# JOHN STACHEL

# **PROBLEMS NOT DISCIPLINES\***

One of my goals... is to try and develop a vocabulary for talking about human projects that does not imply that the outcome of such a project is foreordained by "objective reality," on the one hand; nor, on the other, that "anything goes" – that there are no objective constraints on such projects (Stachel 1994, p. 140).

11 In spite of many rumors to the contrary, I am not now and never have been a 12 "historian of science"- indeed, I am opposed to the definition of any human being 13 by discipline or profession.<sup>1</sup> So I find it difficult to respond to the editors' request 14 to comment on the current state of, and future prospects for, the history of science.<sup>2</sup> 15 But, wishing to honor a dear friend and colleague within the parameters set by the 16 editors, I shall attempt to explain briefly how I view my own work, in the hope 17 that such an account may prove instructive to others- if only as another example of 18 human folly.<sup>3</sup> In order to avoid excessive repetition of the "I" word, I shall formulate 19 my general comments in an impersonal mode and then give some examples of my 20 own concerns. 21

Scholarly work should focus on some problem (or problem complex) as its object of inquiry, and follow this problem wherever it leads. There are two sides to this injunction: the problem and the person (or persons– for brevity the plural will be

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<sup>\*</sup> Dedicated, with great affection and admiration, to Sam Schweber, whose concerns for the future of science and of humanity provide an example for and an inspiration to many of us<sup>4</sup>.

<sup>27</sup> I am enough of an Emersonian to heed his voice in "The American Scholar," with the caveat that 1 28 his use of "man" should be taken as embracing woman: "Man is not a farmer, or a professor, or an engineer, but he is all. Man is priest, and scholar, and statesman, and producer, and soldier. In 29 the divided or social state, these functions are parceled out to individuals, each of whom aims to 30 do his stint of the joint work, whilst each other performs his.... But unfortunately, this original 31 unit, this fountain of power, has been so distributed to multitudes, has been so minutely subdivided 32 and peddled out, that it is spilled into drops, and cannot be gathered. The state of society is 33 one in which the members have suffered amputation from the trunk, and strut about so many walking monsters, — a good finger, a neck, a stomach, an elbow, but never a man. Man is thus 34 metamorphosed into a thing, into many things.... In this distribution of functions, the scholar is the 35 delegated intellect. In the right state, he is, Man Thinking. In the degenerate state, when the victim 36 of society, he tends to become a mere thinker, or, still worse, the parrot of other men's thinking" 37 (Emerson 1837).

I would have liked to contribute a piece entitled "Marx on Measure" (Stachel 2004a), attempting
 to apply some concepts developed in Karl Marx's analysis of the measure of value to the analysis
 of the measure of various physical quantities.

<sup>&</sup>lt;sup>41</sup> 3 I believe it was Einstein who observed that the only way to really teach is by example, good example if possible, but if not....

 <sup>42 4</sup> See the "Preface" to Schweber 2000, pp. ix-xvi, for a brief autobiography, and the entire book for
 43 an example of his moral approach to science.

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omitted hereafter) formulating and working on it. The talents and past experience of 01 the person undoubtedly shape the initial formulation of the problem, if it is original; 02 or the choice of a particular problem, and its interpretation, if it is one that already 03 has been formulated. The interaction between person and problem will then shape 04 the course of further work. Shape, but not determine, since at various stages of any 05 such project choices constantly will have to be made between alternatives, many 06 of which might be followed.<sup>5</sup> Both person and problem are reshaped by any such 07 work if the choices made are at all fruitful. 08

