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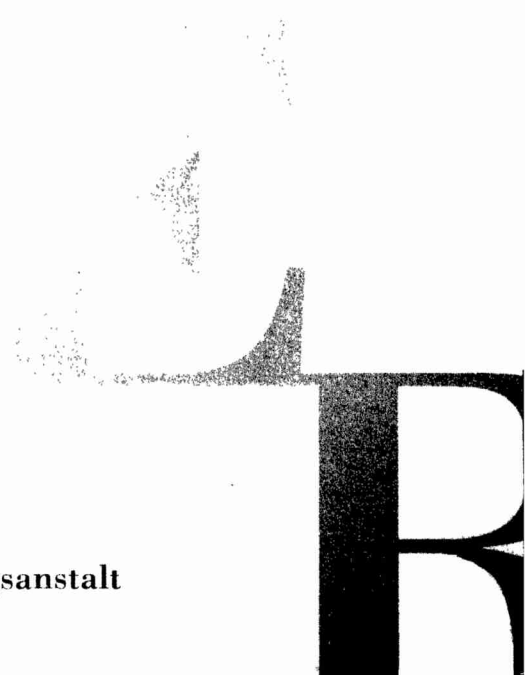
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From Detailed Grant-in-Aid
to Single Line Budget

ESKO HÄKLI
National Library of Finland, Helsinki[*]

The traditional budget

In the past, state institutions had a limited freedom in the use of their annual recurrent grants. The purpose of the grant was prescribed in great detail by the financing bodies. Additionally, the money had to be spent within one fiscal year. The institutions' rights to earn money and to keep it were restricted. Thus, libraries received separate allowances for different purposes. It was not possible to transfer money from one expense heading to another.

The fiscal regulations were accompanied by other, equally detailed, regulations. In many countries for example, the staff structure was regulated by the government or was based on a law covering the whole public administration. Requirements on staff qualifications were strictly controlled and here the trade unions often played a dominant role. Thus the hands of the library directors were bound in many ways.

Regulations and control executed centrally have long-standing traditions in public administration. Seen against the background of responsibilities the old practice was both convenient and

inconvenient. It limited the freedom of the managers by restricting their rights to reconsider the needs of the resources and to reallocate their budgets. It was not the fault of the manager if the money was not reallocated appropriately for different purposes. To make things run smoothly, managers often had to develop creative accounting, sometimes questionable from the legal point of view. On the other hand, the old budget system did not set any requirements, either qualitative or quantitative, on the managers, other than to spend the public money sparsely. Goals were set by the institutions themselves and usually based on continuity and some increase of the volume of their activity. In other words, there was quite a lot of freedom in the actual use of the budget.

Services: From control to shopping

Many countries are at the moment in the process of adopting new budget principles for public administration. Governments want to improve productivity and reduce costs. The remodelling mainly follows the patterns of private economy and will take place gradually. Whereas the old budget principles controlled spending, the new practices emphasise achievements and price.

At the same time, many state activities have been privatised or turned into state owned companies (e.g. in Finland, the PTT). Parts of the remaining duties are liable to be contracted out. That means that even if the government still feels itself responsible for such services, it prefers to buy them, often from the private sector.

In a country where single line budgeting has been introduced, state institutions receive as their recurrent grant-in-aid a sum of money for which the precise use is not specified but from which all expenses have to be covered. In many countries, institutions are entitled to transfer money from one year to another. They are also encouraged to earn revenue. In some countries, libraries would not be able to fulfil their duties without income to supplement their grant-in-aid.

In this new era the financing bodies are buying services from their institutions. They are very interested to know in what they will receive for their money. Arriving at a budget requires annual negotiations between the institutions and their financing agencies.

Being accountable is not only a fiscal issue; it brings about the need for major changes in the structure and management of institutions. It requires management to have freedom of action. It consequently requires new ways and conditions of working.

It is unfortunate that the present need to cut public spending has coincided with the introduction of the single line budget which is interpreted as a new way of imposing cuts. The adoption of the new budgetary practice has therefore not been welcomed. This has overshadowed the opportunities which reform could offer.

How the change takes place

In my country the process has been lengthy. The change has been introduced step by step:

- a number of budget accounts for different types of expenses were merged together, giving institutions more flexibility in the use of the money.

- institutions were given the right to transfer money from one year to the next.

- money granted for maintenance of buildings and renting of premises was amalgamated with other expenditure; as a result, institutions now have to pay rent for their premises which they had hitherto not been charged to use.

- allocations for salaries were also put into the same block sum, in a two-staged process: 1) money from the salaries budget can already be transferred to other functions, but the number of permanent staff is

restricted by the government; 2) as the next step, salaries will be paid out of the same purse as all other expenses and the money can be reallocated freely. It goes without saying that institutions have to calculate their long-term staff costs with great care.

At the same time, the legislation was revised in several other ways, e.g.

- the old law on civil servants was replaced by one which limits the number of permanent posts. Every time a post becomes vacant, the continuing need for it has to be reconsidered.

- laws and statutes regulating staff qualifications were changed and the requirements relaxed; with few exceptions institutions are allowed to appoint the staff they feel are best fitted to their needs; the new practice emphasises the needs of the employer more than the rights of individuals.

- laws and statutes on the internal structure of the institutions have been relaxed and universities will within the next two years be governed by new legislation common to all universities. The new legislation will be very general and the future of faculties will be left to the discretion of individual universities.

- a new law on charging for services of state institutions was enacted.

Consequences

The new budget principles enable institutions to decide how to achieve their goals and allocate their money. At the same time,

financing agencies are becoming very interested in the results of the work and in prescribing the goals. These controls are more noticeable than the fiscal restrictions that they replace. The new controls are, however, an integral part of accountability.

The institutions can:

- deliver services itself or contract them out

- freely choose and appoint the staff they need; libraries can also engage staff with qualifications other than librarianship

- revise the staff structure without permission from the government

- reallocate funds

- earn and keep revenue earned

- borrow money from the government for bigger investments; there are, however, restrictions to accumulate money in advance during a longer period of time.

In today's climate, when funds are reduced, the single line budget has put a new type of pressure on management. As far as financing is concerned, all activities compete with one another. There are no protected areas. This is one of the biggest changes. We are not used to comparing and contrasting totally different types of activities with one another. In the case of my Library it has also proved difficult to accept the fact that the Library has to be treated as one organisation and not as a conglomerate of several organisational units each with its own priorities.

The second big change is that the new budgeting principles aim to persuade the institutions to deliver only those services which are absolutely essential. In principle it is the paymaster who will decide what services are needed. At least in Finland we have

not reached that stage and I cannot imagine that the selection of the services would be done single-handedly by the Ministry of Education. The final selection must be the result of a dialogue. This means, however, that everything will be questioned and it is up to us to succeed in convincing our paymasters that the tasks and activities we propose are all worthwhile.

From a strategic point of view it is important to analyse the core functions of the library and determine their costs. A continuity in key service provision is essential. Because the annual grant-in-aid is to be allocated on the basis of government requirements, measures will be needed to assess unit costs of service provision and other activities. Quantitative measures will also be needed not only to calculate the annual funding requirements but also to compare annual achievements from one year to another. Comparisons between institutions, however, will be problematic.

In this situation my Library is in the process of re-stating its mission. It has proved to be a tough task although one could assume that everybody knows what the tasks of the Library should be. The aim of the exercise is to identify the core services which the Library must provide. The next step will be to calculate the costs of the services, including all procedures and routines (mainly internal technical services and overheads).

After having defined the core services we believe we shall be able to look at the priorities to be assigned to those services more closely. It is already apparent that a new hierarchy of routines will emerge. Much of the traditional library work will belong to auxiliary, supporting routines, the costs of which have to be reduced. However, this conflicts with the traditional values of librarianship and is undermining the self-esteem of the profession. Technical services, including cataloguing, have traditionally been seen as the core of librarianship. In an output orientated library, however, they are simply costs which have to be minimised. Some would claim that all functions other than core services could be

outsourced. For a national library cataloguing may be one of the key services but it could not be classed in that way for most other libraries.

The traditions of the library profession are not supporting this type of change which is questioning core values. In connection with quality criteria, the conflict is even greater. Quality has traditionally been defined by using the criteria and traditions of the library profession. The values have strongly supported perfectionism in technical services. We can, however, no longer afford a level of quality which is not essential for users. A new question arises as to who is entitled to determine the quality requirements of library services. Even if this is a task for library management, it will have to be based on the real needs of the users. Easier said than done!

From my own experience I can say that librarians resist management interference. Heads of departments consider themselves to be the best authorities to decide what is necessary and individual experts jealously protect their own positions against their superiors as well as their peers and subordinates.

Performance measurement may prove to be a good tool for controlling everyday activities. It may be an appropriate tool for management if it helps the institution to achieve its goals. However, there are several problems connected with performance measurement. Not all indicators are relevant from a management point of view because they often seem to have been developed on the basis of traditional librarianship. Also performance measurement can too easily focus on technical processes and neglect the user aspects. Some American experts in organisational matters claim that services which can be measured are no longer core services and that they, therefore, can be outsourced. It is easy to overstate this but it is necessary to be aware that performance measurement has a limited value for library management. Managers have to be able to identify the key products of their institutions, based on a clearly formulated business idea.

Managers have to analyse the costs of these products in a realistic way, taking into account all cost factors, just as if they were operating a private business. Management need not put too much effort into detailed performance measurement but should concentrate on the analysis of the work chains necessary for the key products.

Assuming that we know what our library should be doing as top priority activities, we still have to look at the question of costs. Our paymasters are interested in cutting the costs. In addition to cutting non-essential services the reduction of costs is one of the few ways in which managers can increase the flexibility of their budgets. Overhead costs, which also include accommodation, are increasing and may lead to contracting out.

As to the costs:

- time has to be used efficiently by streamlining processes and eliminating unnecessary tasks

- time has to be used for activities in support of the library's key products

- work has to be done by adequately qualified and adequately paid staff; this calls for a new staff policy as well as a revised staff structure.

I have pointed out some difficulties and shortcomings in my Library's effort to adopt the new principles. We all have reasons to be self critical and to analyse the problems carefully. The traditional library training has not made libraries strong in business thinking and management. The same applies to directors. However, several projects have been launched in my Library. The aim is to eliminate internal barriers in the Library and to create a new type of team organisation, e.g. the acquisition and cataloguing routines of the different departments are being amalgamated into one internal service unit, which in the long run may also include

the National Bibliography. The aim is to create a unit which works like an internal service company, i.e. its services have to become cheaper and faster than the traditional ones. This requires substantial retraining. Several other rearrangements are going on. Common to all our efforts in this connection is the emphasis on horizontal work flow and the reduction of the traditional hierarchy.

One of the most difficult tasks, however, is to create a new hierarchy of values and get it accepted in the whole library.

Earning money

It sounds attractive that state institutions are encouraged to earn money and that they are allowed to keep their earnings. It is, however, not as simple as that. All costs associated with the products which are sold have to be covered fully, all overhead costs included, by income. The charged services cannot be subsidised from government grant. This is certainly the case in Finland and it has caused conflicts with the traditional view of the library profession that information provision should be free and indiscriminating. In my own library, staff influence the prices set by streamlining work processes and reducing the production costs. The Library is entitled to reduce prices accordingly.

Local versus common interests

The single line budget has been applied in Finland for only a short time and the experiences are still limited. Libraries are not yet accountable in the way that universities are accountable. Library budgets have been cut severely and arbitrarily because no pricing principles have yet been developed. The National Library is also a university institution and that means that the Library signs its annual agreement with the University. In order to solve the conflict between the local financing and the University's

national responsibilities, a special arrangement will be made with the Ministry of Education. Some university institutions, the National Library included, will receive special financing for their national tasks. The National Library thus receives the main part of its recurrent grant as a result of a decision made by the Ministry.

Within the framework of a single line budget, new problems have arisen with the wide range of duties expected of individual institutions. University libraries are the cornerstones of the research library network in Finland. During the last twenty years, a national scheme, with national resource libraries in different fields of science and learning, has been developed. Several university libraries have received additional national responsibilities. Hitherto, universities were proud of the national status of their libraries. Today, they feel it is an additional burden because their budget requirements have been assessed according to local needs. The conflict between national responsibilities and local financing will, in the most pessimistic case, only be resolved for the National Library. The single line budget is, in other words, fostering the egocentricity of individual institutions which may start to compete with one another. It is at least a good sign that the new government seems aware of the threats to state activities.

The Role of Books in Print in the
Russian Book Sector

HARTMUT WALRAVENS
International ISBN Agency
Staatsbibliothek zu Berlin - Preußischer Kulturbesitz

The recent political and economic changes offered Eastern European countries some advantages but also numerous difficulties which are, however, unavoidable in any restructuring of this degree. The German Democratic Republic turned out to be a special case as after the German unfication the existing infrastructure and capital resources could be used. Lack of experience in merging two completely different systems as well as psychological obstacles, and in addition the baisse of world economics, led to grave problems, nevertheless. The difficulties of other East European countries, without the option of adapting ready infrastructures, are much more serious, of course.

Let us look at some of the basic changes in the book sector:

Before the political change the situation was almost ideal for publishers in some respects. Namely, the demand for books was almost always larger than the supply. This meant large editions, even for rather specialized subjects (e.g. translations from Oriental literatures). While the book prices were low, also the costs were relatively low: Qualified staff was available at standard wages. As the publishing business was state-run, a strict cost-efficiency calculation was not required as long as the goals of public education and propaganda were reached. Therefore

highest-level scholarly texts could be published without major problems, but also popular and children's books in good quality.

If there was anything to complain about it was the lack of valuta to buy certain foreign titles (if one chose to consider the copyright), occasional shortage of paper and printing capacity, not rarely long delays until a title was finally due to be published, and limited publication options in the political-ideological field. Publishing, book-trade and libraries were well coordinated.

Publishing houses were usually just offices. The printing-shops were responsible not only for manufacturing the books, but they also supplied them to the state distribution firm which passed them on to the state bookshops according to a quota system. This worked usually well without creating too many difficulties. Nobody cared if a suburban bookstore received several copies of a Korean-Russian dictionary or a bulky Tibetan-Chinese dictionary which could not be expected to find customers. The libraries were part of this distribution scheme.

This system had a number of advantages from the point of view of planners:

- Publishers did not have to maintain warehouses, did not have to worry about marketing but could concentrate on the publication of good books.

- As even specialized literature sold well, not to say rapidly, marketing was unnecessary, at least on a larger scale.

- The low, subsidized prices allowed all levels of the population to acquire books.

- Owing to low prices and the book distribution according to quotas bookstores even in rural areas were justified also from the economic point of view.

- The libraries were able - by means of legal deposit, quotas or budgets to acquire the national book production (and those of socialist countries) to a satisfactory degree.

- Publications of socialist countries were usually offered in a representative selection through special distribution channels (e.g. friendhip bookstores). The customer had the option of getting desired titles there. This saved time and effort. Besides, sometimes titles were to be found there which were long out of stock in the country of origin.

The system had a few disadvantages, however:

- As soon as a book was published and distributed there was no use in trying to reorder it. The customer had the only option of visiting bookstores in the hope of locating a remaining copy. The chances were low, however.

- As the second-hand book prices were also low, selling one's own books was not attractive, except for material no longer used, or reasons of space. As to items in demand or rare titles it seemed more reasonable to keep them.

- The offer was too little diversified, and many customer wishes could not be filled.

- Publications from the capitalist countries were made available only in very limited quantities, mainly for financial and ideological reasons. These few copies usually went directly to the national library or other central scientific and research facilities.

- Subscriptions were possible in several countries only on the basis of the official post serials list. This drastically reduced the possible amount of titles while libraries complained about irregular shipments through the state distribution system. Direct supply from and negotiation with the publisher was not the rule.

This situation has changed completely in the meantime:

- Publishers release what they consider attractive and profitable.

- State subsidies have been reduced considerably, or cancelled altogether. This forces the major, in the meantime partly privatized, state publishers to rationalize drastically. A large number of small private publishers have established themselves.

- Book prices are subject to demand and supply. This means that scientific books have become expensive. Only popular material of usually low quality (entertainment, sex/crime, astrology, health books etc.) and high editions remain affordable (and attractive) to large audiences of customers.

- Lack of flexibility like getting accustomed to a new price situation, reduction of editions, increases of rents and salaries, have driven many state publishers, distributors and bookshops to the verge of bankruptcy. Private, parallel distribution channels have been established in some countries, e.g. book stalls in the streets which do not have to bother with rents and salaries; they offer only «sellers» to the public and calculate the prices themselves. This competition aggravates the situation of bookstores even more.

- In spite of reduced editions only a part of the stocks will be accepted by the retailers. Only if an item sells well they will want to order more. This forces the publishers to establish warehouses for their stocks.

- Under these circumstances the offer of individual bookstores or book-stalls will be even more reduced than in previous times, even if perhaps more titles may actually be on the market: The tendency is towards bestsellers and fast sellers; other titles will hardly be kept in stock by the retailers. Thus customers will not see many items in the bookstores, which may be available, however - the question is where to get them.

- Libraries are faced with similar difficulties - they also do not know what is available. Titles registered in the national bibliography may be long out of print, or may still be there after five years. Also information on prices and distributor would be helpful.

The described situation requires new means to make the books available to the customer, viz. to create a demand with potential buyers. This is done by publicity - advertisements, marketing, reviews, coverage in the media, prospectuses and brochures.

To coordinate supply and demand, to establish an information network for the book sector and to include the customer in this network, requires an improvement of the infrastructure. The first step is a directory of available books (*Books in Print, Knigi v nalichii*). This is a bibliographical reference tool that is customized to the needs of the book-trade, which lists the titles (records) of available books with trade-specific information (price, or price level, weight [for shipping], classification, subject headings, distributor etc.). Printed directories contain subject

indexes, or arrange authors, titles and keywords in the way of a dictionary catalogue.

