Paper and Network Scholarships: The Logistical Limits and Futures of Cultural Studies

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0. Introduction

This paper reaches three conclusions: (i) That traditional, i.e. paper-based scholarship suffers from several permanent mechanical and logistical limitations. Therefore, no major progress is likely to happen in cultural studies, until another, less handicapped medium, possibly the Internet, is employed; (ii) Unfortunately, the Internet, despite of being introduced over 30 years ago, is not used in an efficient and imaginative manner; (iii) Serious use of the Net might be able to bring about a Renaissance of cultural studies, albeit at the cost of significant social and political dislocations to the existing research practices and institutions.
The paper commences with an abstract and rather assertive discourse. Midway, however, it waxes philosophically and does a lot of intellectual meandering and back-tracking. Finally, it offers a series of hesitant, tentative, and very sketchy hypotheses. This is inevitable, as it is our past that we perceive best. The present has a tendency to coalesce in an unexpected pattern, which reveals both its un-called for precedents and inferred consequences, while the future is inevitably a dazzling array of competing trajectories and blueprints. Experience shows that most of our projections, however firm or tentative, are always half-baked and misguided.

Any, even the slightest merit of this paper I dedicate fully to my dear ECAITech friends: Janice M. Glowski, Jeanette Zerneke, Susan Whitfield, Ian Johnson, Larry Crissman and Andrew Wilson. Without steady and mould-breaking contacts with them, my synapses would be disappointingly sluggish.

1. Three types of cultural studies

Cultural studies, like Caesar's Gaul, form three major groups.

Firstly, there are studies which create **verbal** models. This type of work usually takes the form of a narrative, a dissertation or an encyclopedic dictionary. In narratives, such as stories or travelogues - a sequential temporal theme prevails. In dissertations, materials and arguments are presented and discussed according to the structure of a subject-tree of issues and data. Finally, in dictionaries, available information is fragmented and shaped into a multitude of self-contained nuggets. These are presented in an arbitrary, usually alphabetic order.

Secondly, there are studies which start with an array of variables. Each of these variables are given a distinct value or attribute. Some of the variables are numeric, while others can be qualitative. Their common feature, however, is that together they form an invisible documentary basis for a **graphic** display: a graph, a chart, or

a map. Such graphic display is subsequently annotated with verbal labels, comments and explanatory notes. However, within the realm of graphic models words play only a minor role. Maps and charts communicate chiefly nonverbally. They *show* their wealth of information wholeheartedly but do not *say* much about the revealed connections and regularities amongst the source data. Any relationships are revealed through the skilful use of lines, points, and areas, as well as symbols, patterning and colours.

The third category of studies; **numeric** models and analyses, also commence their existence with a body of data. However, in such models the many variables to which the data pertain are put together in the form of a matrix or an equation. In all cases the assembled data form a dynamic lattice of quantitative relationships. In numeric studies each of the constituent cells or elements plays a dual role. It both represents (reports) its own value as well as forms a logical link with the values assigned to other parts of the model. Naturally, numeric studies do make use of words. However, such words merely elucidate arithmetic patterns embedded in the assembled information. So, they carry a meta-comment and do not constitute the primary information itself.

All three categories of social science and humanities research have a long and respectable history. The verbal model can be said to originate, at least in the Western world, with the writings of Herodotus of Halicarnassus (485-425 BCE), a man who is commonly regarded as the 'Father of History.' Maps, as tools for systematic presentation of large volumes of complex and interrelated information, also have an ancient heritage. They were known already to Herodotus himself. However, it might be convenient for mnemonics sake, to link them to the research of Claudius Ptolomaeus (ca.100-ca.168 CE). He was a Roman geographer who worked in Egypt and who compiled the seminal *Introduction to Geography* accompanied by an extensive map of the Graeco-Roman world and a gazetteer of ca. 8,000 partially geo-referenced placenames (PWN 1967:601). Numeric studies, by contrast, are a more recent invention. They can be said to originate with the quantitative demographic investigations (see Note 1) of Sir William Petty (1623-1687), Gregory King (1648-1712), economic studies of Francois Quesnay (1694-1774) and the works of Marquise Nicolas de Caritat Condorcet (1743-1794). Condorcet, a French mathematician and philosopher of culture, was among the first Europeans to suggest that if social science research was based on the use of statistics, starting with descriptive statistics, then it could be conducted rigorously and objectively, just like the natural sciences (PWN 1963:593).

Handy examples of verbal models of social and cultural realities are provided by both S. Runciman's superbly detailed chronological accounts of the Crusades (Runciman 1978abc), and F. Braudel's discussions of the grammar, growth and transformations of the world civilisations (Braudel 1995). The graphic model, of course, is best exemplified by a plethora of maps and atlases dealing with social, historical, economical and cultural variables and processes. Some more recent specimens of these are the maps found in Putzger (1963), Shepherd (1976), Scarre (1988), Stone (1989), and Vidal-Naquet (1992).

The numeric model approach also has many examples. For this reason, two of them will suffice. The first is a large set of demographical data for Asia (ESCAP 1994). The model is composed of a matrix of 17 columns and 59 rows. The columns cover variables ranging from such topics as 'mid-1994 population estimates', 'annual growth rate' and 'no of persons per km2' to 'population doubling time at current rate' and '1992 GNP per capita'. Figures are provided for 53 countries and territories. There are also separate totals for East Asia, South East Asia, South Asia, Central Asia, Pacific areas and the grand total for all of the Asia-Pacific region. In sum, the table is made of a grid of 1003 directly and indirectly interdependent cells.

Another example of a numeric model is the study of the supply requirements and arrangements of the Macedonian army during Alexander the Great's campaigns against the Persians, Scythians and Indians (Engels 1978). Although the bulk of the study is made up of words, and the book itself contains several charts showing the roads taken by Macedonian troops at various phases during their war for the East, all key deliberations are predicated upon a simple arithmetic formula. The formula balances daily food and water requirements of the troops, as well as those of the accompanying animals (both the war-horses and the horses, mules and camels from the baggage trains) against the physical capacity of humans and animals to carry weights (such as supplies, armour and weapons, and tools) over extended distances. It is through the use of this equation that Engels can show convincingly that not until the introduction of railway transport in the 19th century, it was possible for a body of men or animals, regardless how many of them would travel

together, to proceed for "more than four days without replenishing its water in a terrain where no water or grain was obtainable" (Engels 1978:63).

