

# Theoretical Challenges for the Current Sociology of Science and Technology: A Prospect for Its Future Development

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## 1 Introduction

This paper will sketch what the author regards as theoretical challenges for the current sociology of science and technology (abbreviated to SOS hereafter) against the background of the development trajectory of the field, examine their sociological implications, and chart a path to approach these challenges. The paper will not confine its perspective to East Asian SOS and/or SOS in East Asia. Admittedly, an overview of a field properly located in a local context such as East Asia is significant in its own right, particularly for this journal. On the other hand, there is a particular pitfall involved in contextualising scholarly work by a locality such as East Asia, as the topic tends to get coupled with a critique of a post-coloniality: “Western STS has argued so-and-so universally, but the reality is different when the East Asian context is analysed”. This is a typical approach employed by the critique, which tends nevertheless to be based on Western frameworks. The situation seems to precisely represent the post-colonial way of doing something because there is a classical division of labour between the Western developed countries that provide a general framework and the non-Western countries that borrow the framework to analyse their own local context. That is to say, the contextualisation by locality alone can reinforce and reproduce the post-colonial way of thinking, which I hope intellectual intercourse initiated by this journal will change.

To sidestep this pitfall, this paper widens its perspective to the current state of SOS in general and singles out theoretical challenges from the viewpoint of a scholar who is

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embedded in the East Asian locality. That is to say, “East Asia” to this writer means a particular viewpoint strategically employed to detect theoretical challenges and to find a way to approach them rather than a term to denote a local area as a subject matter.<sup>1</sup>

In “[The Development Trajectory of SOS and Its Problematic Situation](#)” (section 2), the paper describes and analyses the development trajectory of SOS by distinguishing three different kinds of discourse in SOS. Against this general background of SOS, in “[Beyond the “Third Wave”: The Theoretical Prospect of SOS](#)” (section 3), it then tries to focus on a theoretical challenge to SOS revealed by the “third wave” dispute and suggest an alternative way, based on the dispute, to approach the challenge. In “[The Social Construction of Participation: An Exemplification](#)” (section 4), it turns its attention to another challenge, that of participation, and tries to highlight the importance and implications of clarifying the social construction process of participatory decision-making. In conclusion, the paper recapitulates the main points made and presents a prospect for the future development of SOS beyond challenges involved in the current research front.<sup>2</sup>

## 2 The Development Trajectory of SOS and Its Problematic Situation

The variety of topics in STS has been proliferating to such an extent, ranging from dams (Espeland 1998) to fingerprints (Cole 2001) that there is hardly any place where STS cannot find themes for study. It is difficult to obtain an overview of the development trajectory of STS and its related fields such as SOS by enumerating one topic after another. What is needed is a conceptual tool that enables us to arrange the variety of topics so as to achieve a moderate degree of order. From such a viewpoint, it is meaningful to recategorise the variety of work done in SOS into three types by introducing the following three universes of discourse.

1. Internal Structure of the Community of Scientists and Engineers
2. Institutionalisation of Science and Technology
3. Interaction of Science, Technology and Society

Discourse on the internal structure of the scientific community asks questions about the behaviours of individual scientists and engineers, their networks and the group structure of the community of scientists and engineers (for example, normative structure, reward system, evaluation system) and the relationship between them. While different methods are adopted, such as quantitative analysis using SCI or thick ethnographical description of a particular replication process, what is questioned in this discourse is the internal state of the community of scientists and engineers. Discourse on the insitutionalisation of science and technology treats the social process through which the communities of scientists and engineers have developed institutions that provide such professionals with career opportunities having relative autonomy from society. Discourse on the interaction of science,