Such a reference tool (in many countries now available on CD-ROM) has to be as up-to-date as possible. In contrast to national bibliographies records will be cancelled as soon as the books are out of print. The data are continually updated; new releases will be announced previous to publication (with date of publication), if possible. Changes (new edition, new price, paperback edition, new publisher etc.) are communicated by the publishers at their earliest convenience and included in the directory by the editorial staff. Editorial deadlines are fixed in agreement with the rhythm of publication of the directory. In order to cope with a large volume of work in a limited time span only titles with ISBN are acceptable. All changes of records, includings cancels, are effected by ISBN.

Advantages of *Books in Print*

A *Books in Print* directory has a central steering function for the whole book sector in a market-oriented economy - it coordinates supply and demand.

- It enables the publishers to provide up-to-date information on what they have in stock and what the conditions for delivery are.

- It informs customers what is available.

- For the bookseller it is the surrogate for hundreds and thousands of titles which may be interesting but which he may not be able to sell, or which he cannot accomodate in his shop for reasons of space and cost. The directory gives information on the available titles, and the customer may place an order.

- Even if the customer only refers to the subject matter, or remembers part of a title, the subject headings and key-words of *Books in Print* help the bookseller to find the desired titles, even when he is not himself familiar with the topic in question. Thus access is opened to publications that neither the bookseller nor the customer knew beforehand.

This refers to the bibliographical function of the *Books in Print*. Its real attraction lies in the option of using it as a basis for a nationwide ordering and distribution system which may even be linked with a trade-specific accounting system.

- As *Books in Print* contains bibliographic records which are uniquely identified by ISBNs, an order is very simple: It may just be the quantity desired and the respective ISBN. Such orders may be sent at reduced postage in many countries. Electronic communication (telephone, telefax, electronic mail) is also fast and cost-efficient.

- If a publisher is not also the distributor, it is necessary to indicate the distributor in *Books in Print*. These wholesalers are able to take care of distribution more efficiently than individual publishers. It is also easier for the bookseller to deal regularly with one, or few, suppliers instead of communicating with hundreds of publishers.

An efficient distribution system allows to fill the demand as indicated by incoming orders. This means, however, that it is only worth the publisher's and bookseller's while to order and deliver when the costs are reasonable. The indicators in this respect are, or may be:

-   A comprehensive distribution network. This may be the postal system which often offers reduced rates for book shipments. This may be a special network run by the wholesaler (by trucks).

-   Fast delivery. Most customers want to receive ordered books as soon as possible. They may be important for school or study, or they may be presents on a certain occasion. If the books do not arrive in time, the customer may refuse them, and bookseller and publisher will have to share the cost. If speed is a decisive factor, the following solutions may be considered:

-   The wholesaler decides on his own delivery system. Thus he will be in charge of the shipments himself and not depend on the lack of efficiency of other companies (e.g. the post). Book trucks run on certain routes, comparable to buses; the drivers often have keys to the participating bookstores in order to make deliveries early in the morning.

-   The wholesaler has large stocks (in major countries around 200,000 titles) which are available for immediate delivery. Thus the bookseller is less dependent on the direct cooperation of publishers.

-   The application of technical equipment and a good organization in the warehouse leads to unprecedented rationalization. Thus it is the guideline, e.g. in German bookstores to see orders accepted until 5 p.m. filled until 10 a.m. next morning, at least with regard to the 200,000 titles of the wholesaler's stock.

Demand and supply are directly connected. If small province towns send in many orders, then the distributor will be interested

in making fast deliveries. If there are only few orders, the delivery will take longer, e.g., because it would be too expensive to send a delivery truck just for ten books. Shipments by mail might even take more time.

It should be pointed out that the processing of orders and the distribution is nowadays done by ISBN; also the feedback in case of non-delivery («out of print», «out of stock») is ISBN-based.

Even central accounting may rely on ISBN. The continuous circle of supply and payment (or, remission) is handled more efficiently by crediting the payments to accounts, thus establishing in effect a kind of «book-trade bank» (in Germany the so-called BAG: *Buchhändler-Abrechnungs-Gesellschaft*). Instead of filling in forms, dealing with numerous banks, invoices and credits are balanced by this organization.

The ISBN also works splendidly in the fields of import and export.

- A bookseller may easily order books from foreign countries without knowing the respective languages - it is sufficient to indicate the amount of copies desired and the ISBN. The address and telecommunication of the publisher is to be found in the *Publishers' International ISBN Directory*, edited by the International ISBN Agency. Even Chinese or Egyptian books will be no obstacle - the bookseller will be able to read the ISBN, even if the rest of the book will be unintelligible to him.

- If the books in question carry ISBNs they may easily be listed in foreign *Books in Print*. This opens additional markets to the book-trade. A book in English, published by a Petersburg publisher, may find more customers in the USA and UK than in its

  · country of origin provided the booksellers find it in *Books in Print*!

Libraries

Is *Books in Print* only a matter of the book-trade? Are the libraries left out?

By no means:

- The more efficient and cost-effective the book-trade works, the better for the libraries. They also want their books fast and at low prices (when they cannot get them free of charge!).

- For domestic acquisitions *Books in Print* is the most important source - more important usually than the national bibliography. The main criteria for acquisition is, of course, availability. Books which are not available any more, are not of interest to acquisition librarians.

- The constant and continuous updating of Books in Print permits libraries to provide their patrons with the most recent publications.

- In some countries *Books in Print* and CIP (*Cataloguing in Publication*) are linked. This means that the same report that lists a title in *Books in Print* also leads to the CIP announcement (advance record).

- National bibliographies are usually not very fast regarding the cataloguing of new publications as the book has to reach the library first before it may be catalogued. This is done carefully, and often there is a cataloguing backlog, owing to staff shortage. Besides, the individual issues of a national bibliography are not always cumulated very often so that searching a title may mean going through a number of issues. *Books in Print*, however, provides the respective information often before the release, is always cumulated and

offers better access by means of subject heading, keywords, or dictionary catalogue arrangement.

Knigi v nalichii i pechati and the current situation in Russia

A real Russian *Books in Print* has been under discussion for the last two years, as the publication under the title Russian *Books in Print* (on CD-ROM, published by Bowker-Saur, London) is actually the Russian national bibliography. For the reasons mentioned, the national bibliography is not the ideal reference tool for the book-trade, and certainly not the basis to build the infrastructure of the book sector.

Now we have a handsome publication of 317 pp. before us, which has been realized in record time by the Russian Book Chamber, with the active support of the Russian Ministries of Culture and of Printing. This is a most welcome event and will remain a landmark in the development of the Russian book sector. Compliments to the compilers and supporters of this *Knigi v nalichii i pechati*!

It cannot be expected that a pioneer work is perfect. But as the book is on the table it will be easy to make a few amendments. May I make a few suggestions?

While price information seems to absolutely indispensable (who would order a book without at least having an idea of the price?) the current economic situation of Russia with a high inflation would make the indication of price levels more advisable. E.g., «M» might mean a price which is 10,000 rubles today but which may be increased by inflation soon to 15,000 rubles. The book-trade might provide monthly printouts (1 page only) which would give the current equivalents.

The current division into individual sections has certainly its merits, but for the book-trade it would be easier to have a simple alphabetic arrangement by authors and anonymous titles. This would permit to spot a certain publication within seconds. If a title

is not yet published but scheduled for publication, there might be a note: «will be published in January [etc.]». Subject headings, and the BBK notation may be added.

Very important with an alphabetical listing are full indexes: Indexes by titles and key-words, and, if possible, subject-headings. Such indexes would allow a comprehensive access to the contents of *Books in Print*, as many customers are not aware of the exact title or the exact spelling of an author's name. Sometimes they are only interested in the subject, without knowing about a specific publication. Let's assume somebody looks for a book on spectral analysis: An index providing key-words or subject-headings would easily lead to the desired information.

The electronic form of *Books in Print* (CD-ROM) should provide for the choice of data formats, i.e. there should be a book-trade which would allow the direct use of the records for ordering purposes, and a library format which would allow using the record directly for the library's catalogues.

The most important point is to customize the publication to the needs of the book-trade. If the book-trade does not adopt it there is little chance to use it for nationwide ordering and distribution purposes. This is really the first priority - if publishers do not publish, and if the trade does not distribute the books properly, the libraries will suffer, or continue to suffer.

There is no fault with profit-making in a market economy, provided it is not excessive. If the book-trade makes enough profit, they will be able to improve their services, and it will give them more motivation.

Books in Print does not primarily rely on technology and automation, helpful as they may be. The crucial thing about such a directory is an efficient organization of the updating process; this means there must be constant communication with the publishers who update the records by ISBN (e.g. giving out-of-stock information, new price, new edition etc.) Experience with similar directories has shown that at least 60% of the data undergo

changes during one year! Therefore the nitty-gritty of the routine work should not be underrated.

The Russian Book-market and *Books in Print*

The situation of the book-trade is not ideal. Let me just mention a few points where improvement seems necessary:

Transportation costs in Russia are very high, and in some cases prohibitive. It might be an idea to follow the example of other countries that offer special postal rates for «printed matter», and even very low «book-rates». A nationwide distribution system for books will be impossible without reasonable shipping rates. A book may have doubled its price after it has traveled from Moscow to Vladivostok, and both publishers and customers cannot be expected to cover these additional costs.

Considering that books are one of the most important media of education (in the widest sense), taxes on books seem to be too high. Many countries offer reduced tax rates for books, e.g. Germany 7% (instead of the general 15%), the UK 0%!

Russia was praised for an excellent education system, and many people hold university degrees and are very knowledgeable. If they do not live in the capital they are liable under the present circumstances to receive only a fraction of the current book production: Somebody living in Irkutsk may only see 20% of the new publications! Thus it would be in the best interest of the authorities to keep the level of education high and encourage a better book distribution, e.g. by tax cuts and special shipping rates for books.

In spite of some shortcomings, the present *Knigi v nalichii i pechati* deserves high praise; it needs support and cooperation on a nationwide level, and it will, after some modifications, provide the potential for a comprehensive ordering and distribution system!

РОССИЙСКАЯ КНИЖНАЯ ПАЛАТА

КНИГИ
В НАЛИЧИИ
И ПЕЧАТИ

КАТАЛОГ•1995

I
ВЫПУСК

Москва · 1995

1238. **Тысяча** и одна ночь. 11-12 т. (Малютка). — ТОО Эврика, 1994. — 3500 р. В пер. — 200 экз. — АООТ Центркнига.

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Digital Imaging of Papyri

A Report to the Commission on Preservation and Access

ROBERT S. BAGNALL
Columbia University, New York[1]

1. Purpose of the study

Fragments of the ancient writing material known as papyrus exist in at least a hundred collections in the United States and even more worldwide. Papyri pose significant challenges for both preservation and access: for preservation because of the damaged and fragmentary condition in which most papyri have survived, and for access because almost all research in papyrology involves studying pieces in many scattered collections. Sometimes fragments of a single papyrus may be found in several locations, and, still more commonly, related papyri are distributed in many libraries and museums. Published editions usually (for reasons of cost) include half-tone plates of only a selection of texts. Even with the growth of air travel in recent decades, visiting all relevant collections is rarely an option, and scholars are therefore faced with two unappealing choices: order conventional photographs usually slow to arrive and often prohibitively expensive, or use only published papyri and, even with those, be unable to check the editor's text. Color slides, experimented with in some European

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[1] Reprinted with kind permission from the Commission on Preservation and Access (Washington, D. C.).

collections in recent years, have some advantages over black-and white prints, but the quality and convenience of the viewing technology usually are deficient.

It has been clear for some years that digital imaging offers the promise of more satisfactory solutions to these problems. Digital imaging provides an opportunity to create a worldwide virtual library of images, freeing scholars and students no matter where they are located to study all relevant papyri in any collection. Such a 'library' would encourage wider use of papyrological texts in study and teaching about the ancient world and greatly improve the quality of research. At the same time, the ready availability of images could help reduce the physical handling of the original objects and thus help prevent further damage. These benefits also are relevant to the other writing-bearing objects generally classed with papyri, like potsherds (ostraca) and wooden tablets. Classes of manuscript material have similar characteristics and, findings about digital imaging may have relevance for them as well.

Before major projects get underway, however, it is important to determine how to accomplish imaging so that research and teaching objectives will be achieved. Early in 1994, the American Society of Papyrologists established a committee charged with studying imaging and other current technological developments and establishing standards for the field. Out of this committee grew an interinstitutional project for an Advanced Papyrological Information System (APIS).[2] A contract with the Commission on Preservation and Access supported a study of the imaging

2 APIS was planned to take advantage of recent developments in digital technology to integrate images, texts, cataloging, and bibliographical resources in a single system for research and education. The six U.S. partners in the first phase of its development are Columbia University, Duke University, Princeton University, the University of California at Berkeley, the University of Michigan, and Yale University. In addition, the Université Libre de Bruxelles is cooperating in the bibliographic part of the project in Phase 1.

component of the planned system that would answer the following questions:

1. Is electronic imaging now capable of serving as the main means of capturing the images of papyri and similar objects for research access and for preservation?

2. What objectives must be met in such imaging?

3. What technical standards should be established to accomplish those objectives and preserve the interchange-ability and permanence of data?

4. What are the limits of present technology, the controls and safeguards needed to ensure data quality and integrity, and the means of preventing obsolescence of the product?

5. How well can currently available equipment satisfy the standards and objectives?

2. Method of the study

(a) Building on APIS enperimentation. Three of the institutions cooperating in the development of APIS have acquired relevant expertise in earlier work, two with papyri (Duke University and the University of Michigan) and one with color maps (Columbia University). This previous work has served as the basis of the present study. It may be briefly summarized as follows:

Duke: As part of a conservation, cataloging, and imaging project supported by the National Endowment for the Humanities, Duke adopted 300 dpi color scanning instead of black-and-white photography as its main imaging technology. A few of the resultant images have been put on a World Wide Web (WWW) server in combination with cataloging records for public

examination. Several hundred papyri have been scanned in this fashion so far.

Michigan: About 500 images were initially scanned using a grayscale scanner at 300 dpi; they were given extensive use in teaching as well as research, with generally satisfactory results. In the summer of 1994 a period of intensive experimentation with both grayscale and color technology began, including scanners at densities up to 600 dpi working from originals, photographs, and slides. When a Kontron digital camera (see footnote 6) became available in October 1994, it was added to the test, scanning at 3000 x 2000 pixels. Some of these images have been made available on the WWW for public study and comment.

Columbia: A project over the past year has studied the problems inherent in capturing geological and topographical maps. The problems of color differentiation and resolution addressed in this project are relevant to those encountered in papyri. In particular, this project studied the utility of full-frame color microfiche for recording such large-format color media. One of these fiche was then captured with the Kontron digital camera to see how completely digitization captured the data recorded on the fiche.

All of this work had developed a general sense that digital scanning generally offers substantial advantages over halide photographic technology. In particular, the electronic manipulability of images more than compensates for any drawbacks, including the lower density of information provided by scanning.

Flatbed scanners have some limitations that cameras do not have. Although they can handle originals that are not entirely flat, they cannot capture very curved ostraca. In addition, it is difficult to work accurately with many small fragments on scanners

because the written surface is face down. Also, scanners cannot handle larger papyri satisfactorily.[3]

Digital cameras are superior in allowing underlighting where that is useful, and they allow special lighting or filtering techniques. They also avoid the potentially harmful ultraviolet light emitted by flatbed scanners. The digital camera thus seemed to have the advantages of both photography and scanning to a considerable degree.

(b) Drawing on experts from leading-edge imaging projects. Representatives of the institutions cooperating in APIS met at the University of Michigan in early March 1995, with experts from several imaging projects chosen both for technological characteristics and for the significance of the materials as they relate to papyri:

Gregory Bearman (Jet Propulsion Laboratory, Caltech) and Sheila Spiro (Ancient Biblical Manuscript Center, Claremont School of Theology) represented the Dead Sea Scrolls imaging project. This enterprise has pioneered the use of multispectral imaging on manuscript material. Its results and relevance for the papyri are described in the next section.

Michael Ester (Luna Imaging) described two specific projects and general lessons derived from two projects. One was a study of image quality for works of art and viewer perception of that quality commissioned by the Getty Art History Information Program. The other was the application of digital imaging to a collection of Frank Lloyd Wright's architectural drawings.

Frederick Mintzer (IBM Watson Research Laboratory) reported on the IBM/Vatican library manuscript project, the test phase of which is now in operation. This project is capturing a

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[3]   Cf., e.g., Y.L. Yao and F.C. Mintzer, "A TDI-CCD Colorimetric Scanner and its Applications," IBM Research Report RC 17554 (#76393), 10/11/91. Michael Ester noted during the Ann Arbor meeting that flatbed scanners have been thoroughly unsatisfactory in reproducing art works.

wide variety of manuscripts of the medieval period, especially illuminated manuscripts. He also described work done by IBM on the digitization of art works for Andrew Wyeth.

(c) Joint discussion by imaging experts, papyrologists, system experts, librarians, and curators. The March 3-5 conference allowed for intensive discussion. All six APIS institutions were represented, with a mix of preservation specialists, rare book and manuscript librarians, conservators, and digital library systems analysts. All questions listed above were considered from all angles in light of meeting the objectives both of papyrological research and of sound library and information management practices.

Discussion was informed by reports from the above imaging projects and from APIS institutions. Although there was a considerable range of opinions about many points, joint analysis allowed the emergence of a clear consensus about best practices for papyri, taking into account the way they are used and their particular characteristics.

(d) Visual inspection and experiment following a period of public display and comment. As indicated above, Duke and Michigan have made images available over the Internet in the last year. Michigan incorporated into its study a questionnaire on the quality and usability of the images. User response was generally in line with the observations of the papyrologists at Michigan and helped to confirm internal judgment about the relative merits of the different imaging technologies and sources.

At the meeting in Ann Arbor, the papyrologists took advantage of the availability of a digital camera to experiment further with image density, looking in particular for the point where the image has a high enough resolution that it remains sharp when subjected to the kind of enlargements needed for research use. The five papyrologists were thus able to compare impressions of the same image at the same moment. The

recommendatons in the next section are based in part on that common visual inspection and discussion.[4]

(e) Ongoing research. Imaging technology is changing rapidly, and this report obviously cannot settle all questions. APIS will build in mechanisms for public feedback, and project papyrologists at all institutions will keep systematic records of observations about image usefulness and quality. The group expects that technical advances will affect current recommendations, especially for those objects least satisfactorily captured by standard color digital imaging.

