

"GOOD, CLEAN FUN"

After reading your September editorial on c.b. radio I wonder if it is to be future policy of *Wireless World* to provide free publicity for any other type of illegal activity, provided only of course that its supporters claim their number are such as to render legislation imperative.

I would be happy to provide details of several groups of people at present operating outside of the law who would welcome the support of a long established periodical in order to have their activities legalised. Each of these groups, I am sure, would claim equal ability at least with the c.b. pirates, to meet the qualificatory standards apparently acceptable to *Wireless World*.

I am not particularly opposed to c.b. I am opposed however to modification of law by blatant disregard for it. Presumably it should not be too difficult in the near future to secure abolition, for instance, of the driving test, assuming a handful of people can obtain sufficient publicity for their "freedom of the road" philosophy. There is no difference of principle; it is merely a question of degree. Good clean, fun, in fact!

Your (unintended, I am sure) equation of c.b. with some of the current tv programmes may well be apt. But your contention that many megahertz of airspace are occupied by trash, as you call it, as justification for an extension of the situation, is surely as specious as your statement that an argument based on the necessity to legalize the activities of lawbreakers "does carry a certain force."

If your editorial is a representative sample of the calibre of the arguments being advanced in support of c.b., I find "the Home Office's blank and uncomprehending disapproval" not in the least surprising.

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RELATIVITY AND TIME SIGNALS

The letter of mine on this topic in the September issue was written quickly on holiday and withdrawn from publication equally quickly when I returned to my textbooks, because it contains an elementary error. However, because Murphy's Law intervened and it was published anyway* I feel bound to try again.

First, let me say that the relativistic part of the frequency (or time) correction for a moving square, unlike the classical Doppler part, of course, contains no angular term and is therefore independent of the direction of the source's motion relative to any observer.

Unfortunately for Dr Essen's critics this correction must be applied symmetrically to the observations of all observers in order to preserve the strict equivalence of their measurements of the velocity of light, c . To illustrate this, I will borrow Prof Fremlin's example (Letters, April 1979) of a "Traveller" between Earth and Sirius (12 light years away) at a velocity $v = 0.9999905 c$ relative to Earth. His discussion of this example is correct up to the end of the paragraph containing the reference to the footnote. However, in the footnote, distance in the moving universe seen by Traveller is

* Apologies to Dr Morris and to readers for this mistake — Ed.



given as 12×0.0044 light-years, whereas light-years are invariant under the Lorentz transformation. (This is so because the light-year is a statement of the velocity of light, as distance per year.) If Traveller really saw his own clock showing only 19 days for the journey to Sirius he would know that something was very wrong without having to look out of the window at the foreshortened universe. All his velocity measurements inside his, to him, apparently normal-length space-ship would be wrong, including the local value of c . It would take him 0.0044 of the usual time to boil a kettle or walk the length of the cabin, for example.

His clock appears slowed by this factor only to observers at rest relative to the Earth, so that the velocity of light can remain correct as measured inside his (to them) foreshortened space-ship: $c = (d \times 0.0044) / (t \times 0.0044)$, where d and t are corresponding distance and time intervals in rest co-ordinates. Similarly, when he looks out at the shrunken universe he will conclude that the clocks out there are slow by the appropriate factor to preserve the value of c in moving co-ordinates. His own clock will be running suitably to give the same numerical value of c inside the vessel and in co-ordinates fixed relative to it, and moreover, giving a journey time of 12 years 1 hour each way!

It is not too hard for us to accept that Traveller's volume, and even, superficially, his absolute temperature only appear to be reduced by the factor $\sqrt{1 - v^2/c^2}$ during his journey and no-one would contend that his reading of our apparent ambient temperature of about 1.3 K represented any kind of reality for us. If it did, we would certainly not get much older. The difficulty lies in the time-dimension effect, which to our intuition is not so easily reversible as are steady-state parameters like length and temperature; when ticks, heartbeats, atomic vibrations and decay events of elementary particles have been lost, they cannot be so readily restored. (The relativistic effect on apparent temperature is in fact a consequence of the apparent time dilation, and so similarly represents "missing" vibrations.)

Relativistic corrections for apparent mass, length and time scales of high-energy elementary particles are certainly in everyday use in many fields: in conjunction with Maxwell's equations they "work" to the ultimate limits of measurement. However, this only proves the internal self-consistency of a scheme which was, after all, devised in its numerical form by Lorentz for the very purpose of saving Maxwell's equations from the consequences of an undetectable "ether".

The unexplained "missing ticks" effect, as pointed out by Dr Essen (October 1978 issue), is clearly intrinsic to the Special Theory of Relativity. This fact is at variance with our notions of the nature of "events" and their countability.

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DISPLACEMENT CURRENT

Professor Bell's article "No radio without displacement current" in the August issue raises so many issues it is difficult to know where to start. Rather than deal with the details, I will start with a consideration of the purpose of the article. The title of the article makes this clear; it is an attempt to defend Maxwell's theory against recent criticisms with particular reference to displacement current.

I understand that Aristotelians believed that a force was necessary to keep bodies in motion and that, in the absence of this force, the motion would cease. This theory led them into certain difficulties. For instance a spear, once thrown, appeared to continue to move without a force being present. The philosophers rose to this challenge magnificently with a theory that air, displaced from ahead of the spear, rushed to the rear and generated the requisite force — the theory was saved. Unfortunately they missed the simple point first noted by Newton, that it is in the nature of a moving body to continue to move.

In the same way I fear that Maxwell invented a complex explanation for a very simple phenomenon, ie that electromagnetic radiation, or energy current, moves at the speed of light — and that's all, because that is what energy current does. No mechanism invoking E producing H and H , in return, producing E is required. As for the details of Bell's article — they do not stand up well to close examination.

In the first place, it is unwarranted to suggest, as Bell does, that since Maxwell introduces the idea of displacement current early in his treatise (the correct title, incidentally, is "A treatise on electricity and magnetism" and Bell appears to be referring to the third edition first published in 1891), this is a proof that he thought of it in connection with simple phenomena. This is just too simplistic; the way Maxwell presents his ideas cannot be taken as a guide to how he thought of them. Much has been written and many papers have been published on the genesis of Maxwell's thought and it is inadmissible for Bell to treat the subject in this superficial way. I would be happy to provide a list of references (about 20) to anyone who would like to study the development of Maxwell's thinking in detail. I suggest Joan Bromberg's paper¹ as a good start to the subject.

There are many errors of detail in the article. Perhaps I could draw attention in particular to the statement that "Maxwell... was at home with vectors." Vector algebra was not invented in Maxwell's time and he never used it. He made some use of Quaternionic formulation of his equations but was not consistent in its use — Maxwell, in fact, never formulated his theory in terms of four equations — this was left to Heaviside who also introduced vector calculus more or less as we know it.