Of course, in the majority of contemporary studies of cultures and societies all three approaches are freely used side by side, often within the context of a single investigation.

2. The mechanical problems of paper-based scholarship

Throughout the 2,500 years since Herodotus all three types of scholarship depended on the extensive use of a medium such as papyrus (invented ca. 3000 BCE), subsequently replaced with parchment (invented ca. 200 BCE) and, finally, with paper (invented ca. 100 BCE). All three materials played a vital role in promoting the speedy production and distribution of knowledge. In all cases, the medium of publication, such as paper (let's focus for the sake of simplicity, on the most recent and most widely used invention) invariably performs a dual function. It acts, in private and public spheres of circulation of information alike, both as a *storage* and as a *display* device.

In the first instance it is a tool, a mechanism for keeping data (and any associated commentaries) recorded, preserved and ready for any subsequent uses. In its second aspect, it is used to provide a convenient listing, or presentation of patterns and regularities contained within the recorded data. It is a subtle but important distinction, one which became apparent only recently. It originated with the introduction of communication networks, and client-server technology. To use the Internet's parlance; paper, when used as a tool for communication behaves both like a server **and** a browser system.

The widespread and continuing reliance on paper for the storage and distribution of information is favoured by many factors. These include cellulose's impressive resilience to the damage caused by the elements or vermin. They also include the clarity and high precision with which letters, images and numbers can be imprinted on the surface of a page. The ease of folding, trimming and binding a large paper leaf (i.e. plano) into formats such as folio, quarto, octavo and so on (Ventura Pacific 1999), is also important. However, its chief and most important advantage is its remarkable cheapness. For example, each of the Gutenberg Bibles managed to deliver information in the form of an accessibly priced volume which previously would have required parchment made from the skins of over 200 sheep (Manguel 1996:135). Similarly, the massive history of Europe (Davies 1997) printed on some 1385 pages, can be purchased for AU$29.95, that is for less than half-a-cent a page.

Nevertheless, convenient and popular as they are, all paper-based publications suffer from two major and, as we shall see, essentially unavoidable handicaps. These are: (i) stringent limitations to the overall volume of information a paper document can adequately handle; as well as the (ii) built-in incorrigibility of the paper-stored data. Normally, we are not conscious of these shortcomings, and if we do, we do not take them too seriously. The last five hundred years, or eleven hundred years if we consider China, of print technology and the complete ubiquity of paper have greatly desensitised us to the existence these 'hidden' and stubborn physical problems.

Firstly, there are ergonomic restrictions to publications' overall size and weight. The human hand favours only those objects which can be held comfortably in its grasp for extended periods of time. Some of these pragmatic stipulations are quite old. For example, in 1527 king Francois I decreed a set of standard sizes for all books published in France, and any printer who broke this rule was to be punished by a term in prison (Manguel 1996:127). In addition to purely ergonomic considerations, the maximum weight of a publication is also controlled by the existing schedules of postal charges (see Note 2).

After five centuries of trial and error, the final range of formats for printed publication is quite narrow (Ventura Pacific 1999). In the late 20th century, at the top end of the spectrum there are books such as Le Petit Larousse (Larousse 1993), an encyclopaedic dictionary some 1872 pages long. The entire volume is 8 cm thick, weighs 4 kg and contains some 2 million words. There is also the already mentioned History of Europe (Davies 1987). That volume is 6 cm thick, weighs about 1.7 kg and contains some 600,000 words.

The lower end of the spectrum contains miniature documents. There are books (eg such as from the 'Shambhala Pocket Classics' and 'Shambhala Centaur Editions' series) which are issued in tiny, tricesimo-secundo (32mo) format. They are no more than 10.5 cm wide and 12.5 cm long. They have about 140 pages, weigh approximately 0.05 kg, and are no more than 1.5 cm thick. On average they contain about 17,000 words. Despite their small dimensions their individual pages can still be opened without much difficulty and the text they deliver is still ample and readily legible.

The middle ground, be definition, is occupied by publications falling between these two extremes.

Table 1
Some physical characteristics of recently published books on Asian studies

Aspect/Book format*	Duodecimo	Octavo	Quarto	Total sampl
Numbers in the PBO catalogue	3	81	16	100
No of pages - average	289	224	233	
No of pages - range	216-346	42-432	76-691	
Dimensions - average (cm)	11.5x17.9	17.1x22.2	20.3x26.2	
Thickness** - average (cm)	1.9	1.0	1.1	
Area p/page - average (cm2)	206	380	532	
Weight - average (kg)	0.12	0.26	0.66	
Weight - range (kg)	0.10-0.17	0.07-0.50	0.16-1.53	
No of words per book***	77,000	111,000	161,000	

* For book sizes terminology see Note 3 and Roberts and Etherington (1999).
** Estimated, assuming the average no. of pages
*** Estimated, assuming 1.30 words/cm2 of page and rounded to the nearest thousand

An analysis of the details of 100 books listed in the catalogues of an electronic bookshop (Philippine Bookstore Online 1997) indicates (see Table 1), that approximately 80% of commercial publications dealing with Asian culture, history and current affairs are octavo-sized books (approx 17x22 cm). These books are 1 cm thin, contain approximately 230 pages and weigh about a quarter of a kilogram. These portable containers of information carry about 111,000 words. Only three percent of the books in the analysed sample would have a smaller (i.e. duodecimo) format, and sixteen percent would be issued in a larger (i.e. quarto) formats. Finally, only two percent of the books in the publisher's catalogue would weight over 1 kg, and about one in five (18 percent) of the books would have more than 300 pages.

Above data suggest that in the world of paper documents - such as manuscripts, journals and books - there seems to be a dynamic relationship amongst a host of variables. While the smallest and largest physical parameters of a document are controlled by the economics of postal distribution system and anatomical characteristics of the human body, their intermediate values are dictated by a series of tradeoffs between the document's legibility, portability and the amount of information it attempts to deliver.