3. Results of the study

(a) Physical attributes to be captured. Two points served as the essential grounding of the group's thinking. The first is that no single level of image resolution and dynamic range will be appropriate for every application; these levels will vary according to the objectives of a particular application. The second is that multiple levels of quality can have different roles in a particular application.

In the case of papyri, it is clear that legibility of the writing on papyrus is the most important objective in imaging. Legibility includes clarity of resolution when the image is blown up considerably larger than life-size. Images should not begin to dissolve into individually visible pixels at any magnification likely to be encountered in research use. It is not possible to give a simple measure for this characteristic, but it includes magnification sufficient to allow the viewer to see the ancient pen-strokes, even small dots of ink, and all corrections with complete clarity. In the test during the meeting, a small papyrus (about 9 x 15 cm) scanned at 600 dpi was blown up to fill a standard color

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[4]   The project on Frank Lloyd Wright's drawings on which Ester reported similarly used panels of scholars to rate resolution and dynamic rannge.

monitor, then magnified to twice that size - to about eight times original size. Image integrity at that point was used as the rule of thumb for adequate resolution.

In the art world, by contrast, other features occupy a central role in assessing image quality; these include highlights, shadows, depth, color overlay, and translucency. These features are all desirable in working with papyri, but are of secondary importance compared to writing legibility. In fact, at times they even may be at odds with legibility. For example, a higher contrast between writing and background material than that offered by the original would usually be seen as desirable by papyrologists, even at the cost of fidelity to the actual appearance of the artifact.

Apart from the readability of letters, however, other features of papyri that affect capture are: fiber structure, joins of sheets, sharpness of margins, remains of gesso or similar substances, seals, erasures, folds, color, and ink color. Capture of some of these features sometimes may be at odds with the capture of maximum contrast between the medium and the writing.

It is also desirable to be able to see large papyri in their entirety, not only as collections of images of segments. With current technology, a level of resolution chosen to meet legibility objectives may not allow the capture of an entire large papyrus in a single image. One must therefore use different levels of resolution for some images. In short, archival capture of a papyrus in digital imagery may sometimes require multiple images with differing characteristics.

(b) Archival images and delivered images. It was agreed that archival images should seek to capture a level of quality that provides the maximum degree of satisfaction of scholarly requirements. That does not mean, however, that the same level of quality would actually be delivered to the user under all circumstances. Ester's formulation is useful: "Delivery quality places the premium on satisfying the needs and constraints of specific applications. Archival quality lays emphasis on the

investment for initial image capture and the long-term value of images. Looked at as alternatives, these contrasting perspectives exist in obvious tension. Both sets of interests can be addressed without inherent contradiction, however, provided that archival quality determines the quality of scanning and that archival images become the reservoir of quality that is reduced and modified to suit the requirements of delivery quality".[5] The group anticipated rapid changes in the ability of the Internet to transmit large images, of screens to display them, and of printers to produce hard copies of them. But these are for our purposes secondary to the question of the required archival level.

(c) Methods of capture. The results of the discussions and viewings were clear: digital cameras[6] produce the best results for most purposes. New models of digital cameras are coming out with great frequency. It does not seem useful to specify particular models or vendors, as there are many sources for cameras capable of achieving the standards set out in the section below. But there was agreement that standard color imaging was for most papyri the preferred method. Such images, because they are susceptible to manipulation with a variety of computer tools, are far more useful than the traditional black-and-white photographs used in papyrology or even the color photographs sometimes found.

Most papyri are relatively small, at least as they have survived to the present, and there is no need to create photographic versions; digital images created with current equipment will meet the group's specifications with no difficulty.

Digitial images are as useful for large papyri, but there are simply more problems in working with them. Digital cameras have significant limitations, since current models do not make it

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5   "Image quality and viewer perception," Leonardo 23 (1990) suppl., 52.

6   This term is used here to include both products described as scanners in camera form (like the Pro/3000 scanner developed by IBM Research) and products described as digital cameras (like the Kontron).

possible to meet the standards below when capturing the entirety of papyri larger than (roughly) a standard sheet of writing paper. It is likely that advances in imaging technology will enable us to deal with such larger items. For larger papyri, the experience of the art projects and the Columbia map project came into play: Color microfiche using the entire fiche for a single map image yielded outstanding results to the digital camera. The group therefore recommended that for materials over roughly 7 x 10 inches (17,5 x 25 cm), electronic imaging[7] be supplemented with 4 x 5 inch color photographic transparencies. Experience in reproducing paintings and other fine arts has shown that these transparencies are sufficient for digital imagery as its capabilities improve.[8]

Further, some papyri and other objects have special problems of legibility that standard color imaging may not be able to address baded on the criteria set out above. These objects include pieces with overlays of papyrus or of gesso plaster, palimpsests, ostraca with poor ink-background contrast, and objects where dark medium can barely be distinguished from dark ink. For these challenges, there is promise from multispectral imaging (MSI), a technology pioneered by Bearman and Spiro. Developed for remote sensing in the U.S. space program, MSI is now in use in several other scientific fields, including oceanography, geology, and evironmental studies. It "relies on the unique spectral signature of different parts of the target image (... e.g., the ink versus the writing surface). MSI acquires images simultaneously in

[7]   This is the largest size that can be captured at 600 dpi using a digital camera with a 4000 x 6000 pixel frame, the largest reasonably available frame at present.

[8]   The preservation experts on our panel noted that there are no archival standards for color negatives, and that color is not stable in the long term. They agreed, however, that because of the rapid development of imaging technology even a relatively short time horizon for such color negatives could be helpful in preserving information.

many narrow, contiguous spectral bands over a spectral range."[9]
MSI is thus capable of picking up very slight differences between
ink and medium and enhancing contrast and legibility
dramatically. It is particulary useful in the far infrared spectrum
but could also be used for the ultraviolet, where some late antique
inks can usefully be captured.

MSI is a developing technology. The cameras that use it are
not interchangeable with those supporting standard color imaging,
and the files it produces are very much larger than ordinary
images files. MSI may have considerable use for the categories of
objects mentioned above, but all agreed that it had no advantages
for objects where such factors do not come into play. MSI
therefore will be an important tool for only limited classes of
material.

There will probably be other specialized tools, and projects
creating electronic images of papyri need to monitor new
developments to see what new technology might solve remaining
problems. An example is a project underway in Oxford to deal
with the special problems of incised texts (stylus tablets, lead
tablets, and the like), using special lighting and image-processing
software that allows the user to combine images taken with
different lighting to eliminate much of the background and to
differentiate the strokes from the background much more
clearly.[10]

(d) Technical standards and specifications. We recommend
the following basic technical specifications for digital images of

[9]   G. Bearman, B. Zuckerman, K. Zuckerman, J. Chiu, "Multi-spectral digital
imaging of Dead Sea Scrolls and other ancient documents," Abstract of
paper at the 1993 Annual Meeting of the American Academy of Religion
and Society of Biblical Literature.

[10] Image-enhancement of ancient documents. Collaborators: Alan K. Bowman
(Christ Church), Michael Brady (Engineering Science), R.S.O. Tomlin
(Wolfson College) and Andrew Zisserman (Engineering Science), all at the
University of Oxford.

papyri and similar objects. These are intentionally chosen to include industry standard practices and to avoid experimental, proprietary, or rarely found technological characteristics.

1. Full continuous-scale color; color calibrated with software;

2. Minimum resolution of 600 dpi for primary archival images; some images at 300 dpi may be useful for recording large pieces, and some at higher resolutions where the density of information is unusually high;

3. Image files in TIFF format, 24 bits (8 bits per channel), conforming to the TIFF Specification Revision 6.0;[11]

4. Archival files stored without compression; files using ISO-standard JPEG (1.02) File Interchange Format compression to be provided over the Internet;[12]

5. Inclusion of standard textual identifying material in images (ruler, color scale, digital watermark);

6. Provision of management data in separate data base files (identity codes, method of capture, resolution, equipment used, color specifications, operator, date, any compression, original format, any film intermediary, digital version, quality, consistency);[13]

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[11] It was the group's consensus that using more than 8 bits per channel offered no significant gain in accuracy for papyri, where color is secondary.

[12] We note that the IBM/Vatican library manuscript project makes only compressed and watermarked files available over the Internet, keeping all archival uncompressed files on systems not accessible to the Internet in order to enhance protection of the archival files.

[13] The management data system developed by Luna Imaging, Inc. has been a useful guide.

  7.   System design to minimize damage to originals from heat
       and light during imaging.

   An important issue for archival files is image integrity; that is,
the ability of the user to tell if the file has been altered, either
accidentally or deliberately. This subject has recently been
discussed by Peter Graham, and we have adopted his conclusion
that electronic files (in this case, image files) should bear digital
time stamps (DTS) that reveal any alterations.[14] The Dead Sea
Scrolls project has been sensitive to this issue, given the
controversial history of the scrolls over the past half-century, and
it has also decided to adopt DTS technology to guarantee its
images. All archival files of images should adopt some protection
plan. One public domain program available for this purpose is
Pretty Good Protection, PGP. Another type of image protection is
the secure visual identification of the image as coming from a
particular collection. Such protection allows a proprietor of
intellectual property the ability to demonstrate the origin of an
image and thus protect the property rights in it. At the same time,
it serves as an authentication of the image. A digital watermark
method has been developed by IBM as part of the Vatican library
manuscript project, and such a watermark (produced by altering
the brightness of pixels to produce the seal of the library) appears
on each image from that project made available over the Internet.
IBM plans to make this technology widely available.
   (e) Quality control, mirgration and refreshement issues.
Archival images deserve that term only if they are both checked
for quality after they are created and have a high likelihood of
surviving future generations of technology. The group
recommends that both human and mechanical methods of quality

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[14]   Peter S. Graham, "Intellectual Preservation: Electronic Preservation of the
       Third Kind," Commission on Preservation and Access paper (March 1994).

control be built into any project to capture papyrological images electronically. The human control will necessarily include a scrutiny of the image by a trained papyrologist to determine if the functional resolution standards described above have been met and if the document is otherwise in order. It will also require a check of the image against the management data record to be certain that they are correctly linked. The mechanical control will include a machine check of color using embedded color bar targets. It was recommended that a Q60 target be included at the start and end of batches of images.

The protection of the image data from destruction or obsolescence cannot be provided once and for all by any single set of measures. Against data loss, the group recommends that multiple copies of the data be created. In the case of APIS, this will mean providing each of the six partner institutions with a complete set. The usefulness of this approach will, naturally, depend on the longevity of the APIS consortium and its continued unity on matters of standards. Questions of migration are less clear due to the inherent unpredictability of technological change. During the active phase of the APIS project data, will be updated frequently. In the longer term, data might best be protected from obsolescence through inclusion in a larger body of digital library material managed by universities, rather than managed separately.

(f) Practicalities. This study has not concerned itself with costs and operating concerns for three reasons:

(1)   Even with APIS, and even more when one moves to a larger universe of users of this technology, it is likely that different approaches to implementation of digital imaging will be taken by different institutions. Our concern is with ensuring compatibility of the results of these implementations.

(2) The technology and its costs are changing rapidly, and any details will be obsolete within a short time.

(3) The bulk of the costs of any extensive digital imaging project are likely to be comparable to those of microfilming projects, because most of the cost lies in staff time and the actual operations performed are very similar; operating a digital camera is, if not quite as routine as operating a microfilm camera, only modestly more complicated.

Conference on Digital Imaging of Papyri
University of Michigan, March 3-5, 1994

List of Participants

Roger S. Bagnall, Columbia University (papyrologist; President, American Society of Papyrologists)
David Barber, University of Michigan (technology librarian)
Gregory H. Bearman, Jet Propulsion Laboratory, Caltech (physicist; MSI technology)
Anthony Bliss, University of California at Berkeley (rare books curator)
Robert Cartolano, Columbia University (academic information systems specialist)
Paul Conway, Yale University (library preservation officer)
Peggy Daub, University of Michigan (librarian, special collections and arts)
Michael Ester, Luna Imaging, Inc. (imaging of art works)
James Fox, University of Michigan (special collections curator)
Traianos Gagos, University of Michigan (papyrologist)
Janet Gertz, Columbia University (library preservation officer)
Brenda Johnson, University of Michigan (librarian)

Ludwig Koenen, University of Michigan (papyrologist)
Paul Mangiafico, Duke University (library technical services)
Frederick C. Mintzer, IBM Thomas J. Watson Research Center
(imaging scientist, IBM/Vatican library manuscript project)
John F. Oates, Duke University (papyrologist)
John Price-Wilkin, University of Michigan (Humanities Text
Initiative Librarian)
Don C. Skemer, Princeton University (curator of manuscripts)
Sheila Spiro, Claremont School of Theology (Dead Sea Scrolls
manuscript scholar)
Peter van Minne, Duke University (papyrologist)
Jack von Euw, University of California at Berkeley (library
technical services)
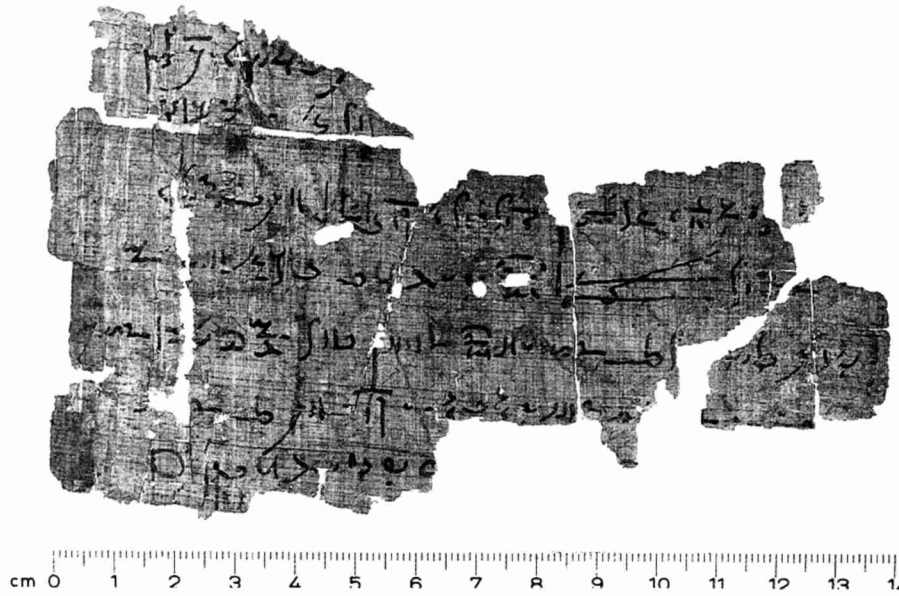
Papyrus from Giessen University Library
P. Giss. 174: Report of boatmen to a temple official
(published in: *Kurzberichte aus den Papyrus-Sammlungen*, 42 (1986), p. 15f.)

Tutorial

Digital Resolution Requirements for Replacing Text-Based Material: Methods for Benchmarking Image Quality

ANNE R. KENNEY / STEPHEN CHAPMAN
Department of Preservation and Conservation Cornell University[1]

Abstract

This tutorial provides a mean to estimate requirements for the use of digital imaging technology in converting text-based material. The authors suggest that benchmarks for resolution can be calculated by evaluating the physical attributes of source documents and by applying Quality Index formulas that have been derived from those established for preservation microfilming. The applicability of standards established for microfilming - an analog process - to image quality for material converted via digital technology may be open to some debate. This issue of comparability was addressed by the C10 Standards Committee of the Association of Image and Information Management (AIIM) in its report, *Resolution as it Relates to Photographic and Electronic Imaging* (AIIM TR26-1993). While acknowledging differences

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between digital and analog capture, the C10 Committee developed a Digital Quality Index formula that was derived from the Classic Quality Index formula used in the micrographics industry. Both formulas are based on three variables: the height of the smallest significant character, the desired quality to be obtained in the reformatted version, and the resolution of the recording device.

For the past several years, the Cornell Department of Preservation and Conservation has experimented with using the Digital Quality Index formula to predict resolution requirements for a wide range of documents using a number of scanning systems. The results of these experiments, and those conducted elsewhere, largely confirm the utility of the Digital Quality Index formula for bitonal (black and white) scanning, but the authors suggest a slight modification to the formula in cases where grayscale scaning is employed.

The authors caution that the use of these formulas are *for benchmarking purposes only*. Because image quality is affected by scanner performance and the operator's judgment, a continuous quality assurance program should be implemented to verify consistency of output. The scanner's performance may be assessed periodically by reproducing technical test targets specifically devised for digital imaging systems, but actual quality assurance should be confirmed by evaluating the output of representative samples of the material to be scanned. In cases where the digital files will replace the source documents, or where the source documents are widely differing, a 100% inspection of output is strongly advised. User requirements and perceptions of image quality - and the costs of conversion - should also be considered, but they should not be the driving forces in determining image capture requirements.[2]

Introduction

"What resolution should I use to replace my deteriorating originals? Isn't 600 dpi considered the absolute minimum?"

"I understand that Kodak PhotoCD technology provides very good image capture, so can I just use it?"

"How can I tell when the quality of the digital image is sufficient for replacing the original?"

These and similar questions are raised by librarians, curators, and archivists as they consider the use of digital technology to preserve and make accessible materials in their care. The answer to all these questions is "it depends." Unfortunately, no commonly accepted standards for digital image quality exist today, and much of the literature on the subject tends to be highly technical or is aimed towards applications where production takes precedence over quality.

The means for determining image quality requirements will vary with the range of documents to be converted and the processes used for scanning. Different document types require different scanning approaches. Capturing finely detailed line art or small type requires high resolution, as measured by the number of dots per inch (dpi), but other documents contain features that cannot be reproduced solely by increasing the resolution. Rendering the subtlety of shading present in a black and white photograph, for instance, requires good tonal reproduction - preserving the levels of contrast between black and white - to distinguish grayscale. As with conventional light-lens technology (photography, microfilm, and electrostatic copying), resolution and tonal reproduction are the principal determinants of image

quality. With digital technology, the final product will also be affected by the use of enhancement software, image compression techniques, system design and performance, and the operator's judgment and care.

