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A NOTE ON THE INTEGRATION  
OF THE STATISTICAL PROFESSION  
IN HISTORICAL LIGHT

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## PREFACE

For the International Statistical Institute, and its five Associations (the Bernoulli Society for Mathematical Statistics and Probability; the International Association for Official Statistics; the International Association for Statistical Computing; the International Association for Survey Statisticians; the International Association for Statistical Education) the integration of the statistical profession has been an important concern.

Most recently, at their March 1994 meeting in Voorburg, the ISI Executive Committee and the ISI Council considered the various practical steps that should be taken to promote the interaction among many specialized fields of statistical activities.

In view of the long-term nature of the problem, and the various difficulties experienced in fostering a higher degree of integration, the author prepared a note for the said meeting on some of the historical and intellectual aspects of the problem.

In particular, the paper - reprinted in this series - considers the advantages of specialization and integration within the statistical profession and provides references to past efforts in both directions. Also, it shows that the relatively slow progress towards integration apparently has a historical component to it.

It seems, generally, that the advantages of integration - although considered to be substantial on both the intellectual plane and in practical terms - are less well understood within the statistical profession than the benefits of specialization. Therefore, ISI and the Sections may want to take new educational and organizational steps to further the integration of the profession. The recent plan of the Editors of the *IS Review* to involve the ISI Associations more intensively in the Review is a prime example for possible efforts in this direction.

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This note was prepared for consideration at the March 1994 meeting of the ISI Executive Committee and Council; the views are those of the author.

## INTRODUCTION

Specialization, and the evolution of sub-specialties, is just as characteristic of the statistical profession as of medicine, law, economics or the physical sciences. As knowledge expands in a given area, it becomes difficult or impossible for professionals to cover it entirely. Thus, restricting efforts to certain fields within an area becomes advantageous and even unavoidable. This has to do, one can say, with the fruitfulness of certain principles of economics (such as the division of labor) - however it is not the purpose of these notes to elaborate on this matter.

Yet, the relentless advancement of specialization also produces undesirable side-effects. This has been understood in many fields of knowledge for some years. Most important problems are complex in nature and can be seldom solved by relying on knowledge from only one specialty or sub-specialty. Moreover, researchers have found, that very fruitful areas of investigations can emerge on the boundaries of two (or more) fields of knowledge. There are so many examples for this process, that it is superfluous to list the numerous successes such as seen by the evolution of biochemistry, astrophysics and many other fields.

## FIELDS OF STATISTICS: SPECIALIZATION AND INTERACTION

The community of statisticians, within countries and internationally, became aware of the needs to foster both specialization and interaction amongst the fields of knowledge in statistics. The International Statistical Institute, for example, established such special sections as the Bernoulli Society for Mathematical Statistics and Probability, the International Association for Official Statistics, the International Association for Statistical Computing, the International Association for Statistical Education, and the International Association of Survey Statisticians. Each of these specialized areas developed important research programs, exchanges of ideas, and publications dedicated to their problems. The biennial meetings of the ISI, at the same time, provide opportunities for specialists to meet statisticians outside their own areas, and try to foster the interaction amongst the various groups. Also, each issue of the ISI Newsletter - which is received by all members of the ISI and the Sections - covers the activities of all ISI Sections, and provide an opportunity for specialists in one field to get news about activities not only in their own areas but in the others as well. The new editorial policy of the IS Review also aims at reducing the effects of ever narrower specialization and attempts to provide reviews of statistical developments of a wider interest to readers.

Over the years the international statistical community recognized certain problems regarding both specialization and interaction in statistics. In respect of specialization the main problem appears to be inadequate international attention to certain specialized statistical activities. For example the currently operating associations (five sections) of the ISI do not necessarily provide a forum to certain groups of statisticians. This may be related to the way the specialized groups evolved within ISI: more or less by 'function' and less by 'field' of application.

(It is interesting to compare, in this context, the sections of the ISI with the sections of the Royal Statistical Society, which are the following: Research; Business and Industry; Social Statistics; Official Statistics; Statistical Computing; Medical Statistics; and General Applications). Also, the numerous sections of the American Statistical Association provide a more thorough 'field' coverage than the ISI does. Within the ISI, the problems of 'coverage' have been addressed, in part, by special committees for certain fields of application, such as industry, environment, agriculture, geographic information systems. In addition, explorations have been made about the possibility of creating a 'general' section (somewhat similar to the RSS 'general applications' section) even though there have been some doubts about this endeavour.