The type-face, point-size, spacing between lines, with of margins all influence the number of pages a book needs to have. For instance, a recent decision by the ANU, RSPAS' journal 'Australian Archaeology' (see Note 2) to use a Times font size 10, instead of the hitherto prevailing size 11, has succeeded in packing 14% more words per page of the periodical (Andrews 1999). The number of pages is controlled, in turn, by their dimensions and their cumulative weight. At the same time, the weight and thickness of a sheet of paper is determined by the information's planned durability and the circumstances of expected use. In other words, paper as a medium for written communication offers an ample and convenient but always firmly circumscribed field of action.

As the work by N. Davies testifies, a volume published in one of the smaller formats (such as quarto or octavo) can contain nearly 1500 pages and still fit within a tolerable weight-limit. This is not possible, however, with larger formats such as folio, elephant folio (i.e. a newspaper page, or 40x58 cm), atlas folio, and, finally, double elephant folio. Here, any increase in the overall dimensions of a page needs to be fully compensated by a corresponding reduction in their overall number.

So, if the overall amount of space available for words, images and numbers is limited, then such physical

constraints strictly govern the amount and quality of information which can be carried between the covers of a manuscript, newspaper or book. A couple of trends can be discerned here.

Firstly, the more information a document attempts to deliver, the greater the likelihood that in a verbal model this information will be geographically and chronologically circumscribed, or, alternatively, ruthlessly simplified in order to match the available display space and the weight. The already cited work by S. Runciman exemplifies the first tactics, F. Braudel's - the second.

In the case of a numeric model, the physical aspect of a publication will influence both the granularity of the data to be presented and the number of associated explanatory notes and glosses. If the physical dimensions of a book prove to be restrictive then it is obvious that large data sets would attempt to limit the number of variables they deal with. They will concentrate instead on providing a wealth of detail pertinent to just a handful of phenomena. Alternatively, they can remain wide in coverage, but then they must surely remain short on specifics. In this case information will be aggregated and retabulated in order to meet the space and weight standards of the publication.

Comparable compromises can also be seen in the world of graphic models. Here, the physical size of a leaf of paper dictates the scale and hence the amount of detail a map can convey. For instance, a chart of the whole world, printed on a single page of a standard atlas (say, 24 cm wide) needs to be at 1:125 mln scale. Similarly, a map of the whole world fitting on two pages of an atlas (say, 48 cm wide) needs to be drafted at no more than the 1:66 mln scale. This means that a more detailed, say, 1:1 mln, and still a physically manageable map is possible only for a small places like Sri Lanka, Belgium or Maine. However, a seamless map of the whole world at 1:1 mln scale, which is an approach adopted very successfully across the electronic medium by the Digital Chart of the World - DCW datasets (see NCSU Libraries 1999), is most unlikely to be created and used, as it would have to be approx 20 meters tall and 40 meters wide.

There is also an additional complication. For both technical and ergonomic reasons the narrowest line which can be printed on a sheet of paper is about 0.1 mm wide (Johnson 1999). This means that in the case of a map drawn to 1:66 mln scale, the positional error is inevitably about 6.6 km. The same error, in case of a in a map drawn to 1:1 mln scale would be about 100 meters.

All this means that paper as a medium for scholarly communication inevitably suffers from a series of mechanical handicaps. Naturally, these limitations are not fully apparent when the data sets are small, or when the need for detail or great precision is not a consideration. However, if more serious work is undertaken, the overall mechanical clumsiness of paper as a storage/display device require us to start making invidious choices:

- In the case of verbal models, authors are forced to determine how much space will be allocated to the presentation of primary sources and extracted data, and how much of it to the ensuing commentaries, interpretations and discussions.
- In the case of graphic models, authors - draughtsmen or cartographers - are forced to decide whether each chart will show precise but necessarily local information or whether it should endeavour to provide readers with generalised but necessarily fuzzy information.
- Finally, in the case of numerical models, the choice is between detailed or plentiful information.

It is clear then that the scholar's skill and training does not resides only in his/her ability to locate data, or in the capacity to analyse them thoroughly. Nor does it reside solely in the speed and aptitude with which findings can be juxtaposed with those of other researchers. The skill in question also goes well beyond one's ability to dress thoughts in adequate words and present them in as a cogent and elegant series of premises, hypotheses, findings and conclusions. Ultimately, it necessarily includes a gradually acquired ability to choose and juggle gracefully yet judiciously between the everpresent mechanical properties of the dominant medium i.e. paper, where all the scholarly work takes shape. This medium is always limited as well as limiting and it hence requires an inevitable compromise in regard to the (i) scope, (ii) quality or (iii) accuracy in the presentation of one's work.

In addition, as if the picture was not worrying enough already, there is still another factor which needs to be

considered.

3. The logistical problems of paper-based scholarship

Information, once printed and bound in the form of a journal or a book is extremely difficult to amend. Any change, any correction, any addition however minor, always implies a major technical procedure which is both labour-intensive and costly. Modified pages have to be printed afresh. If more than a few lines of information is added to, or subtracted from the text, the pagination of the rest of the document is also adversely affected. In this situation all relevant pages need to be reformatted, reprinted and rebound. In short, paper as a carrier of information, is characterised by two built-in logistical or technical biases.

Firstly, the overall complexity, time and costs of production of a printed document makes its authors and editors aim for utmost perfection, content and appearance-wise, of their work. This perfection is certainly welcome but it comes, nevertheless, at a certain price. Not all of the addenda and corrigenda which reach the authors' hands are likely to be included into their work. It is so because sooner or later the publication schedule starts taking precedence over considerations of accuracy and completeness of the work which is about to be printed. As a result, authors and publishers tacitly agree to be 'realistic' about their striving for perfection and freedom from errors.

Secondly, the overall complexity and costliness of revisions to the *already printed and disseminated* documents very strongly discourage production of any subsequent errata and modifications. A book, or an atlas, or a table with statistical materials is always treated as a singular, *once-in-a-lifetime* operation. Thus a body of work, as soon as it completed and released into the hands of public tends to operate as a relic. It turns into an object which is either revered or laughed at, but is unlikely to be ever improved and worked on. Printed information never gets replaced, however erroneous and inadequate it is found to be. Instead, if the work is bad, it is merely appended (logically but not physically) by another batch of print on the same topic. Bad paper-based information never gets repaired and, interestingly enough, almost never gets removed from circulation. A number of practical, financial as well as cultural reasons make burning or pulping erroneous materials rare, at least in the late 20th c., practice. Once inadequate material starts getting distributed, its retraction and emendation becomes a logistical nightmare. For an account of some of such nightmares see Note 4.