This tutorial is aimed to providing librarians and archivists with some basic guidelines for establishing resolution benchmarks. It focuses on text-based documents, and primarily on those that are machine-produced. However, it also offers an initial means for assessing resolution requirements for a wide range of materials. These benchmarks are intended as a starting point for determining whether the informational content of source materials can be adequately rendered *for replacement purposes*. Image quality requirements will be high if the decision is made to dispose of the source documents themselves following conversion. If the digital image is to serve only as a reference and is not intended as a substitue for the original, then qualitiy requirements need not be as exacting. Nonetheless, there is much to be said for specifying a level of resolution that is sufficient to render all significant detail present in the source document. It may be more cost effective to scan material *once* at a high resolution, than to rescan material at a later date when future applications might require greater image quality. Because a true hight-resolution image cannot be derived from a low-resolution one, the document should be captured in a manner designed to guarantee full informational capture. Current use applications, where speed of transmission and on-screen display call for smaller file sizes, can be satisfied by deriving lower resolution images from this "archival" version. It is also possible to derive grayscale from high-resolution bitonal images to enhance on-screen readability, while relying on the full resolution image for printing.

Although resolution benchmarks can be estimated fairly easily, image quality requirements should be confirmed by thoroughly testing a group of documents that are representative of the materials to be scanned. Because requirements for general on-

screen use will be lower than those for full informational capture or for printing, the results of the scanning process will have to be judged on high-resolution display monitors and through by-products, such as paper and film. The results should be confirmed by both the curatorial staff and representatives from the user community. However, it should be recognized that requirements for full image capture may not necessarily coincide with the current range of users' needs. There is often a difference between stated requirements and visual perception. Issues associated with tradeoffs between fidelity to the source material and text legibility should also be addressed.

Where to Begin

Estimating resolution requirements begins with an understanding of the material itself. In general, paper-based documents can be classified into one of four categories: text/line art, halftone, continuous tone, and mixed. The following figure provides a brief definition and examples of documents for each of these four categories. Although resolution will be important for image capture for all documents, it is most critical, and often the principal determinant of image quality, for items that fall in the first category: text and line art. If the source document contains grayscale or color, then the quality of the conversion process will be governed by a combination of resolution and tonal reproduction (often associated with "dynamic range").[3] As will be discussed later in this tutorial, capturing grayscale or color will

[3]   Dynamic range represents the variation in tone of any given scanned dot. In bitonal scanning, this variance may be represented as either black or white, with shades of gray represented by the clustering of black and white dots. In grayscale scanning, the range of values a dot may have - from white to lightest gray to darkest gray and black - is dependent upon the number of bits of gray or color assigned to that dot, and the amount of noise introduced by the scanner.

affect resolution requirements and will result in adjustments to the benchmarking formulas for determining image quality.

Figure 1. Document Categories

Text/Line Art: Can be produced by hand, typescript or machine. Usually in black and white. Includes books, manuscripts, newspapers, reports, typed or laser printed documents, blueprints, maps, line drawings, etchings, lithographs, and music scores.

Halftone: Color or black and white. Reproductions, usually created from a photograph, comprised of small dots or squares or hatchings, which are used to represent continuous tones. Most "photographs" in publications are halftones.

Continuous tone: Color or black and white. Inlcudes graphics in which all values of gray and color can be reproduced: photographs, crayon, chalk and some pencil drawings, acrylics, watercolors, and photographically reproduced facsimiles.

Mixed: Color or black and white: Refers to items containing both text and halftone or continuous tone images, such as newspapers, magazines, illustrated books, playbills, and sheet music covers. Does not include text and line drawings together.

In addition to document category, one must consider the quality of the source material itself. The level of detail, its prevalence, and its significance will all have direct bearing on the resolution required. Other issues to be considered include: the media (e.g., ink) and the support (e.g., paper), and the level of contrast between the two; the production process (machine vs. hand produced); the presence of marginalia; the sharpness (focus) of the image; and the condition of the document (is it damaged? stained? incomplete?). If film is used for conversion, one must also evaluate its condition and quality. For instance, scratches present on the film base could be reproduced on the digital image, and the process of scanning film introduces a host of other issues

(e.g., reduction ratio and film density) which affect image quality.[4] The quality of a digital image will be limited by the quality of the source material. If it is of low quality, the resulting digital file will also be of low quality even if high resolution is used to record it. Capturing an out-of-focus photograph, for instance, with full gray and high resolution will still result in a fuzzy image.

The height and width of a document will also have a bearing on image quality, and may determine the kind of scanning processes used. For oversize documents that will not fit on a flatbed or drum scanner, conversion will require the use of a photo-intermediate or a digital camera. In such cases, a set scanning array is employed for digital conversion. As a consequence, scanning resolution can vary with a document's dimensions: as the size of the original increases, resolution will decrease. The physical dimensions of a page, in combination with the level of detail present on it, will affect resolution requirements for image quality. (See "Calculating Resolution from Pixel Dimensions": Appendix 1.)

In addition to understanding document attributes, one must consider how the technology itself affects image capture. The specific hardware and software used in digital conversion can dramatically alter results. Some scanner initially capture grayscale information which is then interpolated to produce high resolution black and white (bitonal) images. Others use software to achieve an effective resolution higher than that offered by the actual scanning matrix (e.g., effective 600 dpi from a 400 x 400 aperture). Even in cases where a scanner is used that employs a resolution capable of capturing very fine detail in a document, it is impossible to predict whether the document's features (e.g., the

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[4] See: Paul Conway and Shari Weaver, The Setup Phase of Project Open Book: A Report to the Commission on Preservation and Access on the status of an effort to convert microfilm to digital imagery. Commission on Preservation and Access, June 1994, pp. 8-9.

width of a black text character on a white background) will be aligned exactly with the scanner's detectors. "Misregistration," or "sampling error," refers to the variance from the perfect alignment that is to be expected in all bitonal scanning operations. In bitonal scanning, changing the placement of a document on the scanner's platen - even by as little as one-half of one pixel - will alter resolution and output. Different scanning technologies will have a marked influence on the output and on the accuracy of the digital resolution benchmarking formulas described below. Manufacturers' claims of scanning resolution should be carefully investigated, and one should always verify that image quality requirements have been met by examining the output(s).

In determining digital resolution benchmarks, one should consider whether standards for reproduction via microfilm or photocopy are considered sufficient for capturing the informational content of the source documents. If they are, then the image quality obtained using digital techniques may be judged, with some caveats described below, against that achieved using light-lens processes.[5]

How to Determine Digital Image Quality

One place to begin is to review the ways in which quality is judged in other conversion processes. The most exacting standards have been developed for the micrographics industry and are based on the Quality Index (QI) method. Indeed, the quality control

[5] For a detailed discussion of the differences between photographic and digital resolution, see Resolution as it Relates to Photographic and Electronic Imaging, AIIM TR26-1993 (Association for Information and Image Management, 1993). See also, Practice for Operational Procedures/Inspection and Quality Control of First-generation, Silver Microfilm of Documents, ANSI/AIIM MS23-1991; Reproduction of Library Materials Section (ALA), "Guidelines for Preservation Photocopying," 1993.

procedures for microfilm inspection and the QI method to describe text legibility are well suited - with certain modifications - for use in predicting and evaluating the performance of digital imaging systems. Whether it is used for microfilming or digital imaging. QI is based on relating text legibility to system resolution, i.e., the ability to capture fine detail.[6] Provided that a microfilm camera or a scanner is performing at its optimum level, QI may be used to forecast the levels of image quality - marginal (3.6), medium (5.0), or high (8.0) - that will be consistently achieved on the use copy.

The applicability of standards established for microfilming - an analog process - to image quality for material converted via digital technology may be open to some debate. This issue of comparability was addressed by the C10 Standards Committee of the Association of Image and Information Management (AIIM) in its report, *Resolution as it Relates to Photographic and Electronic Imaging* (AIIM TR26-1993). While acknowledging differences between digital and analog capture, the C10 Committee developed a Digital Quality Index formula that is derived from the Classic Quality Index formula used in the micrographics industry. Both formulas are based on three variables: the height of the smallest significant character in the source document (usually the smallest lower case "e" measured in millimeters), the desired

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[6] For a full discussion of the Quality Index method for determining image quality, see, Ibid., ANSI/AIIM MS23-1991, pp. 46-49. Although the QI formula is useful in benchmarking image quality on microfilm, it makes no distinctions for a host of document attributes that affect legibility. These include: media and support, finely detailed typefaces, use of italics and boldface, and varying line densities and width. The QI is used principally to determine text legibility, but it may also serve to measure the capture of nontextual information, such as the level of detail present in graphics, including lithographs, engravings, and woodcuts. Background color, level of contrast, and quality and condition of the original or reproduction will also affect image quality, which may not be reflected in the QI.

quality to be obtained in the reformatted version, and the resolution of the recording device.

In Classic QI, the height of the smallest significant character (h) is multiplied by the smallest line pair pattern (p) on the film version of technical test target that an observer judges to have been resolved by the camera. The resultant number denotes the Quality Index.

Classic QI = p x h

The extent to which Classic QI might accurately forecast text legibility depends upon visual perception, which can be subjective. This is particularly true in cases where an observer is required to inspect line pairs that are smaller than the significant characters in the source document. (See Figure 2.)

In cases where an image (analog or digital) is to serve as a *replacement copy*, a QI of 8.0 or above should be met on the use copy. At this level, full informational capture is achieved, including the rendering of serifs, when present, and/or other fine detail. Figure 3 represents enlargements of microfilmed sans-serif letters at the high, medium, and marginal QI levels. Note that in photographically reproduced images, quality degradation results in a fuzzy or blurred image.
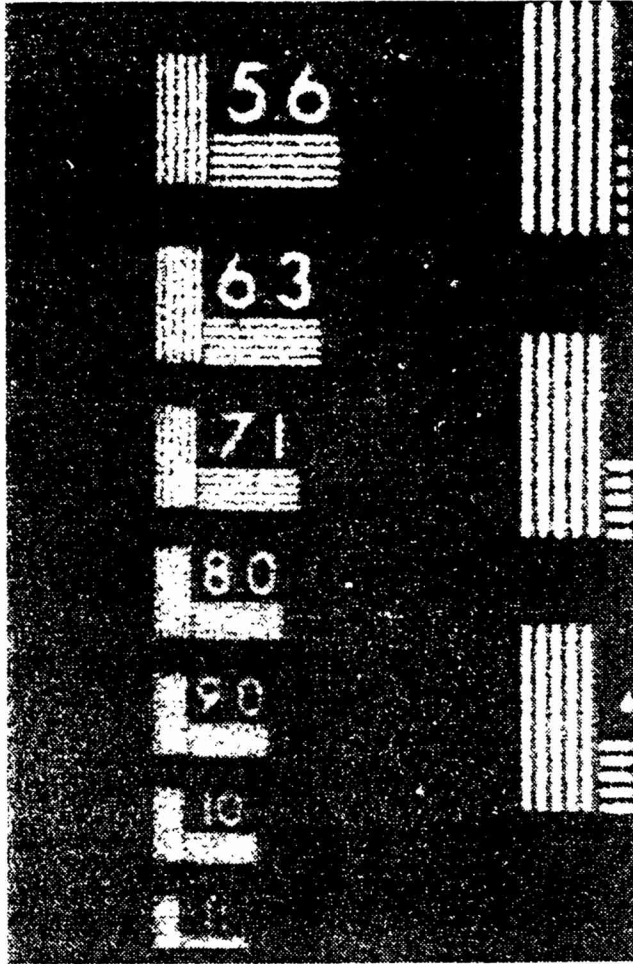
Figure 2: Illustration of a line-pair resolution target used to determine Classic QI. As stated in MS23-1991, 8.0 represents the smallest pattern in which all five lines can be distinguished in both directions.[7]

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[7] Reprinted with permission, from a photograph, courtesy of AIIM. See, ANSI/AIIM MS23-1991, p. 45.

Figure 3: Reproduction of photo-micrograph illustrating
Classic QIs at marginal (3.6), medium (5.0), and high (8.0) levels[8]
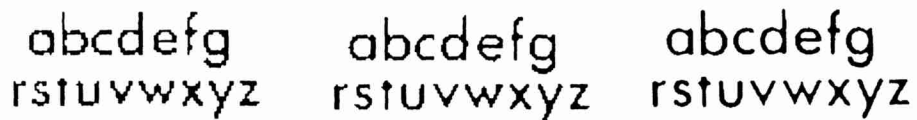
Figure 4: Enlarged Views of Spartan Medium letters,
representing Digital QIs at marginal (3.6), medium (5.0), and high
(8.0) levels.

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8   Reprinted with permission, from a photograph, courtesy of AIIM. See,
ANSI/AIIM MS23-1991, p. 48.

By incorporating proven microfilm inspection procedures into a quality control program for digital imaging, and by adapting Classic QI to account for the differences in the ways in which microfilm cameras and scanners capture detail, the AIIM C10 Standards Committee argues that digital resolution benchmarks for textual documents can be established in a relatively straightforward manner.

Scanning Methodologies and Compression Techniques

To convert documents to digital images, one of three scanning methods may be used: bitonal scanning, in which only black or white values are presented by each pixel: grayscale scanning, in which the values of each bit can depict gray shades in addition to black and white; and color scanning, in which the values of each bit can represent the universal range of colors. As explained below, it appears from various experiments conducted at Cornell and elsewhere that resolution requirements may differ with each of these scanning processes. In addition to the scanning process used, the type and degree of file compression will also affect image quality. Image compression algorithms are broadly classified as lossless or lossy. Lossless compression, such as CCITT Group 4 used for bitonal images, reduces the size of an image by decreasing the number of bits in an image *without losing any data.*

Compressing and decompressing the file results in an exact replication of the original file. With lossy compression techniques, compressing and decompressing results in subtle changes to the file; such effects on image fidelity should be considered carefully in a preservation context. JPEG compression (used for grayscale and color images), for example, reduces the size of a file by selectively discarding some information in the image. The degree

of "lossiness" can be modified by adjusting compression parameters, with resulting tradeoffs in file size and image quality.[9]

Bitonal Scanning
Means for Benchmarking Resolution Requirements

Let's begin with the most basic method of digital conversion: bitonal scanning. A fundamental distinction between light-lens processes and digital imaging is that photographic resolution is measured in line pairs/millimeter (lp/mm) and digital resolution is measured in dots per inch (dpi).[10] Given that Classic QI serves as the basis for Digital QI, it must be modified in several ways to account for these differences.

Recall that Classic QI is measured in terms of the smallest pattern of lp/mm that has been resolved on film (p), and the height of the smallest significant character (h) in the source document:

$$QI = p \, x \, h \qquad \text{and} \qquad p = QI/h$$

To derive Digital QI from Classic QI, "p" must be converted to dpi. Because a *dot* occupies the same space as a line - if a line pair were scanned, one dot would represent the black line, and another would represent its adjacent white line - two dots must be used to

[9] JPEG compression is considered lossless at ratios of 2 or 3 to 1. See, National Archives and Records Administration, Digital-Imaging and Optical Digital Data Disk Storage Systems: Long-Term Access Strategies for Federal Agencies, NARA Technical Information Paper, No. 12, July 1994, pp. 44 - 45.

[10] See: Resolution as it Relates to Photographic and Electronic Imaging, AIIM TR26-1993 (Association for Information and Image Management, 1993).

represent one line pair.[11] This means that the dpi must be divided by two to be made equivalent to "p." Thus,

$$p = dpi/2$$

$$dpi/2 = QI/h$$

In addition, the character height (h), in millimeters, must be made consistent with the measurement for dots, in inches. One millimeter equals approximately .039 inches, so (h) must be multiplied by .039:

$$dpi/2 = QI/ (h \, x \, .039), \text{ or}$$

$$dpi = 2QI/.039h$$

In this formula for Digital QI, dpi refers to a scanner's *output resolution* - the resolution consistently achieved by the scanner as confirmed by visual inspection. For example, if a QI of 8 were desired for documents containing significant characters measuring 1.0mm and above, a dpi of $(2 \, x \, 8)/(.039 \, x \, 1)$, or 410, would be required. Unfortunately, due to sampling errors, the *input resolution* of a scanner may not represent a consistent output resolution.[12] The authors of AIIM TR26-1993 advise increasing the input scanning resolution by at least 50% as a "safe requirement to account for detector-to-line misregistration."[13] In

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[11]   Ibid,. p. 8.

[12]   For the purpose of this tutorial, input resolution refers to the manufacturer's stated resolution; output resolution refers to the resolution consistently achieved on screen or on paper or film.

[13]   ANSI/AIIM TR26-1993, p. 12. In earlier work on guidelines for digital image quality, Thomas C. Bagg, of the National Bureau of Standards, recommended increasing the dpi by "about 30 percent" above that estimated

our example of the 1.0mm character that requires a 410 dpi output to achieve a QI of 8, the input resolution would have to be increased by 50%, to 615 dpi.

Although every scanner will perform at varying levels of efficiency, the authors support the AIIM C10 Committee's recommendation to begin with an assumed misregistration rate of 50% for bitonal scanning. For the past several years, the Cornell Department of Preservation and Conservation has experimented with using the Digital Quality Index formula to predict resolution requirements for a wide range of documents. Two bitonal scanners manufactured by Xerox, with nominal 600 dpi resolutions, have been used in the Cornell projects. Evaluation on high-resolution monitors and paper and microfilm outputs for these scanners reveals that the 50% adjustment for misregistration is an accurate indicator of image quality. Other scanners may perform more or less efficiently.[14] The 50% error allowance can be verified or modified based on a visual inspection of the scanner's output and performance over time.

