left-right symmetry for $Q(v)$ it does not yet follow $Q(v) = 1$. This is because instead of

$$Q(v) = \frac{1}{Q(-v)} \tag{15}$$

it holds

$$Q(v) = \frac{1}{P(v)} \tag{16}$$

where $Q(-v) \neq P(v)$.

From (13), (16) obviously in no way follows $Q(v) = 1$.

First, if we make a requirement that the transformations for $E, E', E'', \ldots$ etc. *have to form a group*, we obtain $Q(v) = 1$. In this sense the Einstein considerations about this point should be corrected (Einstein, 1905).

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