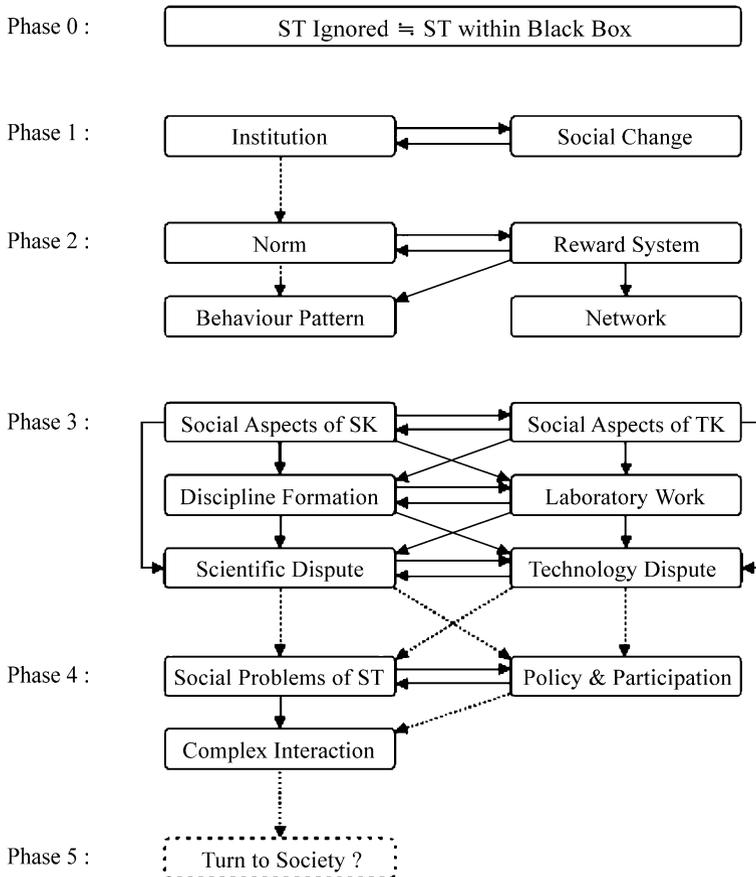
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<sup>1</sup> For a substantiation of this perspective, see Matsumoto (2006).

<sup>2</sup> In this paper, SOS denotes a field exploring the science–technology–society interface and related social phenomena from the viewpoint of sociology, while STS denotes an intellectual endeavour to explore the interface from an interdisciplinary viewpoint.

technology and society treats how science and technology thus institutionalised still interact with society through the exchange of information, money, goods and human resources.

Looking back over the development trajectory of SOS, there is a series leading from (2), to (1) and on to (3). The illustration of the series could be described in a little more detail by focusing on the thematic development in SOS as follows (see Fig. 1).<sup>3</sup>



**Fig. 1** Thematic development of SOS, Source: Matsumoto (2009): 144. *Solid lines* indicate direct influences, and *dotted lines* indicate indirect ones. Phase 1 roughly corresponds to the discourse on the institutionalisation of science and technology, Phase 2 to that on the internal structure of the scientific community, phase 3, and more probably phase 4, to discourse on the interaction of science, technology and society. Phase 5 is one of the possible phases expected in the near future by the present writer. ST science and technology; SK scientific knowledge; TK technological knowledge

<sup>3</sup> Due to the limit of space, this paper can only list a minimum amount of literature that is directly related to the points made here. Those who are curious about the outline of the development trajectory of SOS in Japan are advised to consult the English titles of the refereed papers which have appeared in *Japan Journal for Science, Technology & Society (JJSTS)* since its inception in 1992. For details, see the website of the Japan Association for Science, Technology & Society (JASTS) set up in 1988, <http://www.l.u-tokyo.ac.jp/JASTS/>

Since it is difficult to go deeper into the dynamics at work here due to the limit of space, this paper will focus on discourse about the interaction of science, technology and society, single out a couple of questions, and carefully examine their implications for the development of SOS in the future. The first question involves the problem posed by the “third wave” argument developed by H. Collins and R. Evans and presents an alternative way to investigate the problem that is different from the ways suggested by either Collins & Evans or their critics.

### 3 Beyond the “Third Wave”: The Theoretical Prospect of SOS

The questions posed by the paper, “The third wave of science studies” (Collins and Evans 2002) have attracted wide, and occasionally critical, attention in STS and related fields (Jasanoff 2003; Rip 2003; Wynne 2003; Collins & Evans 2003). Special sessions, symposiums and workshops were organised, heated discussions ensued and the authors’ replies and invitations to new projects such as Studies of Expertise and Experience have appeared (Collins and Evans 2007). Now the temporary excitement centring round the dispute seems to have settled. At this stage, the ordinary way of handling a dispute might be to sum up what has been learnt from the questions posed and the subsequent dispute (or what has not). What I will do in this section differs from this way of proceeding in two respects: first, it tries to further develop the question posed by the paper rather than sum up something already discussed, and secondly, to that end, it attempts to highlight one important implication raised in the dispute that has been dismissed up to now, and yet has a serious impact on the meaning of the “policy turn” in STS.