Figure 4 displays examples of Spartan Medium letters from the IEEE Faxsimile Test Chart (Institute of Electrical and Electronics Engineers, Inc.) that were scanned at various resolutions using the XDOD scanning system. The enlarged illustrations represent, in the authors' judgment, the digital equivalents to the photographically reproduced marginal, medium, and high QI levels as presented in Figure 3. Note that in contrast to photographically reproduced letters, quality degradation with digital conversion is revealed in the ragged or stairstepped appearance of diagonal lines or curves - known as

by the Quality Index. See: Thomas C. Bagg, "Digitizing Documents: Guidelines for Image Quality." INFORM, November 1987, p. 8.

[14] For a description of the scanning and interpolation scheme used in the Xerox CLASS scanning system, see Anne R. Kenney and Lynne K. Personius, Joint Study in Digital Preservation: Report: Phase I (Commission on Preservation and Access, 1992), p. 10.

aliasing or "jaggies." Each institution should establish its own digital equivalents to the photographically reproduced characters in MS23-1991 and apply them consistently in a quality assurance program. (See "Dots Per Character Formula for Bitonal Scanning": Appendix 2.)

Digital QI Formulas for Bitonal Scanning
dpi = 3 QI/.039h
h = 3 QI/.039dpi
QI = (dpi x .039h)/3

Using the Digital QI formulas for bitonal scanning, Table 1 lists the estimated input resolution settings required to render various-sized characters at marginal, medium, and high QI levels.

Table 1			
Estimated Input Resolution Requirements for Bitonal Scanning			
x-height	**QI = 3.6**	**QI = 5**	**QI = 8**
0.5mm	554 dpi	769 dpi	1231 dpi
1.0mm	277 dpi	385 dpi	615 dpi
1.5mm	185 dpi	256 dpi	410 dpi
2.0mm	138 dpi	192 dpi	308 dpi
2.5mm	111 dpi	154 dpi	246 dpi
3.0mm	92 dpi	128 dpi	205 dpi
4.0mm	69 dpi	96 dpi	153 dpi
6.0mm	46 dpi	64 dpi	103 dpi

Grayscale Scanning
Means for Benchmarking Resolution Requirements

As stated earlier in this tutorial, image quality for documents containing gray or color is principally governed by the combination of resolution and tonal reproduction. The lossy compression schemes associated with grayscale and color will also affect image quality, as will system configurations. Although the Digital QI formulas established for bitonal scanning can be applied to grayscale and color, it appears from tests run at Cornell that the 50% adjustment for misregistration may not be necessary. By representing each dot with multiple bits, grayscale and color scanning renders characters with greater fidelity than bitonal scanning. For 8-bit grayscale scanning, the *input* resolution appears to be an accurate indicator of achieved *output* resolution when JPEG compression is used at levels of 10:1 (i.e., the compressed file is 10% of the original file size). (See Table 3.)

In a test conducted by the Department of Preservation and Conservation at Cornell, the AIIM Scanner Test Chart #2 and a page from an early 20th-century brittle book were scanned at various resolutions with an HP ScanJet IIcx grayscale scanner. When 8 bits of gray were used, the characters were rendered on screen at levels that met or exceeded the quality predicted by the Digital QI formula, with no allowance for misregistration.[15] More

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[15] At 400 dpi 8-bit gray, the Bodoni Italic 4-point letters (0.6mm) on the AIIM target were rendered on screen (17" high-resolution monitor, displaying 256 levels of gray) at a QI of 8 with lossless compression, and at a QI of 5 with JPEG 10:1 compression. The Digital QI formula, with no allowance for misregistration, predicted a QI of 4.68. In the 400 dpi 4-bit gray version, the same letters were represented at a QI of 5>8 with lossless compression, and at a QI of 5- with JPEG 10:1 compression. Similar correlations were observed in the 300 dpi versions, for which the Digital QI formula predicted a QI of 3.51. The same letters were rendered at a QI of 3.6, with JPEG 10:1 compression, in the 8-bit version, and a Q1 of 3 was observed with 4-bit gray. In the case of the page from the brittle book, evaluations were made

research is needed to evaluate the effects of color scanning and grayscale scanning above 8 bits on resolution.[16]

> **Digital QI Formulas for Grayscale Scanning**
> dpi = 2QI/.039h
> h = 2QI/.039dpi
> QI = (dpi x .039h)/2

on hand-lettered characters with x-heights of 0.6mm and 0.4mm. Scanned with input resolutions of 400 and 300 dpi 8-bit gray, the 0.6mm letters met or exceeded the predicted QIs of 4.68 and 3.12 respectively, with JPEG compression up to 10:1. See: Andrew Boss, Farm Management (Chicago: Lyons & Carnahan, 1914), p.100.

[16] As a preliminary test, the authors evaluated on-screen displays of four color architectural drawings from the Cornell Division of Rare and Manuscript Collections that had been digitized with 24-bits of color via the Kodak PhotoCD process. The drawings, from the John M. Nolen collection, were displayed and inspected on a 17" SVGA monitor at level 5 with 256 colors. Examinations of text characters revealed inconsistencies in the Digital QI formula predictions. The smallest significant text characters in these drawings measure 1.1mm. Based on the dimensions of the original documents, the effective scanning resolutions achieved using Kodak PhotoCD at 2,048 x 3,072 pixels ranged from 55 dpi (for the 37" x 43.25" drawing) to 111 dpi (for the 18.4" x 20.25" drawing). Given the x-height of the smallest text and the effective dpi, the Digital QI formula for grayscale scanning predicted the following Digital QIs: 4.33, 3.34, 2.12, and 1.29. In the first two cases, the sans-serif letters were legible (Visual QI of 5). In the third example, the characters predicted to be rendered at a QI of 2.12 were marginally legible (Visual QI of 3.6) in context, but not distinguishable as individual characters in all cases. In the fourth example, the smallest characters, at the predicted QI of 1.29, were illegible.

In Columbia University's "Oversize Color Images Project," sponsored by the Commission on Preservation and Access, on-screen examinations of textual information contained in a number of color maps, scanned from paper and film, also revealed inconsistent results. For more information, contact Janet Gertz, Preservation Department, Columbia University Libraries.

Using the grayscale Digital QI formulas, Table 2 lists the estimated input resolution settings required to render various-sized characters at marginal, medium, and high QI levels.

Table 2			
Estimated Input Resolution Requirements for 8-bit Grayscale Scanning and JPEG Compression at Levels up to 10:1[15]			
x-height	QI = 3.6	QI = 5	QI = 8
0.5mm	369 dpi	513 dpi	821 dpi
1.0mm	185 dpi	256 dpi	410 dpi
1.5mm	123 dpi	171 dpi	274 dpi
2.0mm	92 dpi	128 dpi	205 dpi
2.5mm	74 dpi	103 dpi	164 dpi
3.0mm	62 dpi	85 dpi	137 dpi
4.0mm	46 dpi	64 dpi	103 dpi
6.0mm	31 dpi	43 dpi	68 dpi

[17] These input resolutions apply when using JPEG (lossy) compression up to 10:1. At 10:1 text characters are rendered well, particularly when resolutions meet or exceed 400 dpi, but surface distortions which lower overall image quality are introduced. If a lower JPEG compression ratio is used, the input resolution requirements could decrease, at the expense of file size. (See Table 3.) If higher compression ratios are used, noise and surface distortion will be visible in the decompressed image, and the Visual QIs will be lower than the predicted Digital QIs.

Ongoing resarch at the Library of Congress and elsewhere demonstrates the potential to employ grayscale scanning to capture a range of source materials that might challenge the capabilities of bitonal scanners.[18] The use of grayscale to capture halftones will be discussed later, but it also appears that grayscale scanning can have a pronounced effect on the rendering of text/line art. When the same resolution is used in both bitonal and grayscale scanning, the addition of gray for text-based documents, including those rendered only in black and white, may lead to improved image quality *provided that the output renders the gray.*[19]

Even with added gray, however, preliminary findings from tests at Cornell suggest that input resolutions of 400 dpi should be used in order to define small artifacts with a QI of 8.[20] The Digital

[18] For more information, contact Basil Manns, Preservation and Research Testing Division, Library of Congress. The Library of Congress has initiated a project to evaluate image quality of grayscale printouts of manuscript materials captured at various resolutions and compressed with several techniques.

[19] Although lower-resolution color scanning may also be considered as an alternative to bitonal scanning for text and line art, the results from a limited and preliminary test conducted at Cornell suggest that grayscale scanning, with significant savings in file size, enhances the legibility of text as well as or better than color. The Department of Preservation scanned the AIIM Scanner Test Chart #2 at 300 and 400 dpi, in both grayscale and color, with various levels of tonal reproduction. An on-screen inspection revealed that both the 4-bit and 8-bit grayscale versions represented text with greater clarity and sharpness than the 24-bit color images scanned at the same resolutions. Image quality for documents captured with grayscale and color will decrease, however, if the output does not represent the full levels of gray or color used in the conversion process. Conventional 300 dpi laser printers, for example, will not produce improved image quality for text, halftones, or continuous tones captured using grayscale scanning.

[20] In conducting on-screen inspections of the rendering of text from the AIIM Scanner Test Chart #2, captured at 300 dpi, the authors oberserved that the Bodoni Italic 6-point letters (x-height = 0.9mm) appeared to be rendered at a QI of 5-8, when 8 bits of gray were used. The Bodoni Italic 4-point letters

QI formula for grayscale scanning and the dots per character formula (see Appendix 2) indicate that an output resolution of 410 dpi is necessary to represent a 1.0 mm character with 16 dots over its height, for a QI of 8.0. Depending upon the amount of compression used, 300 dpi, 8-bit grayscale scanning may render selected detail at levels of accuracy equal to 600 dpi bitonal capture of the same source document *in instances where only marginal and medium QI levels of image quality are achieved*. But if high QI levels are desired, input resolutions of 400 dpi are necessary. Issues associated with grayscale scanning to capture text line art - including image capture quality, on-screen display, printing, file size, compression, vendor capabilities, and cost - must be explored further.

Initial on-screen review of characters with an x-height of 0.6mm from the AIIM Scanner Test Chart #2, scanned at various bitonal and grayscale resolutions, demonstrates the effect of tonal reproduction and compression on file size and image quality. The file size represented in table 3 refer to the entire target (8.5" x 11"), but the image quality assessments were made only on lower-case 4-point Bodoni Italic letters.

(x-height = 0.4mm) were rendered at a QI of 5. When JPEG 10:1 compression was used, the image quality of the 6-point letters dropped below 5, and the 4-point to 3.6.

Table 3

Image Quality and Resulting File Sizes With Bitonal and Grayscale Scanning of the AIIM Scanner Test Chart #2

Input Scanning Resolution	File Size	Compression	Digital QI	Visual QI[19]
600 dpi bitonal	4.2 MB	uncompressed	4.68	5
	.47 MB	CCITT Group 4	4.68	5
400 dpi, 8-bit	14.7 MB	uncompressed	4.68	8
	1.49 MB	JPEG at 10:1	4.68	5
	.72 MB	JPEG at 20:1	4.68	3.6
400 dpi, 4-bit	7.25 MB	uncompressed	4.68	5-8
	.71 MB	JPEG at 10:1	4.68	3.6+
300 dpi, 8-bit	8.3 MB	uncompressed	3.51	5
	.85 MB	JPEG at 10:1	3.51	3.6
	.47 MB	JPEG at 18:1	3.51	3
300 dpi, 4-bit	4.08 MB	uncompressed	3.51	5-
	.48 MB	JPEG at 8.5:1	3.51	3

An on-screen review of these examples demonstrates that the same image quality as 600 dpi bitonal scanning (QI=5) may be obtained in the *uncompressed* 300 dpi 8-bit image, but the file is approximately 17 times larger than the 600 dpi version, compressed in lossless mode. Although 400 dpi 8-bit grayscale, uncompressed, renders the Bodoni Italic in a superior manner, the

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[21] The bitonal Digital QI formula was applied to the 600 dpi bitonal image; the grayscale Digital QI formula was used for the grayscale images.

file sizes for the 8-bit and 4-bit images are 31 and 15 times larger than the 600 dpi compressed version. When employing JPEG compression at levels in which the medium QI is maintained, the size of the 400 dpi 8-bit image is three times larger than the compressed 600 dpi bitonal version *and* noise and surface distortion are introduced. Finally, when file sizes for the 300 and 400 dpi 4-bit and 8-bit grayscale images approximate those for the 600 dpi bitonal image, image quality significantly degrades (QI=3.6 and below). If grayscale is to be captured, more efficient file sizes can be obtained using 400dpi than 300dpi. Both result in quality comparable to 600dpi scanning (Q1 of 5 for Bodoni 4-point text), but the file size differ significantly. The 600dpi version, compressed with CCITT Group 4, is .47MB; the 400dpi 8-bit version, with JPEG 10:1 compression, is three times larger at 1.49MB; and the 300dpi 8-bit version achieves a QI of 5 only in the uncompressed state, at 8.3MB. This preliminary test suggests that, at present, the use of gray and lower resolution may be better suited for capturing illustrated material than for capturing straight text. Further research must be carried out to establish the levels at which image quality is compromised by current compression techniques.

Verifying the Predicted Quality Index

Although standard line pair targets are effective in measuring photographic resolution, digital resolution relies on an evaluation of character rendering as the basis for determining image quality. This shift is reflected in the composition of technical targets designed specifically for scanning systems.[22] These technical test

[22] Recommended Practice for Quality Control of Image Scanners", ANSI/AIIM MS44-1988 (AIIM, 1988). The IEEE 167A-1987 Facsimile Test Chart, the AIIM Scanner Test Chart #2, and the RIT Process Ink Gamut Chart are reviewed for their utility within a quality control program for image scanner. MS44-1988 has recently been adopted as a Federal

targets will serve as a means to verify the consistency of a scanner's performance, but a quality assurance program should be based on an evaluation of the output(s) of actual source material.

Building on the QI formula and quality control procedures presented in MS23, the AIIM C13 committee on imaging developed the *Recommended Practice for Quality Control of Image Scanners* (ANSI/AIIM MS44-1988) to provide a set of tools and instructions to ensure consistent image quality via a scanner or digital camera. Based on recommendations to establish a quality reference program in MS44-1988, and an assessment of available technical targets, the Cornell Department of Preservation and Conservation has selected three test targets for use in imaging projects. These targets are used in combination to verify consistent system performance and to evaluate the rendering of continuous tones, halftones, and text.

The first target, the IEEE Std 167A-1987 Facsimile Test Chart, is an early scanning test target designed for use with facsimile machines. It is produced photographically and includes grayscale bars, text, rules, and a continuous tone image. It also incorporates traditional line pair patterns used to test photographic systems. In their evaluation of this target, the C13 committee on imaging advised against the use of such patterns to test image resolution for systems including digital scanners.[23] Cornell uses this target to evaluate continuous tone images, but relies on two other targets for measuring resolution: the RIT Alphanumeric Test Object and the AIIM Scanner Test Chart #2. With permission from the Institute of Electrical and Electronics Engineers, Inc. (IEEE), and the Technical & Education Center at

Information Processing Standard, FIPS PUB 157, "Guideline for Quality Control of Image Scanners".

[23] Ibid,. pp. 5, 14. MS44-1988 advises against using "NBS 1010A bar type target resolution patterns" (i.e., line pairs) to test scanning systems with a resolution less than or equal to 600 dpi due to the problems associated with misregistration.

the Rochester Institute of Technology (RIT), Cornell has adapted the IEEE target to incorporate the RIT Alphanumeric Test Object. (See Figure 5.)
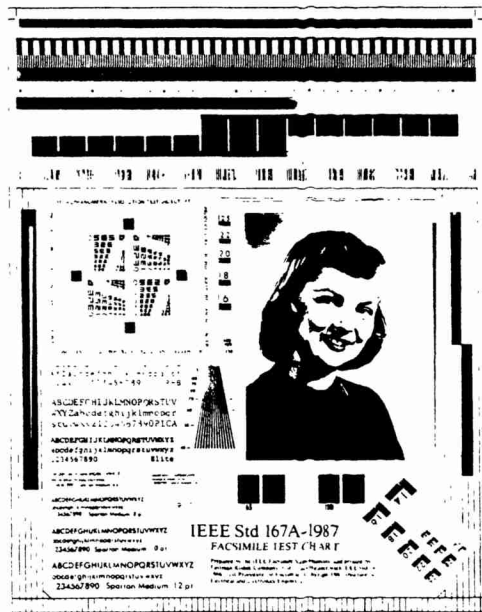
Figure 5: 3" X 3" RIT Alphanumeric Test Object superimposed on the IEEE Std 167A-1987 target

The RIT target consists of lines of block letters, in descending sizes, represented in two directions. During inspection, an observer must *recognize* letters, rather than *detect* resolved line pairs; therefore, disagreements among observers as to whether a target element has been resolved may be minimized. (See Figure 6 for an illustration of the RIT target scanned at 600 dpi bitonal.) The RIT target offers the ability to judge output in carefully measured increments, and thus has broad utility for a wide range of text-based material. Lacking serifs or varying line widths to represent detail, however, the block letters on the RIT target, in

the authors' estimation, may not provide a great enough challenge to predict a scanner's ability to record very fine detail. The rendering of such attributes can be partially judged by resolving characters on the RIT target that are significantly smaller than the x-height of the original document, but a more accurate assessment may be obtained by recording and inspecting the elaborate, serifed characters on a third target, the AIIM Scanner Test Chart #2.
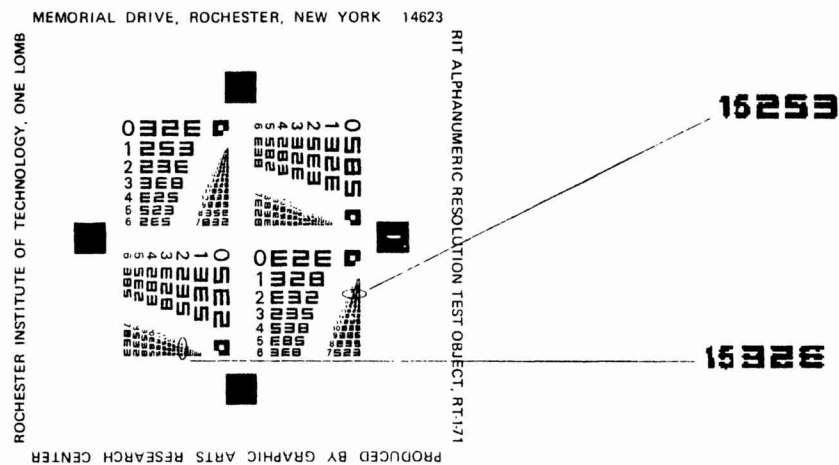
Figure 6: RIT target scanned at 600 dpi, with enlargements of block letters in line[24]

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[24] Readings are taken from the 3" x 3" version of this target, which Cornell has pasted onto the IEEE target over the Pestrecov Star pattern. Following the guidelines in MS44-1988, Cornell performs technical inspections for resolution on-screen: for 600 dpi bitonal scanning, the target is viewed at 5X magnification on a 19" high-resolution black and white monitor; for 400 dpi grayscale scanning, the target is magnified at 5:1 on a 17" high-resolution monitor displaying 256 levels of gray. We use 5.1 magnification on a 120dpi monitor, to achieve an effective 600 dpi view. We use 5.1 magnification on a 1024 x 768 monitor to achieve an effective 400 dpi view.

