An exception to the relativity of motion expressed explicitly in (9a,b) is Einstein's second postulate on the absolute speed of light. According to this postulate $c' = c$ and $\beta' = \beta$, so that (9a) becomes the Einstein-Doppler coefficient for light traveling parallel to the direction of the relative uniform translation of a source and a receiver; (9b) becomes the expression for the relativity or the reciprocity of the contraction-dilation coefficient. The Einstein theorem for the "addition" of parallel speeds is shown in the appendix to be readily derived from Einstein-Doppler coefficients, even though Pauli[13] asserted that the one has nothing to do with the other.

The basic "kinematics" of Einstein's special theory of relativity (absolutivity) has therefore been obtained without the need of coordinate transformations in general or the Lorentz transformations in particular. In addition, there has been no need for concern about simultaneity, synchronization, or the relative phases of a system of uniformly moving clocks as only two relatively translating identical clocks have been considered in the derivation. The concepts of time-dilation and length-contraction as possible physical entities have been shown elsewhere[14] to be both unobservable and experimentally unsupported (see Chap. 4 and Chap. 6).

UNIVERSAL TIME IN HOMOGENEOUS ISOTROPIC SPACE

Certain kinematic relations will now be noted as a consequence of the equalities $D = D'$, $d = d'$ and $v = V$. Thus from (5a), (2a), and (3a)

$$D = T_1/t_1 = T_2/t_2, \tag{10}$$

since $B = \beta$. Next, with (10) and (5b) together with (7a) and (7c) it follows that

$$1 = D'/D = t_2 t_3/T_1 T_2 = t_1 t_3/T_1^2 = d/d' = 1. \tag{11a}$$

This means that T_1 is the geometric mean to t_1 and t_3. Similarly, $T_3^2 = t_3 t_5$, $T_5^2 = t_5 t_7$, etc. The geometric mean to t_2 and t_3 denoted as t' is equal to the geometric mean to T_1 and T_2 denoted as T'; *i.e.*,

$$t' = \sqrt{t_2 t_3} = \sqrt{T_1 T_2} = T'. \tag{11b}$$

Similarly, $t_4 t_5 = T_3 T_4$, etc. It is a consequence of the relativity of kinematic effects expressed as $D' = D$, $d' = d$, and $v = V$ that there is a whole spectrum of distinct specific instants in s and S that are identical and therefore simultaneous on the s-clock and S-clock. The simultaneous instants such as $T_1 = \sqrt{t_1 t_3}$ –which will also be shown to occur under the Lorentz transformations–occur independently of the as yet undetermined speed of propagation of light c'.

It follows by induction that the discreet temporal spectrum of simultaneities can be extended to a continuum, since what has been deduced for the arbitrary moment of starting t_1 can also be deduced for any infinitesimally adjacent instant $t_1 \pm \delta t_1$. Two identical clocks in relative uniform translation therefore run at the same identical rate independently of the nature of the speed of light, c', emitted from a uniformly translating source. The induction of universal spatially extended common time, as a consequence of the isotropy and the homogeneity of space is, of course, quite diametrically opposite to the currently accepted meaning of time dilation. The conclusion is however quite consistent with the demonstration[14] that time dilation is not physically observable. The induction of universal spatially extended time as a consequence of the isotropy and the homogeneity of space means that $d' = 1 = d$ in (7a), (7c), and (9b). It then follows from (9b) that

$$c' = c - v. \qquad (9c)$$

The speed of light emitted from a uniformly translating source therefore depends on the motion of its source. The speed of the light is relative and *not* absolute as Einstein postulated. The universality of time, in addition to being induced, can also be deduced as will now be shown.

