Comments on C2: HISTORY OF PHYSICS AS A TOOL FOR TEACHING (*Igal Galili)*

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This paper advocates for an enlarged view of the goal we should ascribe to physics teaching, that is: teaching physics as a culture. This "discipline-culture paradigm", very clearly defined, is, in my understanding of the paper, justified in itself, this in terms of "cultural validity of their (the students') physics education". This plea is backed up with a schematic representation of the structure of a fundamental discipline in physics, which makes ample room to history of physics. This structure in turn allows an interesting representation of the principle of correspondence between two fundamental disciplines in physics. The author convincingly argues that, with this model, students might better avoid "imaging the progress as a gradual advancement" as well as seeing history of science as "a series of theories in which every next link refutes the previous one".

Adopting such an enlarged view – *per se* - is a decision that can be hardly criticised. However, in order to better justify his position, the author comments on the teaching *efficiency* of using history of science concerning both concepts and the nature of physics as a scientific activity. Again, it is hardly deniable that history of physics can help understand the nature of research activity in physics.

More debatable is the question of using history of science as a guide to help students understand "the *critical points* of physics knowledge, usually difficult for the learner".

There are, indeed, counterexamples. When it became clear, in the 70^{s}, that many students tend to answer some questions as if Force and Velocity where co-linear and their magnitudes in a quasi-linear relationship, many adepts of recapitulation hypothesis commented that this was to be paralleled with Aristotle's theory. This occurred although it was underlined very soon[1] that students' views were much closer to pre-galilean impetus than to Aristotle's theory. This is not only an academic debate as the author rightly underlines that a historical reference may guide our teaching strategies. This means that an inappropriate reference may induce us into endpoints, as argued as soon as 1983[2]. Such misleading parallelisms may occur when a single common aspect (e.g. a linear relationship) is seen as sufficient to establish a deep similarity, whereas it may constitute only a partial, if not superficial, coincidence. Moreover, it is worth noting that history of science lends itself to misunderstandings or reductive analyses. For instance, speaking of pre-galilean impetus should be done

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[1] Viennot, L. 1979 (note 22 in Galili's paper).
Lithott, J. 1983. Aristotle was the question, what was the answer? Proceedings of the *International Seminar in Science and Mathematics*, Cornell University, Ithaca, pp 257-265.
See also (in French): Viennot, L. 1979, Le raisonnement spontané en dynamique élémentaire, chap. VII, Hermann, Paris.

[2] Viennot, L. 1983. Natural tendencies in analysing students' reasoning: two instances in mechanics. Proceedings of the *First International Seminar in Science and Mathematics*, Cornell University, Ithaca, pp 239-244.
Viennot, L. 1985. Analysing students' reasoning: tendencies in interpretation, *American Journal of Physics* , 53 (5), pp. 432-436.
Saltiel E., Viennot L. 1985. Que aprendemos de las semejansas entre las ideas historicas y el razonamiento de los estudiantes? *Ensenanza de las Ciencias*, n°3 (2), pp. 137-144.

cautiously, given the number of different versions of these theories, including the quasi Aristotelian "circular impetus" that blocked Galileo for a time in its way toward the classical description.

These reservations made, there are also – besides Galili's example - convincing examples of strategies that are strongly grounded in history of science, in particular concerning optics and vision. As mentioned by Galili, Al Hazen is a very inspiring scientist in this respect. Among the authors that worked in this line[3], de Hosson[4] stressed the fact that Al Hazen introduced the crucial notion of quantity of light in the debate about vision, a notion that she chose as a pivot for her teaching sequence, with convincing results. Her work is also an example of how to use documents that are built for teaching purposes, kind of quasi-historical sources more accessible to young pupils. It is not so obvious, indeed, to decide how to stage historical documents for a given public and for a cautiously selected partial goal.

In conclusion to this brief comment, I simply stress the need, while considering positively Galili's plea, not to forget a *caveat* about simplistic "recapitulation" approaches. The need for a cautious use and staging of historical sources, also recalled in my comment, should not appear as discouraging: some good examples are there and support in particular one of Galili's claims: using history of science in teaching may raise very positive feelings in students.

[3] See in particular M. Gagliardi, E. Giordano, M. Recchi (2006). "Un sitio web para la aproximación fenomenológica de la enseñanza de la luz y la visión". In: Ensenanza de las ciencias, vol. 24, pp. 139-146.

Osuna, L. Y Martinez-Torregrosa J. (2001). Planificación de una unidad didáctica sobre "la luz y la visión": análisis de las barreras históricas y de su relevancia para la enseñanza. *Enseñanza de las Ciencias*. Número Extra, VI Congreso. 219-220.

[4] De Hosson, C. & Kaminski W. (2007). Historical controversy as an educational tool. Evaluating elements of a teaching-learning sequence conducted with the "dialogue on the way that vision operates". *International Journal of Science Education*, 20 [2].