The AIIM Scanner Test Chart #2 contains typefaces that will challenge most scanners, as well as grayscale bars for a range of halftone screen rulings that can be used to measure how well a scanner reproduces halftones. In contrast to the photographically produced IEEE target, it is an ink-on-paper type that more closely resembles letterpress printing common in books published in the nineteenth and early twentieth centuries. Among the typefaces represented on the AIIM target, the Bodoni Italic letters are the most difficult to render at acceptable levels of legibility. The Cornell Department of Preservation and Conservation concluded that if a scanner could render the lower case Bodoni Italic 4-point letters (0.6mm) at a medium QI level (5.0), then nearly all detail present in printed books from 1800 to 1960 could also be captured.[25] (See Figure 7.) In the authors' judgment, it appears that a quantitative as well as qualititative relationship exists between the RIT target and the AIIM Scanner Test Chart #2, and that one may be used as a check against the other in evaluating system performance and text character rendering on the output.

[25]   Anne R. Kenney, "Digital-to-Microfilm Conversion: An Interim Preservation Solution," Library Resources and Technical Services (October 1993), pp. 380-401; (January 1994), pp. 87-95. As predicted by the Digital QI formula for bitonal scanning, the 600 dpi input resolution that renders Bodoni Italic 4-point letter (0.6mm) at a QI of 5 also renders characters measuring 1.0mm and above at a QI of 8. With 600 dpi bitonal scanning, the letters in line 15 of the RIT target, which measure 0.43 mm, are consistently legible on screen in both directions (see Figure 6) With 600 dpi 8-bit scanning, using JEGP compression up to 10:1, the letters in line 19 of the RIT target, measuring 0.266 mm, are legible on a high-resolution monitor displaying 256 levels of gray. Compared to bitonal scanning, this rendering of block letters at 60% the size (.266/.432) in the grayscale version suggests that a QI of 8 would also be achieved on more finely detailed text characters measuring 0.6mm and above. The on-screen evaluation of loier case Bodono Italic 4-point letters from the AIIM target, captured at 600 dpi 8-bit, confirmed this projected quality had been met.
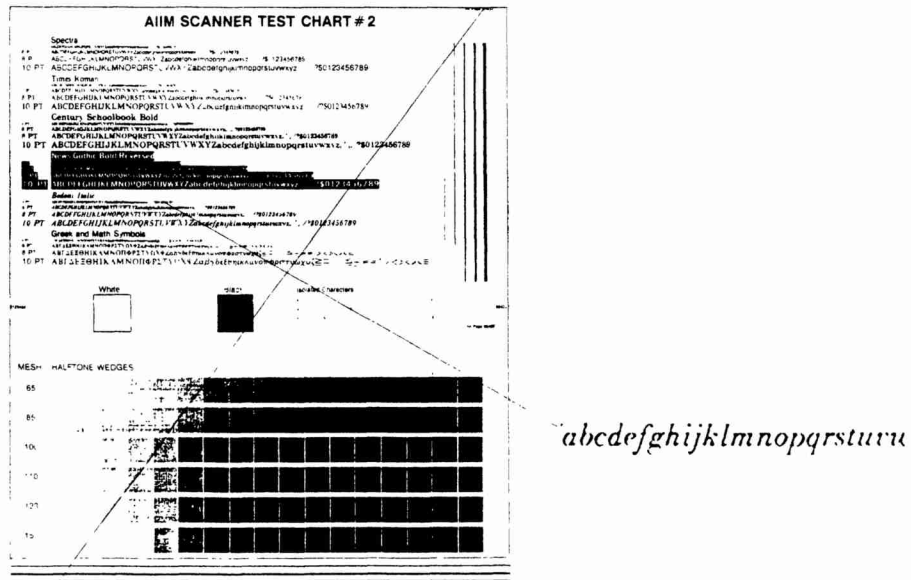
Figure 7: AIIM Scanner Test Chart #2, and enlarged 4-point
Bodoni type, scanned at 600 dpi

Visual Inspection

Although digital resolution formulas provide a useful means for predicting image quality and technical test targets can be used to confirm a system's performance over time, visual inspections should be carried out on a sample of materials for each scanning system employed. MS44-1988 recommends that image quality assessments should be made on the targets being used as "quality references" each time the scanner is calibrated, as well as on the textual and grayscale rendering of the originals achieved on screen and through paper and film output. The Cornell Department of Preservation and Conservation found that initial onscreen review

was best performed on a high-resolution monitor where each pixel is represented by a point of light. Paper facsimiles were best reviewed with the naked eye and under magnification (5X to 10X). Microfilm was best reviewed on a light box, using a 50X microscope. Because image quality is affected by scanner performance and the operator's judgment, a continuous quality assurance program should be implemented to verify consistency of output. In cases where the digital files will replace the source documents, or where the source documents are widely differing, a 100% inspection of output was found to be unnecessary.[26]

As MS44-1988 points out, both on-screen and paper representations may introduce image distortion (e.g., wavy lines, dark or light spots, and/or aliasing). For this reason, user needs must be well understood and visual inspections should be conducted on each of the formats that will be used to provide primary or secondary access. These formats may include: high-resolution images to be displayed on high-resolution monitors; low-resolution images, derived from the high-resolution images, to be displayed on low-resolution monitors; high- and low-resolution printouts; and computer output microfilm (COM).[27]

For images created from text/line art documents, any or all of the following attributes may be considered when examining the printed page without magnification: text legibility at or above the

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[26] The National Archives and Records Administration (NARA) recommends a 100% visual quality evaluation of each scanned image and related index data if the original documents are not retained following conversion. See "Digital Image Quality Assurance," NARA, Digital-Imaging and Optical Digital Data Disk Storage Systems: Long-Term Access Strategies for Federal

Agencies, op. cit., pp. 47-50.

[27] A project currently underway at the Cornell University Department of Preservation and Conservation, with support from the National Endowment for the Humanities, is investigating the use of 600 dpi bitonal scanning to produce raster COM that meets preservation microfilm standards for quality and permanence.

predicted digital QI levels; full reproduction of the page, with the text or lines consistently dark throughout; sufficient contrast between text and background; characters reproduced at the same size as the original; and individual line widths (thick, medium and thin) rendered faithfully. Magnification should be used to examine the edges and other defining characteristics of individual letters: In comparison to the originals, are serifs and fine detail rendered faithfully; are individual letters clear and distinct; are adjacent letters separated as they should be; and are the open regions of characters not filled in?

For halftones or continuous tones, the following attributes should be evaluated with or without magnification, as needed: comparison of the range of tones against the original; consistent rendering of detail in the light and dark portions of the image; even gradations across the image; absence of moiré patterns and other distorting elements; and the presence of significant fine detail contained in the original.[28]

Suggested Guidelines

Although the means for estimating specific resolution requirements for replacement purposes can be derived through the use of the digital resolution formulas and confirmed through structured sampling, a number of institutions have made recommendations covering various document types. It should be noted that these are suggestive only. They have not been confirmed by the larger library or research community, nor have they been endorsed by any standards-setting bodies. Nonetheless,

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[28]   See evaluation criteria presented in Appendix VI in Anne R. Kenney, with Michael A. Friedman and Sue A. Poucher, Preserving Archival Material through Digital Technology: Final Report (Cornell University Library. Department of Preservation and Conservation, 1993).

they can serve as a starting point in a broader discussion involving guidelines for digital image quality.

Monographs, Serials, Pamphlets and other Text-based Publications: 600 dpi bitonal scanning

The Cornell University Department of Preservation and Conservation has spent the past five years analyzing digital image quality for books published from 1850-1950. Based on this experience - including a review of 105 printers' type sizes commonly used by publishers during this period - and visual inspection of digital facsimiles for Roman and non-Roman script materials, Cornell has concluded that an input scanning resolution of 600 dpi is sufficient to capture fully the monochrome information contained in virtually all books published during the period of paper's greatest brittleness.[29] While many publications from this period do not contain fine detail or typefonts below 6-point, a sufficient number of them do. The Department of Preservation found that item-by-item decision making should be avoided because it may result in a more costly conversion process than scanning at a resolution guaranteed to reproduce all significant detail.[30]

Illustrated texts - containing line art and halftones, for which photocopy or microfilm are considered adequate for replacement

[29] In the Cornell projects, scanners offering nominal rather than true 600 dpi scanning resolutions were used. See Anne R. Kenney, "Digital-to-Microfilm Conversion: An Interim Preservation Solution," Library Resources and Technical Services (October 1993), pp. 380-401; (January 1994), p. 87-95; Anne R. Kenney and Lynne K. Personius, A Testbed for Advancing the Role of Digital Technologies for Library Preservation and Access, Final Report, October 1993 (Commission on Preservation and Access, 1993).

[30] As the technology advances, scanners may be set to evaluate "on the fly" image capture requirements based on a micro-second examination of the document's attributes.

purposes - can also be captured using 600 dpi bitonal scanning. For publications containing high quality color and/or grayscale reproductions which are essential to the meaning of the text, bitonal scanning, even at high resolution, will prove to be inadequate. Such publications are frequently found in disciplines such as art history, biology, or geography, and will require good tonal reproduction through color and grayscale scanning.[31]

In 1993, Don Willis, then Vice President for Electronic Product Development at University Microfilm International, authored a highly influential publication, *A Hybrid System Approach to Preservation of Printed Materials*, issued as one of a series developed by the Technology Assessment Advisory Committee of the Commission on Preservation and Access. The author distinguished between *archival resolution*, defined as "the resolution necessary to capture a faithful replica of the original document, regardless of cost," and *optimal archival resolution*, defined as "the highest resolution that technology will economically support at any given point in time." Willis suggested that 600 dpi with 8 bits of grayscale was currently the minimum for achieving archival resolution, and that higher resolutions may be required.[32] Although Cornell's finding suggest that *bitonal* scanning for printed text and line art is sufficient, additional research is needed to examine the interrelationship between resolution and grayscale for a broad range of source materials.

Agency Records: 300 dpi bitonal scanning

The National Archives and Records Administration (NARA) has recommended to federal agencies that a scanning resolution

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[31] Preserving the Illustrated Text, Report of the Joint Task Force on Text and Image (Commission on Preservation and Access, April 1992).

[32] Don Willis, A Hybrid Systems Approach to Preservation of Printed Materials (Commission on Preservation and Access, November 1992), p. 11.

of at least 300 dpi be used for office documents.[33] Typewriters produce text in 10 and 12 point type, and common office laser printers and word processing software produce typefonts at 6 point and above. NARA also notes that a scanning resolution of 300 dpi will facilitate the use of optical character recognition (OCR) technology. For engineering drawings, maps, and other documents that contain fine detail, the National Archives suggests scanning at higher resolutions, up to 600 dpi or greater, and that a representative sampling of such documents be tested thoroughly to verify the appropriate input resolution.[34]

Manuscripts

NARA's recommendations are generally limited to machine-produced documents. The nature and variety of handwritten documents mitigates against establishing broad resolution benchmarks. Normally, however, letters, diaries, and the like do not contain the level of detail present in printed matter, and individual characters are rarely smaller than 1mm in height. The type and color of media used and its uneven application - especially in combination with a poor contrast between text and background - are much more problematic for digital rendering. Such documents will require tonal reproduction in grayscale or color to enhance legibility as well as fidelity to the original.

In one of the largest manuscript scanning projects to date, the Archivo General de Indias in Seville, Spain, is scanning about eight million pages documenting the Spanish colonization of the Americas. Good results have been obtained using 100 dpi

[33] Resolution requirements may change with the general introduction of 600 dpi laser printers.

[34] National Archives and Records Administration, Long-term Access Strategies for Federal Agencies, op. cit., pp. 38-39. See also, ANSI/AIIM MS52-1991, Recommended Practice for the Requirements and Characteristics of Original Documents Intended for Optical Scanning.

resolution with 4 bits of gray (initially captured at 256 gray levels, but only the 16 most significant contiguous levels are retained).[35] However, the Seville Project did not have as a goal the use of digital imaging for replacement purposes. It is unclear from published reports whether this level of resolution provides for full informational capture. Peter Robinson, in an important contribution to the literature, The *Digitization of Primary Textual Sources*, strongly recommends that manuscript materials "of every type" be captured as full-color images, with a minimum of 300 dpi and 24-bit color.[36] Additional work needs to be undertaken with manuscript materials before image quality benchmarks can be established.

Halftone and Continuous Tone Images

A number of studies have been devoted to digital capture of photographic images. In an early study. Michael Ester, former director of the Getty Art History Information Program, examined the relationship between image quality and viewer perception. He began with the premise that image capture must take into consideration the extent to which viewers can discriminate among variations in quality, and the differences in resolution and tonal reproduction they can detect. Based on experiments with a group of art historians, Ester concluded that user perceptions vary inversely with images rendered in grayscale and in color. With grayscale, users were satisfied with 8 bits of gray but were more demanding of resolution. With color images, viewers were less

[35]   Hans Rütimann and M. Stuart Lynn, Computerization Project of the Archiv General de Indias, Seville, Spain: A Report to the Commission on Preservation and Access, Commission on Preservation and Access, March 1992, p. 7.

[36]   Peter Robinson, The Digitization of Primary Textual Sources, Office for Humanities Communication Publications, Number 4, Oxford University Computing Services, 1993, p. 29.

sensitive to lower resolutions but required more tonal rendering -
8 bits of color were deemed insufficient; 24-bit color, with its 16.7
million possible combinations, was preferred.[37]

User perceptions are important, but they should not be the
sole determinant of image capture requirements. There does
seem to be general agreement that at a minimum true black and
white photographs should be rendered by 8 bits of gray, and color
photographs by 24 bits of color. No such conclusions have been
reached regarding resolution. For halftone material, captured with
grayscale, scanning resolutions have been calculated by Robinson,
Willis, and others to be one and a half times the screen ruling of
the halftone itself. Screen ruling measures the frequency or
distance of halftone dots at an angle. Approximate screen ruling
for newspaper quality halftones is 80, medium quality magazines
use 130, and high quality art books use 160. The calculated
resolution requirements, therefore, would range between 120 and
300 dpi.[38]

Robinson suggests using these resolutions as a guide to the
digitization of continuous tone material as well. Photographic
media are capable of capturing very fine detail, and the digital
resolution requirements for continuous tone images will depend in
part on how much detail must be retained. Ester argues that
digital cameras will someday rival photography, but "this is not the
case today." He suggests a good method for testing image quality
is to:

*.... go 'film to film': to begin with the photographic source,
capture it digitally, then use the digital image to regenerate the initial*

37 Michael Ester, "Image Quality and Viewer Perception," LEONARDO,
    Digital Image-Digital Cinema, supplemental issue (Pergamon, 1990).
38 Don Willis, op. cit., p. 34, and Peter Robinson, op. cit., pp. 27-28.

photographic format. Comparing the original and the digital reproduction provides an effective means of evaluation.[39]

As with manuscript material, no general benchmarks for resolution requirements for continuous tone images habe been developed.

Summary of Recommendations

This tutorial has focused primarily on the relationship between resolution and image quality, and only tangentially on the relationship between tonal reproduction and resolution. Other factors that affect overall image quality, including enhancement and compression, as well as tonal fidelity, deserve equal attention. As has been shown, there are simple means for estimating resolution requirements for capturing textual information, particularly for printed matter, but additional work is needed to establish resolution requirements for other categories of material. Investigations underway at the Library of Congress, Getty Art Museum, Image Permanence Institute, Columbia Unviversity and elsewhere promise to add to the understanding of image quality in a digital world.

In closing, there are some general recommendations for resolution requirements that should be considered by an institution contemplating the use of digital technology to convert paper and film-based materials.

- define requirements based on immediate and future applications, not on the basis of current technological capabilities;

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[39] Michael Ester; "Draft White Paper on Digital Imaging in the Arts and the Humanities," Getty Art History Information Program. Initiative on Electronic Imaging and Information Standards, March 3-4, 1994, p. 7.

- scan at high resolution, sufficient to capture essential characteristics of the source documents themselves, so as to avoid rescanning in the future; derive lower resolution images for current uses;

- set resolution requirements sufficiently high to avoid item-by-item decision making;

- confirm estimated resolution requirements by a thorough testing of representative samples of the source material and through curatorial and user review;

- evaluate image quality on high resolution monitors and through printed test pages of technical targets and actual source documents.

Appendix 1

Calculating Resolution from Pixel Dimensions

Although flatbed scanners apply the same number of dots per inch to any document - up to the maximum size that the platen will accomodate - other scanning devices typically state resolution in terms of pixels x pixels. In such cases, the size of the document will have a direct bearing on the resolution achieved. Examples of the pixel matrix dimensions of two digital cameras and the Kodak PhotoCD process are listed below.