Consequently, all paper-based social and cultural studies depend on skilful navigation in an ever growing ocean of information of diverse quality. In an extensive mass of data and mass of commentaries a single page may contain startling truths or outrageous lies, and the difference between the two may be only discovered and highlighted by words printed on some other page, some other time, in some other publication. The chances that a direct physical link between such two documents will ever be formed are non existent.

4. The hierarchy of scholarly publications

Obviously, no cultural research publication occurs on its own. Cultural research is always situated within the overlapping contexts of an already existing body of relevant knowledge. These contexts are always present in the form of references to and acknowledgments of the key aspects of earlier research and publications. The amount and kind of references made to previous studies naturally vary from one author to another. However, certain basic trends can be discerned (see Table 2).

Table 2
The volume of earlier material quoted by scholarly publications

Publ.type	Primary sources	Materials used* articles	books
Research papers	4	9	27
Monographs	17	103	93
Syntheses			

atlases**	4,335	26,265	23,742
maps***	20	119	107

* For details of these materials see Note 5
** 'Average' historical atlas is based on data from 27 earlier atlases and 255 books.
*** 'Average' historical atlas contains approx 221 maps

Thus, an average research paper in the field of Asian studies seems to use about 40 other publications. The corresponding knowledge-base of historical monographs, in turn, is about 200 positions strong. The knowledge-base of large scale syntheses such as historical atlases is, unsurprisingly, much wider. Such works make use of about 54,000 publications. Of course one should expect a considerable overlap between the bibliographies used to produce each of those publications. Unfortunately, there are no readily available data on the extent of such overlaps. Therefore, figures in Table 2 should be treated only as very rough estimates. They are useful because they point to the order of magnitude of the phenomenon in question. They confirm that in a world where the storage and display space is at a great premium it is not really possible for higher level publications such as encyclopedias or atlases to use verbatim **all** the information contained in the publications on which they have drawn.

According to the proverb, a single picture is worth 1000 words. Table 2 above suggests that a single map delivers data selected from over 100 books. This information is now neatly synthetised in the form of a graphic chart ranging in dimensions from a 'generous' 25x35cm (i.e. 875 cm2) to a half, one third, or even a meagre quarter of that area.

It is natural then that even the best background materials cannot fail to be used in an increasingly succinct and abstract manner. Therefore data, where possible, are aggregated. Their detailed annotations and discursive commentaries are either abbreviated or dropped altogether. Finally, details of their authors and publications start getting curtailed and, eventually, omitted. This wholesale process of progressive abstraction of the originally detailed information can be expressed in a form of Table 3.

Table 3
Four levels of generality in scholarly publications

Level of generality	Range of information	Type of publication
1st	data + source + context + methodology	research papers, journal articles
2nd	data + source + context	monographs
3rd	data + source	overviews, text books
4th	data	syntheses, maps, encyclopedias [also, newspapers & propaganda]

The table suggests that existing publications always face a fundamental dilemma.

The information that they offer is either documented in detail, but hardly of universal relevance, or is relevant, albeit terribly disembodied. In other words, a necessary level of generalisation is always achieved at a cost. Each time a publication aims to cover an increasingly large range of issues, geography or chronology, it inevitably risks an unwitting introduction of errors of omission, as well as the progressive loss of integrity. The latter happens because without the neccesary qualifying annotations, factual findings stemming from incompatible methodologies can be (and often are) wrongly conjoined.

5. The presence of errors in cultural studies

Blunders and mistakes present in paper publications tend to form two large groups: contagious and non-contagious ones. On the whole, verbal models seem to provide an environment where a factual error can frequently occur due to poor copy-editing or inadequate typesetting, but where it would remain largely innocuous. It is so because verbal models rely on the integrity of the overall logic of the entire argument and not on any particular value of it's variables. Some of these, such as dates, place names, or the names of the

chief characters, are of course crucial and, as such, tend to be proofread and checked very carefully. But other details are less important and thus any likely fault with them does not undermine the validity of the study in which they arise. For instance, Sir Steven Runciman in his monumental history of the Crusades commented on the march of some 20,000 people led in May 1096 by Peter the Hermit across the Kingdom of Hungary:

> "*The vast majority travelled on foot. Where roads were good they managed to cover twenty-five miles a day.*" (Runciman 1978a:124)

The point made by the sentence in question is that a greater speed of movement was achieved when pilgrims and crusaders walked along the well built and well maintained roads. It is a truthful observation, and it is not undermined by the fact that the stated value of 25 miles/day is impossibly high (Engles 1978, Elting 1997:463, Lewis 1997:142). Another and identical error occurs in his comment on two places in Asia Minor:

> Dorylaeum is "*22 hours' marching distance from Leuce ... To reach this point the vanguard would have to had to cover some 85 miles in four days.*" (Runciman 1978a:186-187).

Here once again the author incorrectly assumes that an army of several thousand men was able to do a forced march for four consecutive days at the improbably high speed of 6.2 km/hr. For discussion of what constitutes real-life marching speeds see the Note 6.

A third example of a non-contagious error is offered by Map no. 13 "Central Europe" published in the vol 10 of 'The Cambridge Ancient History' (Cook et al. 1934:346-347). There, in addition to locations and names of major cities comprising the Augustian Empire (44BCE-70CE), is also a dot surreally marking the city of Berlin, that is a settlement which came into existence only in Medieaval ages, in the 1230s (New Encyclopaedia Britannica 1974:733). This blunder is so simple, so monumental, and so divorced from other information conveyed by the map, that it is unlikely to be ever transferred to other publications. It can be concluded, therefore, that as long as blunders do not alter essential relationships between other variables within a verbal or graphic model, they stay mostly harmless. Such mistakes tend to remain isolated, and eventually forgotten.