Also, the need to provide more 'space' within ISI for statisticians active in the private sector has been emphasized. In general, ISI traditionally focused more on academic and official statisticians, than on those employed in the private sector. The numbers of the latter group have been growing; according to some estimates about 30% of ASA members work in the private sector. Notwithstanding the inadequacies of coverage of certain specialized areas within the ISI, it seems that the problems recognized regarding the relatively weak interaction among the specialized areas of statistics are equally, and perhaps more, pressing than the issues cited regarding inadequate attention to specialization within statistics. The difficulties of international statistics in this regard seem to be similar to the problems experienced among specialized fields of knowledge in general. The Director General of UNESCO, Federico Mayor in his article "The role of the social sciences in a changing Europe" pointed out the following in this regard: "Firstly, the interdisciplinary as well as comparative approaches must be promoted decisively and extensively. Conversely, the disciplinary, paradigmatic, epistemological and ontological fragmentation and debates, important as they are, must be down-played... The aim is to render the social sciences more operational, more relevant in terms of data and evidence and as a knowledge base for policy-making...Secondly, interdisciplinary and comparative research must be based on good quality statistical data. This is absolutely crucial for the further advancement of the social sciences." [Mayor, Federico (1992), in the 'International Social Science Journal', May Issue, p. 279]

Good as it is to read Mayor's suggestions about the use of statistics in the social sciences, one has to think that the problems he sees in the social sciences exist in statistics as well: that story is also about us ('de te fabula narratur...'). In order to be able to help all the other fields effectively, the inter-disciplinary, and indeed the intra-statistical affairs within our own increasingly sub-specialized field also require thoughtful attention.

Our discussion, of course, assumes that increased interaction among specialized fields of knowledge in general, and among the various areas of statistics in particular, can have beneficial results which can usefully augment the knowledge acquired in each specialty. It also assumes, that the cost of such interaction - the efforts needed in increased communication, etc. - are smaller than the benefits which may be derived. It is not easy to

prove that these assumptions are valid. However, the success of many emerging fields of knowledge on the boundaries of different disciplines makes such assumptions plausible for statistics as well. Yet, if expected benefits are obvious, what has been preventing the existing specialties in statistics from reaping the rewards of more interaction? The technical arguments, which are based on the experience of many other fields of knowledge and were mentioned above, are certainly operative in the statistical fields as well (the chances of professional recognition being better within the specialties, etc.).

## **SPECIALIZATION IN STATISTICS: HISTORICAL ASPECTS**

The historical evolution of statistics may be an additional source of the difficulties of interaction among various fields of statistics. Our note cannot review this matter in detail. Instead it reflects - rather briefly - only on two aspects of the historical evolution of statistics. One of these aspects goes back to the beginnings of the profession. The second concerns recent history: the efforts of ISI between 1975 and 1980 to tackle the problems of integration of statistics.

### **(a) Specialization and the Beginnings in Statistics**

While it is a simplification, the argument can be made that probability and mathematical statistics, on the one hand, and official statistics, on the other have historically evolved separately. Admittedly, there have been national differences even within the development of official statistics in various countries; in certain countries descriptive statistics, in others materials more amenable for 'political arithmetic' (or mathematical treatment in general) may have been developed earlier. Notwithstanding these historical differences (and their decreasing relevance by our times), apparently national interactions between mathematical statisticians and official statisticians, even today, are rather uneven. It may be argued, that modern developments in mathematical statistics and probability have not penetrated official statistical activities sufficiently. Conversely, it may be argued that probabilists and mathematical statisticians have paid inadequate attention to the problems encountered by official statisticians. One may also suppose, that there is some truth in both assumptions.

There is, apparently, a long history of this type of dichotomy in various countries as well as internationally. Indeed, even the historiography of statistics has reflected this dichotomy for a long time. Kreager's penetrating review study (to which we cannot do justice at this juncture), put this matter as follows: "...scant treatment of quantification [lack of attention to data gathering aspects] reflects a division of labour that has long troubled the history of mathematical ideas. On the one hand, a common procedure is to write histories of statistical subjects in which no mathematical formulae or quantitative illustrations are used (e.g. Westergaard, Lorimer, and Greenwood)...On the other hand, the history of statistics until recently was dominated by another approach, largely the province of mathematical specialist." [Kreager, Philip (1993) 'Histories of Demography: A Review Article', Population Studies, 47,

pp. 536-537] Kreager reviews, in particular, three new historical studies by *Hacking* (1991), *Daston* (1988), and *Hald* (1990). He considers, that Hald among these 'qualifies as a major new event' [Kreager (1993), p. 537] in the direction of integrating the history of the relevant intellectual movements over the recent centuries.