Scanning Device	Pixel Dimensions
JVC TK-F 7300 Camera	3,456 x 4,416
Kontron ProgRes 3012	2,320 x 3,096
Kodak PhotoCD	2,048 x 3,072[*]

[*] Kodak PhotoCD technology provides 5 levels of display based on pixel dimensions, from 128 x 192 to 2,048 x 3,072 pixels; the "professional" version of PhotoCD uses a scanning array of 4,096 x 6,144 pixels. For an overview of the

It is important to recognize that the number of pixels refers to the dimensions (w x l) of a set scanning array of the camera. If the full scanning array, or pixel matrix, is used to capture a document, resolution will vary with the documents's dimensions: as the size of the original increases, resolution decreases. For instance, the resolution of a 4" x 5" document will be ten times greater than the resolution of a 40" x 50" document.

To calculate the effective dpi from pixel dimensions, determine whether the aspect ratio of the source document is equal to or less than the aspect ratio of the pixel matrix of the digital camera. If it is, divide the smaller number of the pixel matrix by the width of the source document (not the photo-intermediate). For example, the Kodak PhotoCD (2,048 x 3,072 pixels, 1.5 aspect ratio) will capture the information in an 8,5" x 11" document (1.29 aspect ratio) with the effective resolution of 2,048/8,5, or 241 dpi. If the aspect ratio of the document is larger than that of the pixel matrix, divide the length of the pixel matrix by the length of the source document. For example, a Kontron digital camera (2,320 x 3,096, 1,33 aspect ratio) will capture the information in an 11" x 17" document (1.54 aspect ratio) with an effective resolution of 3,096/17, or 182 dpi.

Formulas: Effective dpi calculated from pixel dimensions

1) Aspect ratio of source document equal to or less than aspect ratio of pixel matrix:

    smaller number in pixel matrix/width of the source document.

2) Aspect ratio of source document greater than aspect ratio of pixel matrix:

larger number in pixel matrix/length of the source document.

The following chart illustrates the relationship between the physical dimensions of the source document and the achieved resolution using PhotoCD technology, at 2,048 x 3,072 pixels, 1.5 aspect ratio.

Document Dimensions	Aspect Ratio	Effective DPI
8,5"x11"	1.29	241
10"x20"	2.00	154
11"x17"	1.32	186
20"x30"	1.50	102
30"x40"	1.33	68

Appendix 2

Dots Per Character Formula for Bitonal Scanning

Because character rendering forms the basis for the quality control procedures described in MS44, another useful method of determining the level of detail that a scanner or digital camera will capture is to calculate the number of dots used to represent the height of the character being viewed. Once the number of dots per character is known, the QI may be predicted, so final legibility requirements may be defined in terms of required dots per character.

The number of dots per character can be determined by multiplying x-height (h) by the input scanning resolution (dpi).

Dots per character = dpi x h

Because character height is often measured in millimeters and resolution is measured in inches, (h) is multiplied by .039 to be converted to its U.S. equivalent:

Dots per character = dpi x .039h

Therefore, if we know our scanning resolution and the x-height of a given character, we can determine the number of dots that will be used over its height. For example, a 300 dpi scan would produce 11.7 dots (300 x .039 x 1) for a 1.0mm lower-case letter, such as "e" or "x" (approximately 6-point type). Given that a dot occupies the same space as a line, the 11.7 dots roughly equal 12 lines/mm, or 6 1p/mm. We can then use the Classic QI formula to estimate final legibility. In this case, an output scanning resolution of 300 dpi will render a 1.0mm character at a QI of 6 1p/mm x 1.0mm, or 6.0. (To obtain a QI of 5, which is considered legible, for a 1.0mm high character, approximately 5 line pairs - or 10 pixels - would be needed over the height of the 1.0mm character. The National Archives of Canada requires 10 pixels/mm for rendering digital resolution.)

The Classic QI formula also informs us that 8 1pmm, or 16 *dots*, would be necessary to render the same 1.0mm character with a QI of 8.0. To obtain 16 dots over a 1.0mm character, the required resolution can be determined by dividing the dots/character by the height and multiplying by .039: dpi = 16/(.039 x 1), or 410. To account for possible misregistration in bitonal scanning, the formula should be adjusted by 50% to guarantee a consistent output:

Dots per character formula:

Dots per character = 1.5dpi x .039h

Using this formula, we find that to render a 1.0mm character with the necessary 16 dots for a QI of 8.0, 24 dots are needed over the height of a 1.0mm character, and the input dpi must be increased from 410 to 615.

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The Hundred Most Influential Books Since the War*

Most people enjoy making lists. But who would produce a list of "A hundred books who have influenced Western public discourse since the Second World War"? A brief explanation is called for.

In 1986, a diverse group of writers and scholars came together to try to assist independent East European writers and publishers both at home and in exile. The Chairman was Lord Dahrendorf, Warden of St Antony's College, Oxford. Other members were the French historian Françous Furet; Raymond Georis, Director of the European Cultural Foundation, Amsterdam; Laurens van Krevelen of the Dutch publishing house Meulenhoff; the Swedish writer Per Wästberg, at the time President of International PEN; the European correspondent of the *New Yorker*, Jane Kramer; and the historian and commentator, Timothy Garton Ash. It was envisaged that support would take two forms: first, to ensure publication in the original languages, and second, to encourage more translations.

One of the basic tenets of this initiative, which came to be known as the Central and East European Publishing Project

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(CEEPP), was that the geopolitical division of Europe - the Iron Curtain was then still very much a reality - had interrupted the normal and healthy flow not just of people but also of books and ideas. Its aim, in the words of Ralf Dahrendorf, was to foster a "common market of the mind" throughout the whole of Europe. After 1989, CEEPP was able to expand its activities and organize workshops and in-house training for those involved in publishing, but its main concern remained to facilitate the publication of worthwhile books and journals.

At Trustees' meetings, titles submitted by publishers for consideration were scrutinized for their quality and relevance. Not surprisingly, there were, among the Orwells, Poppers and Hannah Arendts, some very odd works, and also strange omissions. Inspired and provoked by the perusal of these lists over the years, the Trustees decided that in their final year of activity (the Project disbanded at the end of 1994) they would respond to the challenge of producing, as a *jeu d'esprit*, a consciously arbitrary list of the 100 books which have been most influential in the West since 1945. (This list is included in the forthcoming book, *Freedom for Publishing: Publishing for Freedom: The Central and East European Publishing Project*, edited by Timothy Garton Ash. 201pp. Budapest: CEU Press; distributed in the UK by OUP. 1 85866 055 6.)

An initial list was put together by a small panel consisting of Robert Cassen, Dahrendorf, Garton Ash, Michael Ignatieff, Leszek Kolakowski and Bryan Magee. It was then revised, following an extensive discussion at the last meeting of CEEPP Trustees. Works of fiction are included only when they had a wider impact. Titles are grouped in decades by the date of their first appearance. In all cases, the English title is mentioned first and the original title in brackets. Within decades the order is alphabetical.

Certain seminal works which were published before the Second World War but which have had a major influence since the war were set aside. That list would certainly include:

Karl Barth: *Credo*
Marc Bloch: *Feudal Society (La Société féodal)*
Martin Buber: *I and Thou (Ich und Du)*
Norbert Elias: *The Civilizing Process (Über den Prozess der Zivilisation)*
Sigmund Freud: *Civilization and Its Discontents (Das Unbehagen der Kultur)*
Elie Halévy: *The Era of Tyrannies: Essays on socialism and war (L'Ere des tyrannies. Etudes sur le socialisme et la guerre)*
Martin Heidegger: *Being and Time (Sein und Zeit)*
Johan Huizinga: *The Waning of the Middle Ages (Herfsttij der Middeleeuwen)*
Aldous Huxley: *Brave New World*
Franz Kafka: *The Castle (Das Schloss)*
John Maynard Keynes: *The Economic Consequences of the Peace*
John Maynard Keynes: *The General Theory of Employment, Interest and Money*
Lewis Namier: *The Structure of Politics at the Accession of George III*
José Ortega y Gasset: *The Revolt of the Masses (La Rebelión de las masas)*
Karl Popper: *The Logic of Scientific Discovery (Logik der Forschung)*
Ludwig Wittgenstein: *Tractatus logico-philosophicus (Logisch-Philosophische Abhandlung)*

The final list was:

Books of the 1940s

1. Simone de Beauvoir: *The Second Sex (Le Deuxième Sexe)*
2. Marc Bloch: *The Historian's Craft (Apologie pour l'histoire, ou, Métier d'historien)*
3. Fernand Braudel: *The Mediterranean and the Mediterranean World in the Age of Philip II (La Méditerranée et le monde méditerranéen à l'époque de Philippe II)*
4. James Burnham: *The Managerial Revolution*
5. Albert Camus: *The Myth of Sisyphus (Le Mythe de Sisyphe)*
6. Albert Camus: *The Outsider (L'Etranger)*
7. R. G. Collingwood: *The Idea of History*
8. Erich Fromm: *The Fear of Freedom (Die Furcht vor der Freiheit)*
9. Max Horkheimer and Theodor W. Adorno: *Dialectic of Enlightenment (Dialektik der Aufklärung)*
10. Karl Jaspers: *The Perennial Scope of Philosophy (Der philosophische Glaube)*
11. Arthur Koestler: *Darkenss at Noon*
12. André Malraux: *Man's Fate (La Condition humaine)*
13. Franz Neumann: Behemoth: *The structure and practice of National Socialism*
14. George Orwell: *Animal Farm*
15. George Orwell: *Nineteen Eighty-four*
16. Karl Polanyi: *The Great Transformation*
17. Karl Popper: *The Open Society and Its Enemies*
18. Paul Samuelson: *Economics: An introductory analysis*
19. Jean-Paul Sartre: *Existentialism and Humanism (L'Existentialisme est un humanisme)*

20. Joseph Schumpeter: *Capitalism, Socialism and Democracy*
21. Martin Wright: *Power Politics*

Books of the 1950s

22. Hannah Arendt: *The Origins of Totalitarism*
23. Raymond Aron: *The Opium of the Intellectuals (L'Opium des intellectuels)*
24. Kenneth Arrow: *Social Choice and Individual Values*
25. Roland Barthes: *Mythologies*
26. Winston Churchill: *The Second World War*
27. Norman Cohn: *The Pursuit of the Millenium*
28. Milovan Dijlas: *The New Class: An analysis of the Communist system*
29. Mircea Eliade: *Images and Symbols (Images et symboles)*
30. Erik Erikson: *Young Man Luther: A study in psychoanalysis and history*
31. Lucien Febvre: *The Struggle for History (Combat pour l'histoire)*
32. John Kenneth Galbraith: *The Affluent Society*
33. Erving Goffman: *The Presentation of Self in Everyday Life*
34. Arthur Koestler and Richard Crossman (eds): *The God That Failed: Six studies in Communism*
35. Primo Levi: *If This Is a Man (Se questo è un uomo)*
36. Claude Lévi-Strauss: *A World on the Wane (Tristes tropiques)*
37. Czeslaw Milosz: *The Captive Mind (Zniewolony umysl)*
38. Boris Pasternak: *Doctor Zhivago*
39. David Riesman: *The Lonely Crowd*
40. Herbert Simon: *Models of Man, Social and Rational*
41. C. P. Snow: *The Two Cultures and the Scientific Revolution*
42. Leo Strauss: *Natural Right and History*
43. J. L. Talmon: *The Origins of Totalitarian Democracy*
44. A. J. P. Taylor: *The Struggle for Mastery in Europe*

45. Arnold Toynbee: *A Study of History*
46. Karl Wittfogel: *Oriental Despotism: A comparative study of total power*
47. Ludwig Wittgenstein: *Philosophical Investigations (Philosophische Untersuchungen)*

Books of the 1960s

48. Hannah Arendt: *Eichmann in Jerusalem: A report on the banality of evil*
49. Daniel Bell: *The End of Ideology*
50. Isaiah Berlin: *Four Essays on Liberty*
51. Albert Camus: *Notebooks 1935-1951 (Carnets)*
52. Elias Canetti: *Crowds and Power (Masse und Macht)*
53. Robert Dahl: *Who Governs? Democracy and power in an American City*
54. Mary Douglas: *Purity and Danger*
55. Erik Erikson: *Gandhi's Truth: On the origins of militant nonviolence*
56. Michel Foucault: *Madness and civilization: A history of insanity on the Age of Reason (Histoire de la folie à l'âge classique)*
57. Milton Friedman: *Capitalism and Freedom*
58. Alexander Gerschenkron: *Economic Backwardness in Historical Perspective*
59. Antonio Gramsci: *Prison Notebooks (Quaderno del carcere)*
60. H. L. A. Hart: *The Concept of Law*
61. Friedrich von Haydek: *The Constitution of Liberty (Die Verfassung der Freiheit)*
62. Jane Jacobs: *The Death and Life of Great American Cities*
63. Carl Gustav Jung: *Memories, Dreams, Reflections (Erinnerungen, Träume, Gedanken)*
64. Thomas Kuhn: *The Structure of Scientific Revolutions*

65. Emmanuel Le Roy Ladurie: *The Peasants of Languedoc (Les Paysans de Languedoc)*
66. Claude Lévi-Strauss: *The Savage Mind (Le Pensée sauvage)*
67. Konrad Lorenz: *On Aggression (Das sogenannte Böse)*
68. Thomas Schelling: *The Strategy of Conflict*
69. Fritz Stern: *The Politics of Cultural Despair*
70. E. P. Thompson: *The Making of the English Working Class*

Books of the 1970s

71. Daniel Bell: *The Cultural Contradictions of Capitalism*
72. Isaiah Berlin: *Russian Thinkers*
73. Ronald Dworkin: *Taking Rights Seriously*
74. Clifford Geertz: *The Interpretation of Cultures*
75. Albert Hirschman: *Exit, Voice, and Loyalty*
76. Leszek Kolakowski: *Main Currents of Marxism (Glowne nurty marksizmu)*
77. Hans Küng: *On Being a Christian (Christ Sein)*
78. Robert Nozick: *Anarchy, State and Utopia*
79. John Rawls: *A Theory of Justice*
80: Gershom Scholem: *The Messianic Idea in Judaism, and other essays on Jewish Spirituality*
81. Ernst Friedrich Schumacher: *Small Is Beautiful*
82. Tibor Scitovsky: *The Joyless Economy*
83. Quentin Skinner: *The Foundations of Modern Political Thought*
84. Alexander Solzhenitsyn: *The Gulag Archipelago*
85. Keith Thomas: *Religion and the Decline of Magic*

Books of the 1980s and beyond:

86. Raymond Aron: *Memoirs (Mémoires)*

87. Peter Berger: *The Capitalist Revolution: Fifty propositions about prosperity, equality and liberty*
88. Norberto Bobbio: *The Future of Democracy (Il futuro della democrazia*
89. Karl Dietirich Bracher: *The Totalitarian Experience (Die totalitäre Erfahrung)*
90. John Eatwell, Murray Milgate and Peter Newman (eds): *The New Palgrave: The world of economics*
91. Ernest Gellner: *Nations and Nationalism*
92. Vaclav Havel: *Living in Truth*
93. Stephen Hawking: *A Brief History of Time*
94. Paul Kennedy: *The Rise and Fall of the Great Powers*
95. Milan Kundera: *The Books of Laughter ad Forgetting*
96. Primo Levi: *The Drowned and the Saved (I sommersi e i salvati)*
97. Roger Penrose: *The Emperor's New Mind: Concerning computers, minds, and the laws of physics*
98. Richard Rorty: *Philosophy and the Mirror of Nature*
99. Amartya Sen: *Resources, Values and Development*
100. Michael Walzer: *Spheres of Justice*

Book Review

Margrit B. Krewson, *German-American relations: a selective bibliography.* Washington, D.C.: Library of Congress, 1995. 319p.

If one were to accept the celluloid evidence of Hollywood, one would believe that the United States are peopled largely by first or second generation Italian or Irish immigrants. However Margrit Krewson, the energetic and talented head of the German/Dutch section of the European Division in the Library of Congress for a number of years, reminds us in the preface to this work that from the beginning of the nineteenth century until well into the present one Germans represented the largest single ethnic group, and that the 1990 census showed that nearly one in four U.S. citizens claim German ancestry. It is to offer an aid to the study of that relationship, which goes back more than three centuries, that the present selection has been made from the Library of Congress' holdings. That such a study is intended to look forward as well as back is clear from Krewson's observation that, 'At the close of the twentieth century ... a reunified Germany, by virtue of its size, location, and economic power, is fated to play the central role in shaping a new Europe and redefining that continent's relationship with North America'. One can almost hear that great intellectual and Germanophile, Margaret Thatcher, having an apoplectic fit over such an obvious statement of fact.

The present bibliography, which is the first concise coverage of the subject is divided into eight sections, the first listing bibliographies and reference works, the second general works

covering the entire space of German-American contacts, and the remaining six covering the key periods.

Although Krewson singles out for special mention a number of intriguing titles, the interested reader will easily assemble his or her own selection. Mine would undoubtedly include no. 653, G. H. Heffner's *The youthful wanderer* ... adapted to the wants of young Americans taking their first glimpses at the Old World. A first, surprised reaction to the date of publication, 1876, was quickly followed by the memory of the joke made by the Anglican chaplain at Florence in E. M. Forster's *A room with a view* (1908) abouth the American tourists in Rome. A more detailed perusal of the volume uncovered for me the wealth of materials on a particularly fascinating aspect of German-American relations, the so called Pennsylavania Dutch.

The variety of materials on that and other topics touches on my only criticism of the volume, and that is the lack of a subject index, which would have made the volume even more useful than it is.

W. A. KELLY (NATIONAL LIBRARY OF SCOTLAND)

News

IEE PROCEEDINGS JOURNALS TO GO ONLINE THROUGH OCLC

The Institution of Electrical Engineers (IEE) has announced an agreement with OCLC to make all 11 of the IEE Proceedings journals available over the Internet beginning in Janary 1996. The IEE Proceedings will be accessible as both individual journals and one comprehensive journal containing all individual journals.

"With the ever increasing demand for technical information to be delivered to the desk top of the engineer or scientist, the IEE is staying at the forefront of electronic publishing by adding to its offering of online information," said Jeff Pache, IEE Electronic Products Manager. The IEE's rapid-publication letters journal, Electronics Letters Online, is currently available through the OCLC Electronic Journals Online system.