Unfortunately, this is not the case with some other errors. It is especially so if they occur in the context of some more rigorous and more demanding graphic or numeric model. In these more tightly integrated studies, the variables, by definition, form the sinews of an argument, and the foundations of a thesis. Therefore, any errors, if present, are very difficult to eradicate.

For instance, among the many charts comprising the '"Times" Atlas of World History' there is a map entitled "The economic life of the Roman Empire" (Stone 1989:91). In that map, among the many lines signalling the existence of communication links between various parts of the empire of the 2nd c. CE there is one representing a merchant sea route joining Italy and Egypt. A legend attached to the line states:

> "*Alexandria-Puteoli 15-20 days (fastest 9 days)*." (Stone 1989:91)

This is a curious and treacherous observation. It is true that Roman merchant ships (as distinct from oar-powered warships), equipped with a square sail, could catch NW winds prevailing throughout most of the sailing season along the route between Italy and North Africa, and thus reach the Egyptian port in no more than 15-20 days. Hoverer, any journey in the opposite direction - one that would face the adverse winds without the aid of a movable triangular i.e. 'lateen' sail (an Arabic invention of the 8th c. CE) - would have to be necessarily more cumbersome and slower. Casson estimates (1984:15) that such a journey's length would be in the vicinity of 40 days. He also points out that this miscalculation is a simple, but nevertheless common error of reasoning. It was first committed by Oertel (1934:387) in an article commissioned for the vol 10 of 'The Cambridge Ancient History' (Cook et al. 1934). This error managed to remain undetected by the editorial team in charge, published and accepted in good faith by other historians, and reproduced without any qualms 55 years later by the editorial team of the '"Times" Atlas of World History'.

A similar problem can be spotted in numeric models. If we look at the already mentioned ESCAP Population Data Sheet (ESCAP Population Division 1994), we can notice that the table, printed on a 49x60 cm (2940 cm2) chart, aims to provide historic data plus their extrapolations for 53 individual countries and five major regions of the Asia-Pacific area. However, despite its authoritative parentage - there is no doubt that the UN's ESCAP Population Division is a well resourced and a serious research organisation - the Data Sheet presents a number of problems.

Firstly, there is a key omission, motivated by political, i.e. un-scholarly considerations. The table provides absolutely no data on the approximately 18 million people living in Taiwan, while being quite detailed about the demographics of the two thousand inhabitants of the Pacific island of Niue. At the same time it does not offer any indication on the fate of the missing information. It does not state whether the demographic and economic data for Taiwan were/were not included into calculations for some other country (such as, for example, PRC). Secondly, although statistics for each country are annotated with details of a source from it was derived, there is no indication with regard to the methodology employed to calculate reference values for the 37 countries in question. In some cases more than one source was consulted and we are not told which of the sources where ultimately used. Thirdly, the table offers no explanation of the methodology used in calculations. Was it an extrapolation of some kind derived from the analysis of figures available for the years 1990 through 1993? or, was it a simple carry-over of values of the most recent year? There are tacit problems as well. The ESCAP numeric model of Asia-Pacific populations provides no indication on the temporal range of data (i.e. last two years, last five years, last decade etc.) used while computing such key variables as the annual growth rates, life expectancy at birth, fertility rate per woman and so forth.

In short, ESCAP figures collated and made available world-wide are not only incomplete but also they are distributed **without any reference** to any underlying methodologies and assumptions. The statistical figures are collated, printed in thousands of copies, and distributed without any built-in means for any subsequent independent checks and controls. The ESCAP materials can be concluded, therefore, to be **unscientific**. They are unscientific because they represent public and oft quoted authoritative statements, but of the type which cannot be critically scrutinised by their recipients and users (Popper 1969).

Unfortunately, as we have already observed, there is no logistical mechanism through which authors and publishers upon discovering a mistake in the printed data could systematically flag and correct the error all over the world on pages of all copies of all books which are known to contain it. Therefore, it is inevitable that blunders of the magnitudes just described, and greater, will persist un-checked and have a potential to contaminate and hinder any of the subsequent researches.

This pessimism is justified. The separation of data from their sources and their methodologies, so obvious in the ESCAP numeric model, is a common trait of many of the contemporary higher levels syntheses. An analysis of 106 maps with information on the trade routes of Africa, Asia and Europe proves the point (see Table 4).

Table 4
Problems with the maps published in five selected* historical atlases

Shortcoming	Percentage of maps displaying the problem
No time-frame	9%
No legend/key to symbols	12%
Factual errors present	20%
No lat-long grid	53%
No source of information stated	68%
Incomplete annotations of data	69%
No scale is specified	74%
No projection is specified	100%
Total	106 cases (100%)

* atlases analysed: Putzger 1963, Shepherd 1976, Scarre 1988, Stone 1989, Vidal-Naquet 1992

Therefore, there is not doubt that the above atlases suffer from a number of serious data-management problems. That some 9 percent of maps published in historical atlases carry no information on the time period to which they are supposed to pertain, is only one of the nasty surprises. The discovery that no less than 20 percent of these publications contains a major error of omission or commission is another revelation. However, the greatest of all of them is the truly unnerving discovery that in 68 percent of cases the drawn maps are unable to provide even a slightest indication about the identity and nature of the publications which they supposedly summarise and whose intellectual content they present *urbi et orbi* in full colour and typographic splendour.

Does it mean, that upon approaching a certain level of abstraction even the most ambitious of projects turn painstakingly collated data into a mere coffee-table books? Does it mean that once we try to distil wisdom from some 50,000 books and journal articles we are forced by the very nature and economics of the prevailing technology to produce a mere collection of untrustworthy, therefore useless pictures? Does it mean that high level syntheses are something to look at, but not to take seriously and definitely not to rely on in one's own work? Does it mean that cultural studies might essentially be a massive yet a non-cumulative enterprise? I am afraid it might be so.

6. The dilemma of cultural studies

From what has been considered so far we can conclude that paper-based cultural studies seem to be afflicted by a deeply rooted and possibly un-eradicable contradiction:

Low level and grainy studies are cumbersome for the task of developing a universally legible global picture of cultural phenomena. It is so, simply because they are not constructed in a manner which facilitates a global interchange of data and dovetailing of conclusions. Such studies also tend to be much too idiosyncratic, too 'messy', and far too context-specific. High-level studies, on the other hand, are able to provide much prized clarity, better understanding of the subject-matter and a fresh insight, but ultimately - as we have observed before - they are not fully checkable. This happens - as has been the case with the best selling Cultural Atlas of China (Blunden and Elvin 1998) - when the work is prepared to the exacting scholarly standards, but, subsequently, most of the apparatus gets suppressed by the packager or publisher for reasons of space and cost (Elvin 1999).