Any production process is based upon some form of labor exerted upon the object 09 of labor ("raw materials") with suitable instruments of labor ("tools").<sup>6</sup> Purposeful 10 intellectual labor on some problem, its object, has been mentioned already; so it 11 remains to discuss the instruments of intellectual labor. Here is where the various 12 disciplines enter the story: they provide the intellectual laborer with tools to apply 13 to the problem at hand.<sup>7</sup> Again, personal history plays a great part in determining 14 just what tools are readily available to the laborer; or, if initially lacking but 15 found necessary in the course of the work, may be brought to hand with more or 16 17 less facility. In short, rather than viewing disciplines as activities to be pursued separately for their own sake, each with established boundaries to be transgressed 18 only at one's peril, the disciplines are best regarded as providing tools that often 19 must be used conjointly. Many problems clearly transcend disciplinary boundaries 20 at the time of their formulation; and often work on a problem that arose initially 21 within the confines of a single discipline leads outside that discipline to results of 22 importance to others.8 23

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 <sup>&</sup>lt;sup>26</sup> 5 Hegel writes: "Die Bestimmtheit ist die Negation als affirmative gesetzt, ist der Satz des Spinoza: <sup>27</sup> Omnis determinatio est negatio. Dieser Satz ist von unendlicher Wichtigkeit" (Hegel 1990, p. 107).
 <sup>28</sup> ["Determinateness is negation posited as affirmive and is the proposition of Spinoza: omnis determinatio est negatio. This proposition is of infinite importance"(Hegel 1969, p. 113), translation <sup>29</sup> modified] I thank my colleague Aaron Garrett for pointing out that Hegel here slightly misquotes <sup>30</sup> Spinoza.

 <sup>&</sup>lt;sup>35</sup> 7 These tools may be conceptual, such as mathematical techniques or scientific theories; or material,
 <sup>34</sup> such as experimental apparatus and laboratory notebooks. Even the use of conceptual tools will
 <sup>35</sup> usually involve a material aspect: textbooks and journal articles, pen and paper, calculator, computer,
 <sup>36</sup> etc.

 <sup>8</sup> Indeed, this is the main problem with Mihaly Czikszentmihalyi's otherwise brilliant analysis of creativity:
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We cannot study creativity by isolating individuals and their works from the social and historical milieu in which their actions are carried out. This is because what we call creative is never the result of individual action alone; it is the product of three main shaping forces: a set of social institutions, or field, that selects from the variations produced by individuals those that are worth preserving; a stable cultural domain that will preserve and transmit the selected new ideas or forms to the following generations;

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In my case, the tools that come most readily to hand are found in parts of the 01 disciplines of theoretical physics, history of science, philosophy of science, and 02 in a Marxist outlook on social problems. The main example of transcendence of 03 disciplinary boundaries in my work has been work on Einstein's "hole argument."9 04 This arose from the attempt to answer a problem in the history of general relativity: 05 Why did it take over two years from the time that Albert Einstein first realized 06 the need to use introduce a metric tensor as the mathematical representation of the 07 potential for the gravitational-cum-inertial field until he adopted the final formu-08 lation of the field equations obeyed by this tensor field? Finding the answer to this 09 historical problem led me to some important conclusions about the physical inter-10 pretation of general covariance,<sup>10</sup> conclusions that have had important bearings on 11 the still-unsolved problem of formulating a quantum theory of gravitation;<sup>11</sup> and to 12 some important conclusions, and further questions, about such philosophical issues 13 as the nature and origins of individuality and the distinction between internal and 14 external relations.12 15

At first sight, it might seem that my Marxist outlook played no role in work on this problem, but it did. Stress on the historical aspects of questions such as this led me to emphasize the importance of the historical sciences; and Marx's emphasis on the element of intention in all human activity<sup>13</sup> led me to eschew deterministic narratives (see the epigraph).<sup>14</sup> Indeed, I found fruitful the idea of developing alternate historical narratives in order to show that things need not have

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and finally the individual, who brings about some change in the domain, a change that the field will consider to be creative (Czikszentmihalyi 1988).

Indeed, the field and domain act upon the individual's contribution; but the effects of such contributions may also transcend an individual domain and lead to fruitful interactions between several domains, or even to the creation of a new ones.