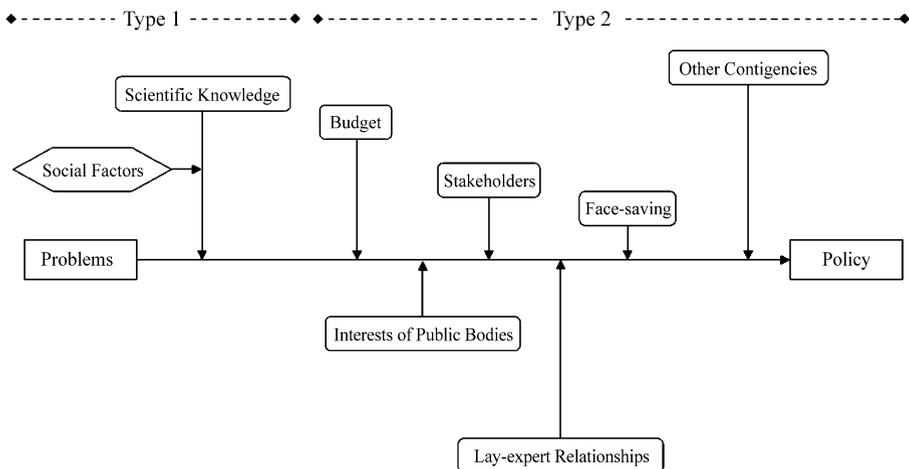
According to Collins and Evans, wave 1 was the positivism which started around 1950, and wave 2 was the constructivism that began around 1970. They argue that wave 2 showed that wave 1 was “intellectually bankrupt” based on the sociological extension of underdetermination (the difficulty of strict one-to-one correspondence between scientific statements and empirical evidence). In contrast to this, they argue, wave 3 is the application of wave 2 to social issues in the public sphere (abbreviated here to “policy turn”).

The standpoint adopted here is that the questions posed are genuinely important, interesting, and far-reaching, but the solution suggested is only one of a number of broad and rich possibilities. That is to say, the articulated possibilities seem to fall within a narrow scope that sticks mostly to expertise. One of the reasons why this paper finds the questions they raised genuinely important, interesting, and far-reaching is that these have self-exemplifying implications for the credibility of the very foundation of STS and related fields. I suspect nobody had brought forward these implications up to the time when the Collins' and Evans' paper was published. For example, the possibility of “expert’s regress” (if expertise could be defined in a relative manner only with hindsight, then expertise could regress downstream, eventually leading to a state in which there are “lay experts” everywhere) could be applied to the endeavour of STS itself. Therefore, if the sociological extension of underdetermination is attempted, the application of “expert’s regress” to the foundation of STS could be envisaged. To avoid this questionable prospect, Collins and Evans put forward “interactional expertise”, a kind of upstream work making

possible mutual translation between experts and the lay public, as a legitimate task of STS.

The point of this paper is that the legitimate task of SOS could also be pursued in a completely different way based on the same problem situation. If we can assert at least a well-specified sociological account of underdetermination of expertise, in particular that of scientific knowledge, the assertion will enable us to open the door afresh to the sociological examination and assessment of the underdetermination of policy. That is to say, if there is really a possibility of underdetermination of scientific knowledge, then it is obvious that people are all the more likely to see the underdetermination of the entire process of policy making, implementation, and evaluation in the science-technology-society interface. This is not only because indeterminate scientific knowledge is one of the key elements involved in the entire process of policy making, implementation, and evaluation, but also because the process includes a different kind of underdetermination of its own. This is due to parameters of a different nature, such as the delicate relationship between experts and the general public, the changing limit of budgets and the necessity of its execution within a strict date limit, the need for face-saving in the public sphere, the particularistic interests of a specific public body, and others, which are usually fixed by various implicit assumptions. This paper calls the underdetermination of scientific knowledge 'type 1' underdetermination, and all other underdeterminations involved in the process of policy making, implementation and evaluation 'type 2' underdeterminations (see Fig. 2).

This double underdetermination has up to now escaped the scholarly attention it deserves. The complicated situation due to the double underdetermination has been put in a black box by appealing to dichotomous phrases such as the technocratic way of decision-making vs the participatory way. As a result, the important and interesting questions posed by the "third wave" dispute seem to have not yet grasped the realities of people including scientists and engineers in their day-to-day



**Fig. 2** The underdetermination of scientific knowledge (Type 1) and that of policy (Type 2)

workplaces, not to speak of answering questions based on realities. To break through this situation, in-depth elucidation of the hitherto unexplored realities of type 2 underdetermination should be sought separately from those of type 1. How is the indeterminate state due to the delicate relationship between experts and the general public, and the changing limit of budgets, the need for face-saving in the public sphere and the particularistic interests of a specific public body? How in turn are these handled in the social process of policy making, implementation and evaluation, and what kind of assumptions is introduced to fix that state? The formulation of frameworks that make it possible to investigate these questions will constitute a path-breaking theoretical task for SOS.

