ABC of Relativity

B.Russell

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It was written in the early twenties based on earlier newspaper articles and intended to earn the author some (desperately needed?) money. Nevertheless it was hailed as a masterpiece at its time. It came out in subsequent editions late in Russells life (with the collaboration of an unknown physicist) and even a post-humous one. This is confusing. The book is mainly intertesting as a historical document and as a testimony to the personal grasp of Russell, as far as a popular introduction it is bound to have been superseeded by many abler works. Thus to the modern reader it is confusing to see references to things that may not have been knoiwn during Russells lifetime and certainly was never known at the time of the writing.

But is the book really so great? Russell intendss to give the reader an inkling of relativity theory without any mathematics by relying on suggestive metaphores (the standard way of any popularizer.). This is hard, maybe impossible, and of course Russell does allow himself numerical examples and even some formulas, although he stays shy of writing down the Lorenz transformations, which is sad, at least he could have supplied an appendix. The interesting question to the student of Russell is exactly how much mathematics he understood and mastered. He, who had taken in his philosophical work such high ground having claimed to have reduced mathematics to logic and to have disclosed its ultimate nature as just a sequence of tautologies, each of which makes no sense. I suspect that Russells mastery of mathematics was far less than he would have liked to acknowledge, even to himself. How convenient is it not for him to claim over and over again in the book that this and that would require more mathematics than he has permitted himself to employ. He refers to tensors several times, as a kind of mantra, making you suspect that those gave him insurmountable troubles. In fact I doubt very much that he had penetrated the mathematical part of the theory himself (especially not those pertaining to general relativity), probably he had just seen it ultimately as technicalities, (and vaguely caught the notion of tensors as somehow being crucial) which he had no desire to penetrate, obviously because of impatience, having more interesting things to do, rather than out of sheer incompetence. But of course I am just speculating.

Russell does of course get a few subtle points and gets them across as well. Such that the greatness of Einstein consisted in his logico-physical thinking, making the transformations supplied by Lorentz, come out as inevitable consequences of some transcendent principles, not just as the result of some formal make-shift fudging. (And Borel in his lectures and article on Einstein and Poincaré, makes the same point.). Furthermore he has no truck with the so called Twin-paradox, noting that there is no necessary symmetry involved, that two people crossing twice in life, cannot both follow geodesics. (And also that following a geodesic maximizes time, just as Penrose notes in his recent book[1]). He

[1] The road to reality

also makes the obvious, but easily overlooked point, that special relativity forces us to reconsider Newtons gravitation, based as the latter is not only on instantaneous effect but also on (absolute) distances. In the necessary generalization to include masses the notion of gravitational force disappears, there is simply no action at a distance, planets do not experience a tug by the sun, they are just following paths of least resistance (Russell mumbles something about minimizing action, that mysterious quantity of energy times time). This discussion ties in quite nicely with Humes suspicion of cause and effect, and it is clearly, and not surprisingly, in the philosophical approach that Russell proves his mettle.

Russell makes two important points both relating to the confusion as to the theory manifested by many intellectuals. One that relativity theory is not about relativity in any metaphysical sense (if everything would be relative, the notion of relative would have no sense as he points out sarcastically), it is more about invariance than relativity, such as the permanence of physical laws among frames in uniform motion relative to each other, including the speed of light. Relativity theory is very much the theory of the absolute, only that this notion cannot be applied to space and time separately only to their conjunction. (Yes, he talks about the 'interval' of such being either positive and negative, time or space like.). Secondly, what eventually is a physical theory? How much of it is just pure abstract mathematical reasoning, in which we impose that there are three feet to a yard[2]? How much of it is 'geography' (the more or less accidental facts of our actual existence, such as the specific lumpings of matter that make out our solid everyday world)? Russell stares intently and comes away with a feeling of unsubstantiality. Is the world a creation of our will? He naturally shies away from such an extreme conclusion, noting that we know much less of the physical world than we think, as much of our cherished notions such as 'force' being but human conventions with no intrinsic meaning; yet he rightly points out that it is a miracle both that we know as much as we do and the amount of power that little we actually endows us with. (He notes that in society those with abstract knowledge usually have more power than those of concrete. The capitalist does not need to know the difference, between wool and cotton, he is just concered with the future development of their prices.)

Russell claims that it is hard for old men like himself to appropriate relativity, but much easier for the upcoming generations. Is this true? I doubt it very much. People in general have no real feeling for relativity, in spite of all those pedagogical tales of running trains, thunder and lighting and station-masters staring at their chronometers, with which enthusiastic popularizers have soiced up their explanations with. The working physicist has of course a working knowledge and intimacy with the concepts, at least what you cannot really understand you can get used to, something that supposedly also characterizes the everyday of most mathematicians. Of course there are well-known analogies to relativity theory that are taken for granted by everyone. I am speaking about perspective. Our visual world is not 3-dimensional, it is essentially two-dimensional [3] projected onto our visual field. The world of our visual field is constantly changing, lengths change and so

[2] This is typical Russell, dismissing mathematics as ultimately carrying no more meaning than such conventions.

[3] I write essentially because there is the phenomenon of stereoscopic vision with which we are endowed, and gives to our theoretical understanding a tangible touch

do angles, and what is small to me might be big to you, and that is no source of wonder at all[4], as we somehow are able to construct an underlying 3-dimensional reality in which what is supposedly varying and shifting is in fact solid and invariant. What more beautiful illustration of the Platonic principle! Relativity is in principle the same. An underlying 4-dimensional space-time continuum with its various projections onto 3-dimensional space (and running time). This is I think the philosophical (and pedagogical) tack to take in order to present the philosophical aspects of the theory, and to sap some of the surrounding mystery, in which it is unnecessarily wrapped.

Canberra, November 11,2008 **Ulf Persson:** *Prof.em, Chalmers U.of Tech., Göteborg Sweden* ulfp@chalmers.se

[4] And of course it is a consequence purely of a particular point of view, not the subjective interpreter of the observation. The problem of the congruity of the sensory observation is an entirely different, and far more intractable problem of philosophy.