<sup>&</sup>lt;sup>28</sup> 9 See Stachel 1989, reprinted in Stachel 2002, pp. 301-337.

<sup>29 10</sup> See Stachel 1993 and references therein to earlier work.

<sup>30 11</sup> See Stachel 2006

<sup>12</sup> See Stachel 2006

<sup>31</sup> 13 "Wir unterstellen die Arbeit in einer Form, worin sie dem Menschen ausschließlich angehört. Eine 32 Spinne verrichtet Operationen, die denen der Weber ähneln, und eine Biene schämt durch den Bau 33 ihrer Wachszellen manchen menschlichen Baumeister. Was aber von vornherein den schlechtesten Baumeister vor der besten Biene auszeichnet, ist, daß er die Zelle in seinem Kopf gebaut hat, bevor 34 er sie in Wachs baut" (Marx 1974, p. 193). ["We ascribe to labor a form, which belongs exclusively 35 to humanity. A spider conducts operations which resemble those of a weaver, and a bee would 36 put many a human architect to shame by the construction of its honeycomb cells. But what at the 37 outset distinguishes the worst of architects from the best of bees is that the architect builds the cell 38 in his mind before he constructs it in wax" (Marx 1976, p. 284, translation modified)] Again, I have taken my inspiration from Karl Marx's dictum: "Die Menschen machen ihre eigene 14 39 Geschichte, aber sie machen sie nicht aus freien Stücken, nicht unter selbstgewählten, sondern 40 unter unmittelbar vorgefundenen, gegebenen und überlieferten Umständen" (Marx and Engels 1973,

 <sup>&</sup>lt;sup>41</sup> p. 115). ["Men make their own history, but they do not make it just as they please; they do not make it under circumstances chosen by themselves, but under circumstances directly encountered,

<sup>43</sup> given and transmitted from the past" (Marx [1852] 1979, p. 103)].

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happened just as they did. On the other hand, I do not believe that "anything goes,"
 i.e., that all such narratives are equally plausible or probable.<sup>15</sup>

To conclude, let me mention two problems that seem to me of great current 03 importance, one theoretical and one social. The theoretical problem- or rather 04 complex of problems- in theoretical physics that seems most compelling at the 05 moment goes under the name "quantum gravity." Here, my personal equation plays 06 a large role in the choice of this problem. I can well understand that others with a 07 different background will pick a different problem; just as I understand that those 08 who agree with me on the significance of the problem will, based on their differing 09 backgrounds, disagree on the best tools to be used in the attempt to solve it. 10

The social problem that seems most compelling in this epoch is how resistance to the global onslaught of capital on world-wide labor standards,<sup>16</sup> commonly known as "globalization," can best be organized; and whether and how such organized resistance might ultimately be turned into a challenge to the dominion of capital.<sup>17</sup> I think the problem itself compels– or will ultimately compel– attention from all persons concerned with the survival of humanity.

It might seem that here the tools that I bring to bear from the natural sciences are not of much relevance, but again this is incorrect. Since so much of contemporary society is built upon the basis of the application of modern science to capitalist industry, it is important to understand the development of modern science within the framework of capitalism if one is to formulate effective policies to combat the encroachment of capital on all forms of modern life.<sup>18</sup>

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<sup>15</sup> See Stachel 1994. For an example of some alternate scenarios for the development of general relativity with different degrees of probability, see Stachel 2007.

Again inspired by Marx, I understand labor as it functions in the modern process of production;
 that is, in the sense of collective labor, which includes intellectual as well as manual labor. Many
 people who consider themselves middle class, and have been led to see their interests as entirely
 distinct from- and even opposed to- those of manual laborers, belong to the working class. See
 Stachel 1995.

<sup>&</sup>lt;sup>42</sup> 17 See Stachel 1995, 1998.

<sup>43 18</sup> For some hints in this direction, see Stachel 2003, Stachel 2004b.

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