On the Reality of "Now" at a Distance; Answer to Abbé Lucien

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ABSTRACT. In answering a criticism by B. Lucien, we concentrate on discussing the concept "now at a distance" in connection with Special Relativity. Giving a prototypical example, we prove that, in order to maintain physical consistency in agreement with our observations "*here and now*", it is unavoidable to also accept the reality of specific events *at a distance at specific times in our inertial system.*

RESUME. En réponse à une critique de B. Lucien, nous nous concentrons sur la discussion du concept "maintenant à distance" en relation avec la relativité restreinte. En donnant un exemple type, nous montrons que pour maintenir une cohérence physique en accord avec nos observations "ici et maintenant", *il est inévitable d'accepter aussi la réalité d'événements déterminés* à distance à des instants déterminés, dans notre système d'inertie.

1. The essence of the problem

In order to keep this answer to Abbé Lucien's criticism [1] short, I concentrate on the main point of difference, viz. on the question "How real is the back end of an arrow D for an observer O on or with D's point, at the time 'now' of O's inertial system ?". Mind that for the coincident observers C and W of my criticized paper [2] (see pp. 143-144) events I and III were "appearing now", simultaneously with event II, respectively. Because III happens in I's absolute future, I concluded that C's future –viz. III– is already legitimate, realistic, present for W beside C and, therefore, has to exist "already". Abbé Lucien posits that "now at a distance" in an observer's inertial system does not make

sufficiently sense for considering it to be really existing now, that is, as really as I am existing myself now and here.

2. Prototypical example : the sun really has to exist now at a distance for both of two mutually moving observers on earth in order that both find the velocity of light to be c

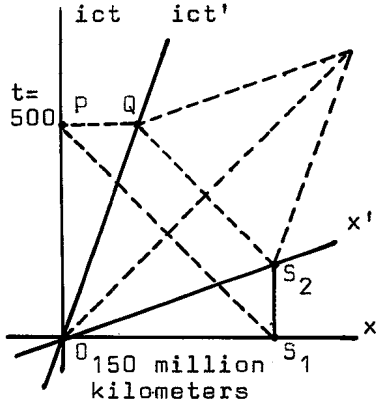

Figure 1. The inertial systems $(x, 0, t)$ and $(x', 0, t')$ of W and C, respectively.

Suppose two observers W and C –to be compared with W and C of Ref. 2– are at 0 on the earth. (See Fig. 1). W is at rest in inertial system $(x, 0, t)$ of the earth and C moves with $(x', 0, t')$. W looks at his watch at $t = 0$; he says : "The sun at S_1 *now* emits the light I shall receive at $t = 500$". At receiving such light (or a special signal S) at point-event P he correctly says : "S has really been emitted by (an instrument on) the sun at point-event S_1 when I saw $t = 0$ on my watch, in order that it could reach me now, because the distance of 150 million km takes 500 sec to be covered by a signal travelling at velocity 300,000 km/s". Now the crucial point is : given the distance sun - earth = 150 million km, the (instrument on the) sun *must very realistically have emitted S at my $t = 0$ in order to "deliver" S at P at my (W's) $t = 500$, because $c = 300,000 km/s$ for me.* So the sun (the instrument) really did exist at S_1 at my $t = 0$, for it even performed an afterwards verifiable act there and then, viz. it emitted S, which cannot but imply its real existence at my $t = 0$. We can only escape from such conclusion by denying that S covers 300,000 km/s. If, in particular, it were not really simultaneously

with my ($W's$) passing 0 at my $t = 0$ that the sun at S_1 emitted S, *how could the emission then have been 500 seconds ago when I absorb* S *at* P *at* $t = 500$? Still, those 500 sec are inescapable because any other number would produce an inconsistency: S, at velocity 300,000 km/s, would not really have been 500 sec on its way to me at P from the sun, that is, in covering 150 million km. Then, our relativistic spacetime picture of Fig. 1 would no longer be consistent, and elementary logic would be violated.

After passing W at 0 in the direction of the sun, observer C can argue similarly in connection with his observation at Q of a light signal S' emitted by (an instrument on) the sun at S_2. Viz. : "Just at the same moment at which I looked at my watch at 0, the sun, then being at S_2, emitted S' that I receive now". Again, any other emission event and emission time than those corresponding to S_2 and appearing "now" for C at his passing 0, would contradict the fact that the worldline of S' is S_2Q, that is, the fact that S' covers 300,000 km/s. Again, C has to admit that the emission of S' "now at a distance at S_2 when I (C) was at 0" was a *very realistic phenomenon that had to occur in its then-present, not earlier or later*, in order to deliver S' in time, viz. at Q. Of course, the sun at S_2 has to exist very really for C at 0, for at that very common moment $t' = 0$ in $(x', 0, t')$ the sun *did something very realistic*, viz. it emitted S', an act indispensable for the absorption-event at Q. If the sun did not realistically perform the emission of S' "now", at $t' = 0$, for C at 0, but at some $t' \neq 0$, S' would not arrive in time at Q, given its velocity c.

The conclusion is that "now at a distance" *is as real as the light signals* S *and* S' *produced "now at a distance"*, signals that we can observe later. A consistent relativistic picture of the world as indicated by Fig. 1, with a velocity of light c for all observers, cannot be maintained if we posit –as Abbé Lucien does– that S_1 and S_2 do not have to be taken very seriously as present at a distance for W and C at 0, respectively. Both are as real now for their respective observers W and C at 0 as is the departure from Tokyo of the airplane, now for me, that will bring my friend to Amsterdam in ten hours. If its departure is not realistically happening now, its scheduled arrival in ten hours will not happen, either. It is not different for light, in all inertial systems similarly because of special relativity. We simply cannot maintain a consistent model of the world, of natural laws and velocities, *here and now* if we deny the reality of *now at a distance* as indicated by Fig. 1. For various distant

processes have to appear *at very specific times on my clock*, at "recognizable nows", in order to have certain verifiable effects later, here and now, such as the arrivals of S and S' above.

A final remark about the hypotheses H1) and H2) Abbé Lucien compares. I indeed argue in agreement with H2). The sentence "Because R is not shortened for W, he sees back-end A and front-end C simultaneously pass..." has to be read as "...he *knows* back-end A and front-end C simultaneously to pass..." Of course he *sees* the A passage with a retardation. My intention is clear from the context ; Abbé Lucien understood it, too, as appears from his remark following H2). In Ref. 2 I gave my argument only rather concisely ; it is stated more extensively in Refs. 1, 2 and 6 mentioned in Ref. 2.

References

[1] Abbé B. Lucien, *A.F.L.B.* **14**, 461-467 (1989).
[2] C.W. Rietdijk, *A.F.L.B.* **13**, 141-182 (1988).

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