The sad truth is that, some 25 hundred years since Herodotus, and 19 hundred years since Ptolomaeus, we are still unable to know with much certainty:

1. what primary materials have been actually used to create a particular set of conclusions;
2. what conclusions have been reached on the basis of a particular set of data;
3. how to check and then repair data speedily, simply and inexpensively and re-draft related conclusions when an error in either of them has been located.

This surely is an unhappy state of affairs. My purpose of pointing to it is not to whinge and bemoan it. Nor is this an occasion for witty observations and clever remarks. Rather, the above analyses and observations are undertaken to ascertain for myself (and interested colleagues) what are the likely invisible boundaries to the work we have been doing for so long and so energetically.

Therefore, this paper is akin to an investigation of the technical limitations of car traffic as opposed to railway traffic or air traffic. The realisation that trains, upon reaching certain speed inevitably will loose traction and are prevented from travelling any faster, is a very practical finding. Similarly useful is a reminder that passenger and cargo planes are unable to travel at speeds below their built-in stalling speed. These observations simply tell us about the performance and efficiency one can legitimately expect of a given technology in a given range of contexts.

So a question arises, if the use of paper for storage and display of scholarly work inevitably leads, as soon as our syntheses become increasingly global in scale, to drastic over-simplifications, incompleteness of glosses, and occurrences of structural as well as random errors, what is the key reason for which these problems

cannot be rectified? Well, the answer to this question should be by now self-evident.

The loss of confidence with which we can approach the high-level generalisations occurs because the necessary **permanent links** between **data** and **interpretations**, that is links between the source materials and inferences, **are** typically **lost** or broken. Let me reiterate: It is not the existence of mistakes and errors in the published materials *per se* that worries me here. Let's be realistic - we are all human. We all have made - at one point or another of our researches - an error or two or more. The problem I am concerned with is more fundamental. Given that errors or oversimplifications are unavoidable and they always find a way into our work, the question is - will we be ever able to track them down if necessary and repair them as a matter of fact, as another part of our work routine?

7. Is a shift to the electronic medium a solution? 3 answers...

So, paper-based scholarship seems to has reached its natural limitations. Its ongoing growth and wellbeing are daily undermined by the logic of the very medium that the scholarship depends on. A question therefore arises with respect to the future of cultural studies. Can we, should we, bypass these limitations by switching our work to another medium, say to the electronic medium, to the realm of digital files, intelligent software and the Internet?

The answer to this question is again, like Ceasar's Gaul, three-partite: yes, no and perhaps.

Yes, we can take advantage of the electronic medium because it has a number of favourable characteristics:

- Electronic storage of even very large volumes of information is now inexpensive. Hence, there is no need to aggregate raw data. Our scholarly apparatus and appendices can be as detailed and complete as we wish. Our verbal, graphic and numeric models can be as ample and rich, or as skinny and tentative as necessary.
- The cataloguing of digitally stored information can be made automatic and reliable, without the author's or librarian's intervention. A multitude of web-crawling spiders and agents already roams the Net on hourly bases. Entire collections of documents and data-sets, no matter how small or how large they are, can be fully and adequately tracked;
- The location and retrieval of networked data can be made very fast. Any string of characters - and increasingly often, any sequence of pixels - is now globally findable and globally downloadable.
- Online GIS systems become ubiquitous. Complex information can be arranged into arrays of individually or jointly accessible layers. Each layer of information can generated afresh in a few moments from both highly aggregated and highly granular data.
- Vector-based GIS systems are not constrained by the scale of the objects they handle. A single electronic display system can be as detailed or as general it needs to be. It can handle information at all scales, ranging from a 1:1 (in order to show the right arm of an ancient sculpture in a historic garden) to 1:125 mln (in order to show patterns of distribution of languages, political systems, and religions across the entire planet).
- Live data sets (as opposed to 'canned', or prepackaged ones) can be easily maintained online. Therefore, data can be not only made accessible to all interested parties, but they also can be easily repaired and enhanced, whenever the need for such intervention arises.
- For the first time in humanity's long history, the Internet offers a unique opportunity for endless and iterative error-correction and perfectibility (Raymond 1998, Ditlea 1999) of information released into the public domain. The initial product does not need to suffer from the inflexible publication-deadline syndrome. It can be worked on and refined and updated before as well after the publications stemming from it having been placed online (see also Note 7).
- Dynamic, i.e. on-the-fly graphic and numeric displays (as opposed to more traditional prepackaged displays) can be fairly easily arranged for. A high-level syntheses can be always generated afresh, on the basis of the most current (and, hopefully, more correct) rich and un-aggregated data;

However, to be honest with ourselves we need to also answer the above question in the negative. **No**, we cannot really take advantage of the electronic medium because:

- Despite the fact Net is now over 30 years old (The New York Times 1999) and the Web is no less then 8.5 years old (Ciolek 1998) we still keep using them as substitutes for the paper-world. We continue to think of the electronic media as a special case of inexpensive and fast-transmitting faxes. Even the repertoire of our Internet keywords alludes the paper-made objects: we talk excitedly about electronic papers, electronic books and e-journals.
- We also continue to propagate, consciously and otherwise, the primacy of conclusions over the data from which they stem. We appear to value more the elegance of verbal arguments than the cleanliness and integrity of the information on which these arguments rest. The higher social ranking enjoyed by those who write papers and books as compared with to those who verify and compile bibliographies and maintain resource catalogues confirms this point.
- The truly new uses of the Internet, those which go beyond our current attempts to replicate in the digital format tools and resources hitherto known from the world of paper, implies the emergence of distributed, open-ended, and large-scale collaborative research initiatives.
  Such projects will inevitably center on the construction and use of countless arrays of electronic data-sets whose maintenance and evolution might continue well beyond the life-time of a particular task, of a particular publication, funding arrangement, or even the life-time of its original creators and maintainers. But if the prestige and importance is attached to projects and not to their personnel, how shall we rate a scholar's performance?
- The identity and well-being of such novel projects will necessarily have to take precedence over those of the contributing scholars and data-librarians. Such a hypothetical social arrangement, however, goes against the very grain of current employment and promotion policies of the Academia. (see Note 8).
  This means that an effective shift to the new technology is, at present, activley undermined and inhibited by the prevailing social and micro-political practices and customs. The contrary statement can also be made - existing social structures and policies of research institutions are very much threatened by the Internet-influenced shifts in the role and definition of scholarly work.
- There is no known mechanism, no known software (so far) which can be used to establish and preserve simple, persistent and, importantly, **bi-directional** online coupling between
  (i) data;
  (ii) all their transformations;
  (iii) all conclusions based on them.
  While the digital world promises, in principle, seamless tracking of the data's legacy information, all such operations would need to be made explicit and fully meaningful to a human operator. This means that any postulated bi-directional hypertext links need to be not only interoperable across a wide range of software and platforms but fully legible to daily users too. Also, any problems the legacy data may present need to be easily correctable by ordinary users. In short, if the digital world is not going to tyrannise and dummify its beneficiaries all it's component parts need to be made simple, intuitive, transparent, and repairable - not by software wizards and networking experts - but, like the WWW files, at the user's end. A tall order indeed.
- The network, although capable of transcending paper's traditional limitations of space, is itself severely constrained by issues of **time**. Software-engineering and ergonomics studies confirm that a task whose length is perfectly legitimate and acceptable in the world of paper, is perceived as excessively and insufferably long whenever it involves computers and exeeds the 10 seconds (sic!) limit (Nielsen 1994,1997; Buckingham 1996). Thus electronic operations which do not provide instant gratification to their audience and ample feedback on the progress of the transaction; are unlikely to be readily engaged in. This is a serious issue, especially that studies of Northeast Consulting Resources (1999) hint that despite overall improvements in the network speeds, the Internet may not be really able to sustain performance-based applications in the nearest future.
  Moreover, a crucial point: it is likely that the Net contains a multitude of other mechanical, logical or logistical limitations, whose existence and possible adverse consequences to our scholarly work, are - at present - simply uknown and invisible to us.

Finally, an answer to the question about transcending the boundaries of paper-based scholarship by switching to the electronic medium might be simply given as a hesitant and inelegant **perhaps**. Who knows, maybe the networked digital medium will provide the required solution after all. It might be so, because:

- Our prevailing attitudes to, and relationship with information are not static and they may change. We may earnestly wish one day, for example, to do the work we do, not only more easily and more quickly - but also more **accurately** and more **reliably**.
- There is also another reason for the qualified optimism. The Internet and its tools do not cease to evolve and improve. What seemed to be revolutionary a few years ago, is now a part of an elementary technical and intellectual milieu. After a few month on the Net, even the magical and unfathomable invention is domesticated, taken for granted and incorporated into routine. The innovativeness trots on. The last major reshaping of the Internet occured in 1995 (Ciolek 1998). It was the moment when the Web crawlers commenced roaming the Net in search of the data and started bringing them back to feed batteries of ever-clever search engines. The previous revolution was that of May 1991, when Tim Berners-Lee, Robert Cailliau and a team of software engineers in CERN, Geneva devised a simple method of building of
  (i) general purpose
  (ii) Internet-based archipelago of
  (iii) unstructured data (texts, images, numbers)
  (iv) connected by a world wide web of
  (v) one-directional hypertext links.

  Therefore, we may assume fairly safely some eight or nine years after that momentous invention, that it's time to take the next step. This may happen in the next few days, or in the next few months, no one really knows when: another team of boffins is bound to devise simple tools for creating a brand new
  (i) general purpose
  (ii) Internet-based archipelago of data, this time carefully
  (iii) **structured** ones and
  (iv) spanned by a world wide web of
  (v) **bi-directional** hypertext links.

This, if we think about it, is not such an impossible scenario after all. If this happens, a two-way communication and well calibrated interaction between low-level and high-level studies might become possible for the first time since Herodotus.

When this happens, this will truly be a development of unimagineable consequences, both to our research practices and to all social institutions of which we are a vital part.

8. Notes

Note 1 - Numeric models of society

I am grateful to Prof. Mark Elvin for drawing my attention to the role Gregory King and Francois Quesnay have played in developing 'Political Arithmetic' (population statistics) as a methodical and scholarly operation.

Note 2 - Postal charges and publication weight

The maximum weight of a publication depends on existing schedules of postal charges. For instance, each issue of a semi-annual journal, 'Australian Archaeology' published by the Research School of Pacific and Asian Studies, ANU in A4 (i.e. quarto) format, contains exactly 76 pages, so it can stay just under 200 g (Andrews 1999). This 0.2 kg limit is Australia Post's cut-off point for the concessionally priced printed-matter.

Note 3 - Book and paper sizes

Book sizes were traditionally measured by number folds to a leaf of paper of a base size. One leaf (i.e. plano) if folded, creates a folio, if it is folded again, it creates a quarto, and so forth. These *logical* sizes have been assigned various numerical values. For example the generally accepted formats of books in the 20th century are:

Name	Abbrev	Max Book Length
Tricesimo-secundo	32mo.	5" 12.5 cm
Sextodecimo	16mo.	6" 15 cm
Duodecimo	12mo.	7" 18 cm
Octavo	8vo.	10" 25 cm
Quarto	4to.	12" 31 cm
Folio	fo.	over 12" 31 cm
Elephant Folio		up to 23" 58.5 cm
Atlas Folio		up to 25" 63.6 cm
Double Elephant Folio		up to 50" 127.0 cm

Src: Ventura Pacific Ltd 1999

Now, toward the end of the 20th century world book sizes are governed by ISO 216 paper size system (Kuhn 1996). In the "A" (European) standard, the base leaf is 1m sq (841x1189 mm or 33.11x46.81 in).
The ISO specification generates the following sequences formats 4A0, 2A0 - special publications; A0, A1 - technical drawings, posters; A2, A3 - drawings, diagrams, large tables; A4 - letters, magazines, forms, catalogues, laser printer and copying machine output; A5 - note pads; A6 - postcards; B5, A5, B6, A6 - books (eg. the width and height of a B series format is the geometric mean between the corresponding A format and the next larger A format); B4, A3 - newspapers.