Kreager cites complex reasons why the history of statistical activities and statistical methods evolved on different lines, which occasionally intersected, but typically remained parallel. He suggests, that the new series of historical studies by Hacking, Daston and Hald "makes an impressive case for the fundamental role of early modern population inquiry in the history of probability, and thereby in the rise of social mathematics." [Kreager (1993), p. 539] Whether his suggestion will be as fruitful as he hopes, remains to be seen. Yet the prospect of joining the intellectual evolution of statistical activities, probability, population studies, 'political arithmetic', and national statistical activities may indeed open up the possibility for a more integrated historical evaluation of all these somewhat separate developments. And a more integrated historical perspective may be very illuminating for understanding the special reasons for the 'fragmentation' of statistical fields, and provide some guidance as to the integration needs and possibilities of the statistical profession as we understand it today in all its diversity.

In short, the history of statistical thought and activity reveals complex and early reasons for a certain lack of 'professional integration' in our discipline. New historical research explains some of the reasons for this; other causes still appear to be only partly understood. Given the intellectual and historical complexity of this matter, further research results will be needed (and encouraged) for a more complete understanding of the problem. Indeed, it would be in the best interest of statisticians active in all main areas if they asked the historians of statistical thought and activity to further examine the issue of integration (or the lack of it) in our profession.

#### (b) The 1975-1980 ISI Efforts for the Integration of Statistics

Whatever the reasons for the problems of integration, the leaders of ISI have been attentive to the difficulties resulting from the fragmentation of the profession. For example, in 1975 the President of ISI, Petter Jakob Bjerve presented an important overview to the 40th Session of the ISI held in Warsaw. Among others, he underlined that "...our feeling of satisfaction with the progress made in both fields is mixed with worries about the wide gap existing between official statisticians and academic statisticians. Professionally, these two groups of statisticians seem to be living in two different worlds without communication in between....even when official and academic statisticians are brought together in national and international associations they do not attend each others' meetings, presumably because, often, presentations made by academic statisticians are incomprehensible for official statisticians and because papers presented by official statisticians are found boring by academic statisticians." [Bjerve, Petter Jakob (1975), Presidential Address presented to the 40th

Session of the International Statistical Institute.] Interestingly, and perhaps reflecting the composition of the statistical profession in many countries (albeit not in all) Bjerve did not stress similarly the needs of integration regarding a third group of statisticians: those working in the private sector. Today, of course, we consider this group as also a key component of our profession.

In order to follow up the matter, ISI at the Warsaw Session set up a committee "to study the gaps between various categories of statisticians and to report to the General Assembly concerning recommendations which will lead to minimizing such gaps in the future." [Duncan, J.W. and Durbin, J. (1980), "Report of the International Statistical Institute Committee on the Integration of Statistics", *International Statistical Review*, 48, p.139.] The terms of reference of the committee were the following:

- A. To study the phenomena that different categories of statisticians are often unaware of, and disinterested in, each others' professional achievements, and apparently lack adequate appreciation for the interrelationship of their respective work;
- B. To recommend ways and means to promote a closer collaboration and improve mutual understanding between these categories of statisticians;
- C. To support specific program activities which may be undertaken by the ISI and which require the joint collaboration of statisticians of different specializations.

The committee utilized for its report the results of an inquiry distributed to ISI members in 1977 and presented a wide ranging review of the problems involved and the reasons apparently causing the problems. Readers are referred to the original report for the particulars; on the whole - despite progress made in certain respects - many of the problems regarding integration, as perceived today, are remarkably similar to the issues vexing statisticians in this regard in the 1970s. Certainly, the four basic recommendations put forward by the committee still deserve our attention and reprinting here:

#### **COMMITTEE RECOMMENDATIONS TO THE ISI:**

1. **The International Statistical Institute should regard the integration of statistics as one of its major objectives.**

The report of this Committee and the report of the Conference of the Transfer of Methodology Between Academic and Government Statisticians should be sent to all statistical associations, together with a formal request for consideration of the Committee's report. The ISI should develop research projects where there is an opportunity for bridging gaps within the profession. If the ISI organizes a series of recurrent symposia, the Committee suggests special attention should be given to integration by including statisticians of different categories.