#### 4 The Social Construction of Participation: An Exemplification

As mentioned above, one of the parameters that could give rise to type 2 underdetermination is the delicate relationship between experts and the general public, which raises the second question for examination. There are two types of implicit assumptions that have been employed to fix the uncertain situation springing from the delicate relationship. One assumption is what this paper will call the monotonically increasing theory of participation: “the more participation by the general public, the better”. The other this paper will call the non-monotonic theory of participation: “sometimes more and sometimes less public participation” (Collins and Evans 2002). Running through both assumptions, on the other hand, there is another which seems not to have received careful examination: the assumption that roughly equates participation with something democratic and *vice versa*. Intuition tells us participation and democracy have something to do with each other. But what is the actual relationship between the two? It is exactly here that we need a symmetrical application of the perspective of social constructivism, the core of wave 2, because participation seems to be a point that has escaped for some reason the symmetrical application of the perspective of social constructivism—the “reverse salient” compared with expertise. There is no a priori reason to believe that participation always guarantees democracy in the science-technology-society interface since the procedure of participation could go hand-in-hand with technomass democracy (Matsumoto 2002: 245), in which a particular stakeholder could further its own interest and legitimacy by using various skilful procedures of participatory decision-making, whose results can be represented as the results of “social” decision-making.

From such a sociological point of view, it follows that the results of participatory decision-making strongly depend on social contexts in which the decision-making process is designed, implemented, and evaluated. Who can participate? Who is in actual terms excluded? Who is regarded as the expert and/or the lay citizen by whom, and with regard to what? Who evaluates success or failure, and in what respects? And who subsidises who, and for what? These are some examples of questions which hold the key to the clarification of the social settings of participation. It hardly needs saying that well-devised participatory procedures could enhance the quality of democracy and be in the public interest, while seemingly similar procedures could be “little more than a coopting device” as

mentioned with reference to participatory experiments such as consensus conferences on biotechnology (Nelkin and Marden 2004).

That is to say, it is an open-ended question whether the procedure of participatory decision-making will lead us to democracy or to techno-mass democracy at the science–technology–society interface. And there have already been a considerable number of critical assessments of procedures, which show that the answer to that question is highly dependent on the social context in which they are designed, implemented, and evaluated (Lin 2006; Irwin 2006; Kerr et al. 2007; Rothstein 2007; Evans & Plows 2007). Therefore, elucidation of the social construction process of participation should be sought and the formulation of new frameworks for designing social decision-making processes in the science-technology-society interface, based on insights obtained from that elucidation and accumulated critical assessments of participatory experiments will provide another important theoretical task for SOS.

## 5 Conclusion

There are two new theoretical frontiers for developing SOS. They can be summarised as follows:

1. Frameworks to understand realities surrounding the “policy turn” should be further developed. In particular, it is important to make clear the working mechanisms of various implicit assumptions introduced to sort out the type 2 underdetermination due to the delicate relationship between experts and the general public, the changing limit of budgets, the necessity of execution within a strict time limit, the need for face-saving, the particularistic interests of a specific public body and others.
2. Frameworks to make clear the social construction process of participation should be developed to break through the asymmetrical attention given to the social construction of expertise and participation. These frameworks can be expected to elucidate equally the social function and dysfunction of various social decision-making processes and enhance their quality.

Since policy and participation are liable to become coupled with each other in the science-technology-society interface (Juraku et al. 2007), the two frontiers are associated with each other to a considerable degree. By the same token, there is a general idea common throughout these discussions that the problem of knowledge distribution cannot be self-contained in the sphere of knowledge alone since it is inextricably related to the allocation of responsibility for something collectively decided in the actual science-technology-society interface, for example environmental regulations, a guideline for bioethics, or a site selection for nuclear waste disposal.<sup>4</sup>

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<sup>4</sup> For a detailed investigation of the relation between knowledge distribution and the allocation of responsibility for something collectively decided in the science-technology-society interface, see Matsumoto (2009). As for nuclear waste disposal, see <http://generi.nuc.berkeley.edu/4S2009/index.html> (24 November 2009)

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