In addition to the world ISO 216 standard there is also a slightly different set of North American standards (ANSI/ASME Y14.1 and ANSI X3.151-1987.), not fully compatible with ISO 216, and it uses as the base a paper leaf which is 34x44 in.

For details of Text Encoding Initiative's (TEI) work on the SGML markup of data dealing with physical sizes of various books see Bauman and Catapano (1997).

Note 4 - The removal of printed material from circulation

It was only in totalitarian countries like Soviet Russia (1917-1991) or communist Poland (1945-1989) that a costly, complicated and ineffective retrieval and substitution of an inconvenient printed material could be ever contemplated. In the case of the Soviet Union, editors of the Great Soviet Encyclopaedia made an energetic approach circa 1954 to all libraries and research institutes owning the reference book in question. They requested them in writing that they cut out from one of the volumes (and destroy, of course) a page with an article about the Bering Strait and replace it with the supplied page containing a brand new and greatly extended article about that geographic region. The actual point of the exercise, however, was to accomplish a quick and surreptitious removal of a nearby article with a laudatory biography of the KGB's head, Lavrenti Beria. Beria was one of Stalin's henchmen, who in July 1953, during a power-struggle upon Stalin's death in March that year, was ambushed, arrested and executed by his Politburo colleagues. Subsequently, the editors of the Encyclopedia were instructed by the new rulers to replace the now compromising material with a shorter, and a less brown-nosing note. Apparently, the ploy succeeded only partially, as many owners of the Encyclopedia disobeyed the official directives and simply stored the old and new Beria's biographies side by side (Besemeres 1974, Elvin 1999). A similar procedure, and with similar result, was attempted in Warsaw in 1966, when the wording of an encyclopaedic article on Nazi concentration camps of the WWII drew criticism from the Polish communist party bosses. A replacement article was promptly produced by the PWN publishing house, and distributed free of charge to all subscribers to the series of the 13 volume Wielka Powszechna Encyclopedia.

Note 5 - The size of scholarly apparatus

The number books and journals required to produce a new publication can be calculated as follows:

Journals:
an inspection of bibliographies contained five consecutive articles published in a recent issue of the ASAA's Asian Studies Review reveal the following values. Morris-Suzuki (1998) - 1 primary source, 13 articles, 28 books; Reid (1998) - 2 primary sources, 9 articles, 28 books; Goodman (1998) - 15 primary sources, 12 articles, 21 books; Bapat (1998) - 0 primary sources, 7 articles, 16 books; and Ip et al.(1998) - 0 primary sources, 6 articles, 41 books).
These preliminary figures suggest that, an average journal article uses 4 primary sources, 9 other articles and 27 books.

Monographs:
an inspection of bibliographies contained in the three publications Adams (1976), Engels (1978), Casson (1984) provides the required data. Adams in his monograph made use of 17 primary sources, 95 journal articles and 76 books. Engels in his study referred to 10 sources, 120 articles and 126 books. Finally, a collection of 12 essays by Casson, were estimated to contain references to approximately 24 sources, 94 journal articles, and 76 books.
These preliminary figures suggest that, an average book represents information derived from 17 primary sources, 103 articles and 93 books.

Syntheses:
an inspection of bibliographies contained in five historical atlases such as Putzger (1963), Shepherd (1976), Scarre (1988), Stone (1989), and Vidal-Naquet (1992) shows that an average historical atlas contains approx 221 maps which are based on 27 earlier atlases and 255 books.
Since the monographs data above indicate that each of these each of these books appears to recapitulates 17 primary sources, 103 articles, and 93 still another books we are able to obtain the following estimates: sources (255*17) = 4335; articles (255*103) = 26,265; books (255*93 + 27 atlases) = 23,742.

Note 6 - Movement rates of armies

The 25 miles/day or 40.2 km/day rate of movement, as reported by Runciman (1978a:124) could be attained only by an individual or two. It is however absolutely unachievable by large masses of men and animals moving along a narrow ribbon of a road. Most probably, then, Runciman is talking about the speed 25 km/day or 15.5 miles/day. This revised value is still very high, but more in step with the marching speeds of the highly fit, superbly drilled (Dodge 1890) and disciplined Macedonian army (comprising infantry, cavalry, followers and a baggage train) who covered the distance Babylon-Susa at the average rate of 12.3 miles/day [19.8 km/day] (Engels 1978:153).

Note 7 - Perfectibility

According to Ditlea (1999), iterative perfectibility is a major concern of Donald Knuth's, the now-retired Stanford University professor, and computer programming guru. "The only e-mail address Knuth maintains gathers reports of errata from readers of his books, offering $2.56 for each previously unreported error. (The amount is an inside joke: 256 equals 2 to the 8th power-the number of values a byte can represent.) Knuth's reward checks are among computerdom's most prized trophies; few are actually cashed.

He takes this error business very seriously. Engraved in the entryway to his home are the words of Danish poet Piet Hein:

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The road to wisdom?
Well it's plain
and simple to express:

Err
and err
and err again
but less
and less
and less."
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Note 8 - Promotion criteria

As far as the today's norms are concerned, it could be very difficult to argue successfully that Ms X or Mr Z deserve the tenure not so much on the basis of their intellectual contribution to the body of world's knowledge in the form of peer-reviewed articles and books on, say, the burial practices of Ch'an monks of Song Dynasty of China, or the numismatics of Cyprus, but rather on the strength of their contribution to a SGML mark-up of a series of primary sources dealing with these Ch'an burials, or in terms of geo- and chrono-referencing of all archaeological sites world-wide where Cypriot coins were uncovered.

In other words, in order to transcend the existing boundaries of a paper-scholarship we need to pay less attention to the scholarly **uses** of information and more to the scholarly **creation**, **structuring**, **enhancements**, and **maintenance** of such information.

9. About the Author

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10. Acknowledgements

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12. Version and Change History

- 15 Dec 1999 - added notes on Gregory King and Francois Quesnay.
- Revisions, so far, incorporate minor editorial and markup fixes.

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