KINEMATICS

Referring to Fig. 1 and Fig. 2 as displayed in Fig. 3, it may be readily seen that the three pairs of instants (t_2, T_1), (t, T) and (t_3, T_2) describe the linear temporal progress of the light flash at the varying coordinates (x,t) in s as it travels from S to s with speed c' relative to s. The same light flash is represented in S at the varying coordinates $(-X,T)$ as it travels from S to s with speed c relative to S. The linear temporal relationship of the two relatively translating clocks can be expressed in determinant form as

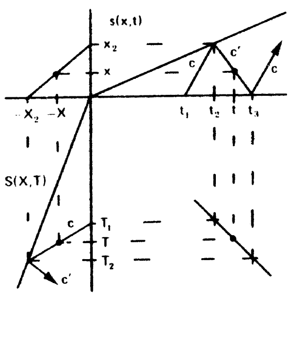

Fig. 3. Coordinated reflections.

$$\begin{vmatrix} t & T & 1 \\ t_2 & T_1 & 1 \\ t_3 & T_2 & 1 \end{vmatrix} = 0, \qquad (12a)$$

which yields

$$T = [t(T_2 - T_1) - (t_2T_2 - t_3T_1)]/(t_3 - t_2). \qquad (12b)$$

Since $D' = d$ and $d' = d$, it follows from the respective first equalities in (5b), (7a), and (7c) that $t_3 = DT_1$, $t_2 = dT_1$, and $T_2 = dt_3$. Thus, $T_2 = DdT_1$, so that $T_2 - T_1 = (Dd - 1)T_1$; $t_2T_2 = d^2t_3T_1$, so that $(t_2T_2 - t_3T_1) = (d^2 - 1)t_3T_1$; lastly, $t_3 - t_2 = (D - d)T_1$. Therefore, (12b) reduces to

$$T = [(Dd - 1)t - (d^2 - 1)t_3]/(D - d). \qquad (12c)$$

Assuming "absolutivity" means that $\beta' = \beta$ in (9a,b), so that $(d^2 - 1) = \beta^2d^2$, $(Dd - 1) = \beta(1 + \beta)d^2$, and $(D-d) = \beta$. These identities reduce (12c) to the *form* of the Lorentz transformation for time:

$$T = d[t - \beta(t_3 - t)] = (t - vx/c^2)/\sqrt{1 - v^2/c^2}\ , \qquad (13)$$

since $x = c(t_3 - t)$. Assuming, as is usually done, that a network of clocks, stationary in s and S, can be synchronized means that (13) is then the temporal Lorentz transformation.

The spatial Lorentz transformations can be similarly derived from the pairs of positions $(x_2,0)$, (x,X), and $(0,X_2)$ that describe the linear spatial progress of the light flash as depicted in Fig. 3; thus,

$$\begin{vmatrix} x & X & 1 \\ x_2 & 0 & 1 \\ 0 & X_2 & 1 \end{vmatrix} = 0, \qquad (14a)$$

so that

$$X = -(X_2/x_2)x + X_2. \qquad (14b)$$

Since $X_2 = -vT_2$ and $x_2 = vt_2$, $X_2/x_2 = -D$, in accord with (10); $T_2 = dt_3$, so that $X_2 = -dvt_3$, and (14b) reduces to

$$X = d[(D/d)x - vt_3]. \qquad (14c)$$

Assuming "absolutivity" in (9a,b) means that $(D/d) = (1 + \beta)$ and (14c) becomes the Lorentz transformation for position along the direction of the relative motion:

$$X = d(x + \beta x - vt_3) = (x - vt)/\sqrt{1 - \beta^2}\ , \qquad (15)$$

since $x = c(t_3 - t)$. The Lorentz transformations are unambiguously seen to depend on the *relativity* of motion with the one *postulated* exception of the *absolutivity* of the propagation of light.