2. **The Review of the International Statistical Institute should give a high priority to papers which will make a contribution to bridging various gaps within the profession.**

Invited papers in the **Review** should summarize various fields within statistics, highlighting recent methodological innovations in simple terms. Authors should be encouraged to bring together theory and applications whenever possible.

3. **The Committee on Training and Education should review curricula in statistics with a view toward promoting a core educational program which will improve the student's ability to reach out in various specialized branches of statistics.**

In offering assistance to developers of curricula and in assisting regional institutions, the ISI should update curricula to give students an introduction to the branches of statistics and awareness of the benefits of drawing parallels among subsectors of statistics.

4. **The Programme Committee for the biennial Session of the International Statistical Institute should ensure that several sessions will be organized for each meeting with the aim at least in part of improving integration within the profession.**

Within the biennial Session it will be necessary to establish time period for plenary sessions designed to appeal to the entire profession. At least one such time period should be organized in the next two biennial sessions which is identified with the integration of the profession. Organizers of sessions should arrange juxtaposition of developments in theory with illustrations of practical applications.

## **THE CHALLENGE OF INTEGRATION TODAY**

The long history of problems with the integration of the statistical profession indicate the existence of important underlying intellectual, economic, cultural factors which play a role in this matter. We referred to the historical intellectual factors (such as the early separate development of fields of statistics) but others are no less - indeed probably more - important. The ever-increasing specialization of knowledge, in statistics as in other areas - is related to the economics of specialization, the advantages of the principle of division of labor in our field as in all others. Last but not least the somewhat different cultures (and rather different reward systems) in which the main groups of statisticians (academic, government, private, etc.) have to make their living have consequences for their behaviour. Given such deep-rooted origins of the problems of integration of the statistical profession, this note can address only a few thoughts regarding possible remedies at this juncture. It is noted, that several important matters related to the problems were addressed by the recent Moriguti Report on the role of statistics and statisticians, which was also the subject of a wide discussion at the Florence

Session of the ISI. [IS Review (1992), 60:3, pp. 227-246; ISI Occasional paper series #4 (1994), The Moriguti Report on the Role of Statisticians: A Discussion]

At any rate, points relevant to the integration of the statistical profession today include the following:

- (1) The history of the matter indicates that both specialization and interaction (integration) have their value for the members of the statistical profession. Therefore, ISI has to cater to both needs. Usually it is felt, that by accident or design ISI caters better to the specialization needs of the statistical profession than to its needs for interaction (integration). While there are reasons for this impression, the truth is that certain needs of specialization are not fully met either. This is one of the reasons for pressure to establish new committees, working groups, interest groups, and sections within ISI. A frequently mentioned gap is the apparent lack of 'space' for private sector statisticians (in comparison with academic and governmental statisticians).
- (2) There is no question, that ISI activities furthering the specialized needs of members are widely welcomed. In particular, the Sections of ISI have been instrumental in catering to such needs (the establishment of IASE and the launching of the Bernoulli Journal are recent initiatives in this regard). The programs of the ISI Associations and their publications are typically rather successful in meeting the specialized needs of their members.
- (3) It is felt that neither the ISI Associations or ISI are as successful in respect of interaction (integration). Indeed, the argument can be made that many (perhaps most) members active in specialized areas do not feel the same need for interaction as for specialized activities and certainly feel less urgency about such needs. One reason for this may be that the benefits of integration are less well articulated (and less well supported by institutional and other arrangements) than it is the case with the advantages of specialization. Yet the advantages of integration, in addition to specialization, have been recognized and advocated by many leading statisticians for a long period of time.
- (4) One major advantage of interaction and integration within the statistical profession are related to the potential of **intellectual gains** in the process. Clearly theorist can have stimulating messages for practitioners and vice versa. Persons working in statistical computing can offer insights to teachers of statistics, to official and private sector statisticians, to academic people, etc. Indeed, any field of specialty and sub-specialty in statistics may offer stimulating ideas, results, or questions to many other fields. Alas, in part because of the specialized language utilized within each area the difficulty of communicating such thoughts is far from an easy task.