RELATIVE SPEED OF LIGHT

It is *not* necessary to postulate the nature of the speed of light from a moving source; the "law" of the speed of the propagation of light can be deduced. It follows from the just obtained equalities $t_3 = DT_1$ and $t_2 = dT_1$ that $t_2 = (d/D)t_3$, whereby (11b) becomes $t' = \sqrt{t_2 t_3} = t_3\sqrt{d/D} = T'$. Thus, at the instant $t = t'$, between t_2 and t_3, simultaneous with the instant $T = T'$, between T_1 and T_2, it follows that (12c) reduces to

$$(d - 1)(\sqrt{Dd} - 1)(\sqrt{d/D} - 1) = 0. \qquad (16)$$

From (9a,b) find

$$d/D = 1/(1 + \beta') \text{ and } Dd = 1/(1 - \beta). \qquad (17a,b)$$

Now $Dd \neq 1$, since $\beta \neq 0$, and $d/D \neq 1$, since $\beta' \neq 0$; thus, the only valid physical solution in (16) is $d = 1$. This means according to (7a), (7b), (7c), and (7d) that

$$T = t \text{ and } D = 1/(1 - \beta). \qquad (18a,b)$$

It follows from (9a) or directly from (9b) with $d = 1$ that

$$1 + \beta' = 1/(1 - \beta), \qquad (19a)$$

so that the speed of light from a uniformly receding source has been deduced as

$$c' = c - v; \qquad (19b)$$

it need *not* be postulated for isotropic and homogeneous vacuous space.

These deductions can be obtained even more directly from physical kinematic conditions without the need to explicitly introduce the concept of temporal linearity as "formally" expressed by (12a). It will first be noted from (17a,b) that

$$c' = vd/(D - d) \text{ and } c = vDd/(Dd - 1). \qquad (20a,b)$$

At the simultaneous instant $t' = T'$, between t_3 and t_2, it may be deduced from Fig. 1 that relative to s the distance from S of the returning light pulse is $vt' - c'(t_3 - t')$. Relative to S, between T_2 and T_1, this distance—at the *same* instant T'—of the light flash from S is $c(T' - T_1)$, so that

$$|vt' - c'(t_3 - t')| = |c(T' - T_1)|, \tag{21a}$$

or, since $|vt'| = |vT'|$,

$$|vT' - c(T' - T_1)| = |c'(t_3 - t')|; \tag{21b}$$

the left side of (21b) is the distance of the light pulse from s *relative to* S and the right side is its distance from s *relative to* s.

The specific simultaneity (11b) was previously expressed as $t' = t_3\sqrt{d/D} = T'$ and the relationships (21a) and (21b), therefore, both reduce, with the aid of (5b), to

$$(c' - c + v)\sqrt{d/D} - c' + (c/D) = 0, \tag{21c}$$

which with (20a,b) reduces to (16), so that (19b) is again deduced.

RELATIVITY OF SIMULTANEITY

The last equality in (1a) together with (19b) leads to the expression $c(t_2 - t_1) = (c - v)(t_3 - t_2)$, so that a typically inferred time of arrival is

$$t_2 = [(t_1 - t_3) - \beta t_3]/(2 - \beta). \tag{22a}$$

If there is no relative motion $\beta = 0$ and

$$t_2 = \frac{1}{2}(t_1 + t_3). \tag{22b}$$

The erroneous and unnecessary Einstein absolutivity postulate imposes the static condition (22b)—obtainable from (1a) with $c' = c$—for the dynamic situation of relative motion. This forces the unneeded metaphysical "redefinition" of the concept of simultaneity first suggested by Einstein in his first publication[1] (p. 42) on relativity in 1905. It was from this suggestion, and the wrong semantic synonymity (in German as well as English) of the distinctly different physical concepts of synchroneity and simultaneity, that the mistaken idea of the "relativity of simultaneity"—*as a consequence of the Lorentz transformations*—was *inferred* rather than proved. The mistaken idea of the "relativity of simultaneity" has misled capable physicists, both proponents and opponents of the Einstein theory, into sometimes heated and derisive discourse that for the most part has been futile.[12] It can be readily shown that the Lorentz transformations are incompatible with the fundamental kinematics of uniform translation.

Consider two identical clocks s and S at the respective origins of the relatively translating systems $s(x,t)$ and $S(X,T)$ as depicted in Fig. 4. The time indications of these clocks at the origins $x_0 = 0$ and $X_0 = 0$ will be denoted as t_0 and T_0 respectively in order to distinguish them from the time indications t and T on other clocks at rest in s and S at the respective positions x and X. The identical clocks at rest in s run at the same rate relative to s and will be considered to have been synchronized relative to each other in s. Similarly, the identical clocks at rest in S run at the same rate relative to S and are likewise synchronous relative to S.

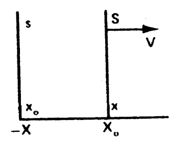

Fig. 4. Relative translation.

The fundamental kinematic verities (1a) and (1c), based on the isotropy and homogeneity of space, can in this context be simply stated as

$$x = vt_0 \quad \text{and} \quad -X = vT_0. \tag{23a,b}$$

This simply means that the distance x of the S origin relative to the s origin is given in terms of the known relative *scalar* speed v and the elapsed time t_0 on the clock at the origin of s; similarly, the distance $-X$ of the s origin from S is given in terms of the relative *scalar* speed v and the elapsed time T_0 on the clock at the origin of S. Synchroneity of the s clocks relative to s and synchroneity of the S-clocks relative to S yields the complementary kinematic verities

$$x = vt \quad \text{and} \quad -X = vT. \tag{23c,d}$$

The kinematic truisms (23a) and (23c) are expressed only in terms of the variables of s and are therefore independent of any coordinate transformations. Similarly, (23b) and (23d) are also independent of any coordinate transformations. The kinematic consistency of any coordinate transformations has to be tested by showing their accord (or discord) with the fundamental kinematics (23a,b,c,d).

The Lorentz transformation (15) with $d = 1/\sqrt{1 - \beta^2}$ yields $X_0 = d(x - vt) = 0$, consistent with (23c). The Lorentz transformation for time (13) therefore yields, as a consequence of s-system synchroneity expressed in (23a) and (23c),

$$T_0 = d(t - vx/c^2) = t/d = t_0/d. \tag{24}$$

From (15) find, since $x_0 = 0$,

$$X = d(x_0 - vt_0) = -dvt_0, \tag{25a}$$

and from (13) find

$$T = d(t_0 - vx_0/c^2) = dt_0. \tag{25b}$$

It follows from (25a,b) that $-X = vT$, consistent with (23d).

The fundamental S-system kinematic truisms (23b) and (23d) express the S-system synchroneity $T = T_0$ *relative to the S-system.* It is a consequence of the Lorentz transformations (24) and (25b) that the S-system synchroneity $T = T_0$ *relative to the S-system* is contradicted, unless $d^2 = 1$; $T = T_0$ only if $d^2 = 1/(1 - \beta^2) = 1$, but $d^2 \neq 1$ since $c \neq \infty$ and it has been *kinematically assumed* that $v \neq 0$.

Rather than reject the Lorentz transformations, as incompatible with the kinematics of uniform relative translation, it has been asserted *without rigorous logical proof* that the synchronous clocks of the "moving" S-system "appear" to be asynchronous *relative to the s-system.* The "moving" S-system clocks are alleged *without rigorous logical proof* to be out of phase with each other by a constant factor that depends on their distance from each other. The simultaneous "appearance" of different S-clock indications *relative to s*—which are supposed to be due to only a constant phase difference—is also paradoxically alleged to represent a sequential time interval in S from the point of view of s. Such alleged "appearances" beg the question of a logical contradiction of the very meaning of a coordinate transformation. The vexing mischief caused by such unsubstantiated assertions of the mistaken concept of the "relativity of simultaneity" has been considered in detail elsewhere.[12]

CONCLUSIONS

The essential concept for both the induction and the deduction of the relative speed of light (19b), based on the isotropy and homogeneity of space, was the demonstration of a discrete spectrum of temporal events of simultaneous identical indications on the s-clock and the S-clock. These simultaneous identical clock indications, typically expressed in (11a), were obtained independently of and before the determination of the speed of light emitted from a uniformly translating source.