- (5) A prime example of the persistent difficulties in reaping the desired **intellectual gains** from more interaction among statisticians is the IS Review. In 1979 the ISI Committee on Future Directions stated that "...it will be necessary to...continue present efforts to implement a quality Review which is designed to be of wide interest and to meet the needs of integrating the profession...". [Report of the ISI Committee on Future Directions, October 1979, p. 15]. As quoted earlier, the ISI Committee on the Integration of Statistics reiterated the same need in 1980. The cover of the IS Review indicates, that it is "A journal of ISI, Bernoulli Society, IAOS, IASC, IASE, IASS". However, beyond the members of ISI only the members of the Bernoulli Society receive the IS Review regularly (and there are doubts whether the Bernoulli Society can - or even wants - to continue with such an arrangement). The reason for the limited readership of the IS Review within the ISI family of organizations is only partially financial: the more important reason is the lack of relevant reading material from the viewpoint of many (most) section members. As it is well known, the new editorial policy of the two editors of the IS Review, Bernard Silverman and Dennis Trewin is to turn the Journal into a truly review oriented publication with wide interest to statisticians active in all areas. But the implementation of this goal is far from simple, and the expected intellectual gains - which are truly compelling - are not realized easily.
- (6) In addition to the hoped for **intellectual gains**, the integration of the statistical profession offers certain **practical benefits** as well. Crudely put, there is strength in numbers. A profession that can show a higher degree of unity, has more influence than one that is very fragmented. Modern social life is considerably influenced by pressure groups, various lobbies, etc. Whether one likes this feature of modern life or not, the fact remains that the less well organized and united groups typically lose out in the unavoidable competition for funding and other opportunities. Even advertisers in statistical journals prefer those publications which can reach more (and more important) readers.
- (7) Clearly, statisticians working in specialized areas cannot give up the manifold benefits accruing from increased specialization. Neither specialized publication, nor separate meetings and programs can be given up. At the same time, statisticians also have the right for benefiting from the **intellectual and practical advantages** of interaction (integration) within the statistical profession.
- (8) It seems that the promotion of understanding the benefits of interaction (integration) as well as creating proper conditions for integration require sustained efforts. In respect of expanding the understanding of such benefits first of all educational efforts are needed within the statistical profession. ISI and its Sections may need to maintain a persistent campaign (for years to come) explaining the expected **intellectual and practical benefits** accruing to a more integrated statistical profession. For proper conditions of integration certain organizational efforts would be also needed. A prime example for such possible efforts is the new proposal of the Editors of the IS Review to 'devolve' the

journal (at least the larger part of it) to the Sections, appoint Associate Editors from each Section, and make the IS Review a truly common journal for ISI and all its Sections.

- (9) Such a measure, involves both organizational and educational efforts within the statistical profession. Reference was already made to such organizational measures as the appointment of new Associate Editors from every Section. The educational efforts required are also extensive. For example, both potential authors and the readers of the IS Review will need to change their perceptions about this journal. In the new situation, **the articles generated by a section will be primarily for informing, influencing, and generally relating the readers from other Sections to the work results and approaches of the Section where the article originated.** Specialized journals, in contrast, generally aim at the circle of readers within the same Section. In a way, each Sections' potential authors for the IS Review would need to aim at a wider circle of non-specialist readers-statisticians, than usually found within their own Section. This could be understood also as an investment in the desired integration of the statistical profession. **The intellectual benefits, to each Sections' readers would primarily come from the articles written by other Sections' authors.**
- (10) There are other ways to increase interaction among the specialist groups within the statistical profession. The purpose of these notes is not to list the various possibilities. (A recent proposal is to increase joint meetings between Sections). The first order of the day seems to be an understanding the **intellectual and practical benefits** expected from expanding interaction (integration) within the statistical profession. Once these are widely agreed upon, the practical steps to be taken will be relatively easy to formulate. Perhaps a general rule can be devised, that for ISI the emphasis on specialization and integration should receive equal attention. In the case of the Sections one would accept that attention to specialization would be considerably higher than interaction. Nevertheless, a perceptible amount of energy (perhaps 10-20 percent of the total effort) could be allocated to integration as well.

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A. Hald, **The History of Probability and Statistics and their Applications before 1750** (New York: John Wiley and Sons, 1990). Pp. xiii+586, £63.00.