The Lorentz transformation for time (13) does actually predict the simultaneities (11a) while at the same time contradicting relative motion; the Lorentz transformations are valid only if there is *no* motion, under which trivial static circumstance simultaneity is *not* denied. The coordinates of the translating origin of S relative to s are (x_2,t_2) and (x_3,t_3), etc. corresponding to $(0,T_1)$ and $(0,T_2)$, etc. respectively. It follows from (13), since $x_2 = vt_2$, that

$$T_1 = d(t_2 - vx_2/c^2) = t_2/d. \qquad (26a)$$

The Einstein absolutivity postulate, on which the Lorentz transformations have been shown to depend, means that $\beta' = \beta$ in (2a) and (2b), so that $t_1t_3 = (t_2/d)^2$, and therefore (26a) does lead to $T_1{}^2 = t_1t_3$, as in (11a). $T_1^2 = T_1T_2(1 - \beta)$, since $T_1 = T_2(1 - \beta)$, as given by (3a) with $B = \beta$; in addition, $t_1t_3 = t_2t_3(1 - \beta)$, since $t_1 = t_2(1 - \beta)$ as given by (1a); the Lorentz transformation for time (26a) also leads to $T_1T_2 = t_2t_3$ as in (11b). It follows from (13), since $x_3 = vt_3$, that

$$T_2 = d(t_3 - vx_3/c^3) = t_3/d, \qquad (26b)$$

which together with (26a) means that $T_1T_2 = t_2t_3$ only if $d^2 = 1/(1 - v^2/c^2) = 1$, so that the symbol v in the Lorentz transformations is identically zero since $c \neq \infty$.

The Lorentz transformations are incompatible with a kinematic condition of uniform translatory motion. The speed of light is "absolute" only if there is *no* relative motion. It is for this reason that the postulate of the absolute speed of light is immediately irreconcilable with a statement involving relative motion.

The chimera of the Lorentz transformations is first that mathematical covariance under them has no physical consequence, and second that they are erroneously accepted as kinematically valid for uniform relative translation when in actuality they can only deal with the trivial and uninteresting state of rest in statics, rather than the state of motion in kinematics. The deception inherent in the Lorentz transformations has been hidden due to the failure to recognize that the symbol v for speed that appears in them is identically zero. The situation brings to mind the fable about the emperor with invisible clothing of infinitesimally fine gold thread.

APPENDIX

The Einstein "addition" theorem for parallel velocities can be derived from the Einstein-Doppler expression for the case in which the velocity of the light is parallel to the relative velocity of the source and the receiver.

Consider two coordinate systems S' and S'' which recede uniformly and rectilinearly with the respective scalar speeds v and u $(u > v)$ relative to a "stationary" system S. The system S'' is always assumed here to be further away from S than is S'. The speed of recession w of S' relative to S'' is given by the Einstein "addition" theorem as

$$w = (u - v)/(1 - uv/c^2). \tag{27}$$

The emission of light of wavelength λ from a source at rest in S will be received at S' and S'' as the respective Doppler shifted wavelengths

$$\lambda' = \lambda \sqrt{(1 + v/c)/(1 - v/c)}, \tag{28a}$$

and

$$\lambda'' = \lambda \sqrt{(1 + u/c)/(1 - u/c)}. \tag{28b}$$

The Doppler shifted wavelength λ' of the light received at S' from S will, on re-emission from S' toward S'', be received at S'' as the Doppler shifted wavelength

$$\lambda'' = \lambda' \sqrt{(1 + w/c)/(1 - w/c)}. \tag{28c}$$

Eliminating λ between (28a) and (28b) leads together with (28c) to the Einstein "addition" theorem (27). If either S' or S'' approaches S, the Doppler formula for approaching motion (reciprocal to that for recession) will lead to (27) with plus signs instead of minus signs for the relative speed w of approach between S' and S''. If *both* S' and S'' approach S, then (27) is again obtained for the relative speed w of *approach* between S' and S'' because u was assumed greater than v and S'' was assumed more distant from S than is S'.

Pauli's[13] assertion that the Doppler effect "has nothing to do with the addition theorem for velocities" is therefore incorrect. Experimentally, the Einstein "addition" theorem is contradicted; instead, confirmation will be shown in Chap. 5 for the classical composition of velocities.

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