"The IEE Proceedings journals represent a highly acclaimed, comprehensive collection covering the key areas of electric and electronic engineering." said Andrea Keyhani, OCLC Electronic Publishing Manager. "Subscribers to the whole collection will be able to search across all the journals for important new developments that may have applications to other fields. Alternatively, researchers can subscribe to the specific journals of interest to them. In either case, subscribers will have fast and convivent access to cutting-edge research."

The IEE Proceedings series comprises 11 titles in the following subject areas: Circuits, Devices and Systems; Communications;

Computers and Digital Techniques; Control Theory and Applications; Electric Power Applications; Generation, Transmission and Distribution; Microwaves, Antennas and Propagation; Optoelectronics; Radar, Sonar and Navigation; Science, Measurement and Technology; and Vision, Image and Signal Processing.

IEE Proceedings Online will use OCLC's window-based graphical user interface, *Guidon*, which operates in the Microsoft Windows environment. Specific features include: full-text searching of all articles; typeset quality display and printing of text, equations, tables, and figures; a table of contents created for each article which allows you to browse the article sequentially or to jump to any listed section; hypertext links to and from the figures and tables as well as footnotes and cited references; linked documents such as comments on articles already published and author' replies brought to your attention when you view any one ot these; hypertext links from cited references to abstracts in the INSPEC Database; automatic notification of newly published articles in your field by weekly fax, mail, or e-mail.

The Institution of Electric Engineers is the largest professional engineering society in Europe with a worldwide membership of over 130,000. It is a not-for-profit organisation, registered as a charity in the UK. Through its Publishing and Information services division it publishes over 20 primary journals and is the producer of the well known INSPEC bibliographic database.

OCLC is a nonprofit computer library service and research organization whose computer network and services link more than 20,000 libraries in 61 countries and territories.

Contact: Jeff Pache
Tel. +44 (0) 1438 767286
Fax: +44 (0) 1438 742840
E-mail: jpache@iee.org.uk

SUPERJOURNAL PROJECT RECEIVES £833,000 FUNDING FROM UK HIGHER EDUCATION

London, UK. - The SuperJournal Consortium announces today that it has received a grant of £833,000 to develop multimedia electronic journals. The Higher Education Funding Councils will fund the work over three years as part of the Electronic Libraries Programme (eLib). Project work begins immediately, and the first electronic journals will be ready in March 1996.

The SuperJournal Project is a major collaboration between publishers, librarians, and universities. The aim it to develop the electronic journals of the future that researchers, students, and librarians find useful and usable. Electronic journals in the project will be based on quality refereed journals that exist in print today, but with innovative electronic features such as interactivity, hypertext linking, video, animation, and 3-D graphics.

An important feature of the project will be to use industry standards and off-the-shelf tools to develop the electronic journals. Standards for structuring the information, like SGML, and standard file formats will be used. Vendors of user interfaces, browsers, and search/retrieval programs, and multimedia handling tools will be invited to provide software for the project.

Project partners include the 21 publishers of the Superjournal Consortium, University of Manchester, and Loughborough University of Technology. Each publisher will contribute journals and be involved in developing the multimedia features. University of Manchester will develop the host infrastructure to make them available electronically to user sites.

HUSAT Research Institute at the Loughborough University will conduct the research on user testing and evaluation.

In the first year the journals will be tested at 9 Partner User Community sites. These include University of Birmingham, Cambridge University, De Montfort University, Heriot-Watt University, London School of Economics. Oxford University, Ulster University, University College London, and University of Warwick. As the project progresses, the number of sites will grow, and may eventually extend to Europe and the USA.

Of particualar interest for the future is answering the scaleability questions: How do you handle large quantities of multi-media content? This is the only project in the Electronic Libraries programme that examines this.

David Pullinger, Project Director, said "The project is unique because of its scale and collaborative approach. By teaming together, publishers, researchers, and librarians, we can achieve what none could do alone. The critical mass of journals, the testbed environment and network of users will enable us to translate the printed journal into new electronic paradigms. It's a real opportunity to redefine the scholarly publishing process, from author, to publisher, to library, to reader."

Professor Ken Eason, Loughborough University of Technology, said "Too often we rush blindly into major technological applications. Loughborough University is very excited about the opportunity to evaluate systematically the positive benefits that might obtain from electronic publishing and to identify the problems that organisations face as we move from print-on-paper to electronic publishing."

The Director of the Electronic Libraries programme, Chris Rusbridge, said, "With its involvement of both the universities and many publishers, SuperJournal will be a flagship project for us. The issues of access and presentation it addresses are vital ones for the success of electronic publishing, and it is good to see the users brought into the process. We hope and expect the project to lead on to much wider availability of material and further material throughout the UK HE."

The Subject clusters of journals will include protein genetics, computing, physical chemistry and communication and cultural studies.

The SuperJorunal Consortium of publishers was formed in (1993) when 8 publishers collaborated on a pilot project to explore the potential of SuperJANET for journal publishing. Since then the group has expanded to include 21 society, university press, and commercial publishers. These include: Academic Press Ltd, Blackwell Publishers Ltd, Blackwell Science Publishers Ltd, CAB International, Cambridge University Press, Carfay Ltd, Chapman & Hall Ltd, Churchill Livingstone Ltd, Elsevier Science Ltd, Institution of Electrical Engineers, Institute of Physics Publishing Ltd, Society of Endocrinology, Macmillan Publishers Ltd, Oxford University Press, Rapid Science Ltd, Routledge Ltd, Royal Society of Chemistry, Sage Publications Ltd, Taylor and Francis Ltd and John Wiley and Sons Ltd.

The project is supported by the Joint Information Systems Committee of the Higher Education Funding Councils and DENI.

For further information abouth the SuperJournal project contact:

David Pullinger
SuperJournal Project Director
Porters South
Crinan Street
London, N1 9SQ
United Kingdom

Voice: +44-171 843 4764
Fax: +44-171 843 4766
email: d.pullinger@nature.com

eLib Programme

The eLib programme is a £15 million UK initiative to deal with the pressures on Library resources caused by the rapid expansion of student numbers and the worldwide 'explosion' in academic knowledge. These problems were recognised in the 1993 report of the Joint Funding Council's Libraries Review Group, chaired by Professor Sir Brian Follett.

The objectives of the eLib programme include the use of IT to improve delivery of information through increased use of electronic libraries services, to allow academic libraries to cope better with growth, to explore different models of intellectual property management and to encourage new methods of scholarly publishing.

Web pages for the eLib programme are accessible at URL:

http://ukoln.bath.ac.uk/elib/

LIGUE DES BIBLIOTHEQUES EUROPEENNES DE RECHERCHE

Division of Collection Development

JACQUELINE DUBOIS
Bibliothèque Musée de l'Homme, Paris

Annual Meeting of the Division, Centrale Bibliotheek, Katholieke Universiteit Leuven, 3 July 1995

Present:

J. Dubois (Chair), Bibliothèque Musée de l'Homme; T. Bakker, Koninklijke Bibliotheek; J. Braeckman, Katholieke Universiteit Leuven; J.-P. Cressent, Ministère Education Nationale; J. Escobedo, Biblioteca de Catalunya; J.-C. Garreta, Arsénal; N. Jenkins, National Library of Wales; E. Lamaro, Biblioteca Camera dei Deputati; A. Matheson, National Library of Scotland; K. Tammaru, National Library of Estonia; V. Tesnière, Bibliothèque Nationale de France; A. Wade (Secretary), British Library; J. Walterus, Koninklijke Bibliotheek Albert I/Bibliothèque Royale Albert I; B. Wartmann, Zentralbibliothek Zürich.

1. Committee membership

J. Dubois explained that she had selected four members of the Division to form a Committee, as work had to start early in the year, before elections should be organized. Those members were: Trix Bakker (Koninklijke Bibliotheek, the Hague), Rolf Griebel (Bayerische Staatsbibliothek, Munich), Emilia Lamaro (Bilioteca Camera dei Deputati, Rome), and Ann Wade (British Library, London) who had also been asked to be Secretary. The first elections for the Committee would be held in two years' time, when two members would stand down. From then on there would be elections every two years for two Committee members, and every four years for the Chair. She asked the gemeral membership to confirm the present Committee membership, and this was done.

2. Expert Committees

It was agreed that the Groupe des Cartothécaires should become an Expert Committee of the Divisions, as much of its work involved collection development. However, this would not prevent it from contributing to the work of other Divisions, such as Access, as necessary.

It was also agreed that a separate Conspectus Group was not needed, as the work of the Group would be carried forward within the programme of the Division.

3. Aims and scope of the Division

The statement of aims and scope which had been drafted by the Committee was agreed by the members.

4. Programme of work

The draft statement of the activities in which the Division would be engaged was agreed, and on the basis of this the programme which follows was agreed.

a)   A one-day meeting would be held in Malta just before the next annual conference of LIBER. The Division would present a review of the current position in Europe in relation to coordination and cooperation in collection development. This would ensure that all members were well informed, and it would provide a sound basis on which to build future work. Members would deliver a brief report (15-20 minutes) on the situation in their country or region for the meeting. Further guidelines would be provided by the Committee later in the year.

Members then presented very brief summaries of the position at present in their countries, and a note of these is attached.

b)   The Division would monitor the growth in electronic publishing and would assess its impact on the collecting practices and policies of libraries. In the electronic environment the balance between collection development and access was shifting, and the Division, together with the Division of Access, should be fully aware of the implications and able to help its members during the transition. New areas for international cooperation between libraries were offered by the developments in electronic access (for example, the US Association of Research Libraries was working with German libraries to establish electronic access to certain German materials; the British Library and the Koninklijke Bibliotheek had entered into an agreement to cooperate in providing

access to a wider range of material). The Division would arrange for speakers on both these topics to address a future meeting. It was also agreed that it would be useful for the Division to discuss the practical work of advising on procedures for identifying electronic publications and techniques for acquiring them.

Bakker: Half a dozen libraries in the Netherlands have made their collecting profiles this and last year, using the Conspectus methodology and the Dutch Basic Classification (in use by all the participating libraries since 1992). What's important is that the library directors find it very essential that profiles are being made. Later on the profiles will be compared, also by taking the budgets into consideration. The Royal Library is also evaluating the holdings of research libraries against those of the German special libraries to see how strong (or weak) the collections are. In december 1995 there will be a report.

Braeckman: The Flemish project to test out the Conspectus methodology has concluded that it was difficult to apply to a heterogeneous mix of libraries, and that it was very time consuming. The White method of evaluation [Evaluating subject collections / Howard D. White in *Annual Review of OCLC Research*, July 1987-June 1988, p. 46-48] was more successful at it was more objective. In Francophone Belgium the University of Brussels is doing a Conspectus-type project for literature. The WLN Conspectus software has been used for the Flemish project (demonstrations during the conference).

Cressent: The French Ministère de l'Education nationale is responsible for university libraries, and makes special funds available to the CADIST libraries. Beyond that, there is no national plan for collecting.

Dubois: The Library of the Musée de l'homme is a CADIST library for Anthropology and Prehistory. The collection is intended to be exhaustive, but the library is short of staff and acquisitions funds. A Conspectus review has been tried, but the subject structure is quite unsuitable for the situation in France. The library then developed its own evaluation technique by checking its holdings against the catalogue of Harvard's Toser Library. This was not entirely successful, and other methods will be tried. There is a new policy in France of establishing Bibliothèques Associées to support the collections of the Bibliothèque Nationale de France in certain special subject fields for a trial period of three years. The Library of the Musée de l'homme will be one of these associate libraries.

Escobedo: The Biblioteca de Catalunya, at the head of the Catalan library system, is responsible for holdings of heritage material in Catalan libraries. The library has an outline collecting policy statement. It is not able to participate in the Conspectus programme at present because it has other priorities, viz: a new structure, also financial; a new administration; a new system of networks; restoration of the building.

Lamaro: There is no national policy for sharing resources between libraries as they are entirely autonomous. However, there has been some progress in cooperation at regional or local level. A group of libraries in Rome have used Conspectus, and there are other groups in Florence and Lombardy. Parts of the Conspectus have to be amended for use in Italy, the Conspectus manual has been translated, and new checklists for political science and Italian law are being compiled. The Rome group is aiming to cooperate on expensive acquisitions and serials in law, history and government publications. A union catalogue is being compiled, and the section for Italien periodicals on history is

finished, foreign periodicals on history will be completed early next year, and then Italian law and international law will follow.

Tammaru: As the large collections in university libraries are very Moscow-oriented, many of them are of little use in the new Estonia. A new policy of collection development is needed, Every aspect of life is changing rapidly, including relations between libraries. The Ministry of Education and Culture is planning for 6 major research libraries in Estonia. There is no network for the library catalogues, and a system for this would need to be introduced quickly. Via the Internet the libraries can be accessed.

Tesnière: A big change in the Bibliothèque Nationale de France is the recent introduction of two new divisions: Science and Economics/Law. The latter in particular will broaden the scope of the library's foreign acquisitions. A Conspectus survey of Government Publications has been completed very recently, and this will lead to a statement of collecting policies and priorities in that area. A broad collecting policy statement for the whole library is being compiled and will be ready by the end of the year.

Wade: The British Library is involved in cooperation in many areas andon various levels. Thress broad categories can be identified:

1. Cooperation with other Legal Deposit libraries (the libraries work together to ensure that the national output is covered as comprehensively as possible, and also that holdings of legal deposit material are not duplicated unnecessarily);

2. Cooperation in provision for certain subjects (the Library is represented on many groups of subject specialists which

aim to improve coverage and share responsibility for expensive purchases);

3. Cooperation in new initiatives with the higher education sector (a national review of library provision for higher education calls for research libraries to define their collecting policies more clearly and to publish them as a basis for further cooperation, and the BL will be issuing its policy statement).

Walterus: The Belgian Royal Library is participating in a Conspectus-type project for internal use. He is doing his PhD in the Library, on the theory and application of different methods of collection evaluation.

Wartmann: The Zentralbibliothek and and the Technical Library in Zurich are working together to define their acquisitions policies. Both libraries use the same systems and methods of access.

LIGUE DES BIBLIOTHEQUES EUROPEENNES DE RECHERCHE

GROUPE DES CARTOTHECAIRES DE LIBER

10th CONFERENCE: STAATSBIBLIOTHEK ZU BERLIN,

GERMANY, 23-27 SEPTEMBER 1996

Planning the new map library

PROVISIONAL PROGRAMME

September 23,
Monday

08.00-10.00: Registration
10.00-12.00: 1st working session:
    Keynotes
13.30-15.30: National Progress Reports
    1994-1996
15.30-16.30: LIBER-meeting
    (business-meeting)
Afternoon: Visit to Map Exhibition and
    Map Department of the Staats-
    bibliothek zu Berlin

September 24,
Tuesday   09.00-10.45: 2nd working session
                            11.00-12.30: 3rd working session
                            Afternoon: Visit to Berlin
                                    Map Collections and special
                                    exhibitions

September 25,
Wednesday   09.00-10.45: 4th working session
                            11.00-12.30: 5th working session
                            Afternoon: Visit to Potsdam
                            Evening: Conference dinner

September 26,
Thursday   09.00-12.30: 6th working session
                            14.00-15.30: LIBER meeting
                                    (subject-meeting)
                            Afternoon: Meeting working-groups
                                    Central and East Europe and
                                    Education

September 27,
Friday   Excursion to Dresden and the Elbe
                                    valley with a visit to the
                                    Mathematisch-Physikalischer Salon
                                    with globes and a Map exhibition

Registration fee: DM 80,00 (inclusive 5-day public transport
ticket)
Excursion fee: DM 50,00

Inscription to be sent to:

Jan Smits, Koninklijke Bibliotheek,
Sectie Kartografische Documentatie,
Room 0269, P.O. Box. 90.407,
NL-2509 LK Den Haag, The Netherlands

Further conference information

The conference will be organized by the Map Department of the Staatsbibliothek zu Berlin - Preussischer Kulturbesitz in co-operation with the German Map Curators Group. Co-ordinator is Dr. Lothar Zögner of the Staatsbibliothek zu Berlin.

Conference languages will be English, German and French.

The programme includes map exhibitions, as well as demonstrations by institutions and manufacturers.

A final programme will be circulated in March/April 1996.

Planning the new map library

concerns itself with two facets of the future of map libraries. Not only are collections housed in new buildings, but the invasion of electronic maps in all its forms requires also different infrastructure and the acquisition of knowledge.

The two facets can also be described as «What can we offer users in new environments» and «What demands can users make of the future library».

Regarding the housing of map libraries the following items are concerned:

-       planning the move of a map collection

-       requirements for stockrooms, reading-room and offices

-       equipment (PC's, scanners, copiers, printers, etc.)

Regarding the future services of map libraries the following items are concerned:

-       technologies (scanning, GIS, WWW, etc.)

-       services (how much knowledge do we offer, time-constraints, charges)

Special items could be to discuss the 'interavailability of materials' (electronic documents can be held anywhere within an institution) and the role national libraries have in the acquisition of electronic materials.

The above is not a limited list of possible subjects for papers, but is meant to sketch a frame for the conference.

The Royal Library in Copenhagen, Denmark, is sorry to inform the Board GdC that, due to delay in their building process, it is impossible for them to organize the 11th conference in 1998. However, they are willing to host the next conference.

Institutions or a group of institutions are invited to offer to host the 11th conference of 1998 and the 12th conference of 2000. Offers should be made during the LIBER meeting on 23 September 1996. Information on organizing a conference can be obtained from the Secretary, Jan Smits.

Map curators from Central and Eastern Europe who want to participate in the conference, but who have trouble financing travel and/or accommodation are requested to write to the conference co-ordinator:

> **Dr. Lothar Zögner, Staatsbibliothek zu**
> **Berlin, Kartenabteilung, Potsdamer-**
> **strasse 33,D-10772 Berlin, Germany**
> **tel.: +49-30-2662419;**
> **fax.: +49-30-2662814**

However, the German Organizing Committee cannot guarantee that requests will be met.

JAN SMITS, SECRETARY GDC

SILVER JUBILEE
ANNUAL GENERAL CONFERENCE
MALTA 1996

The Electronic Library at Work

The Silver Jubilee Annual General Conference will be held in the University of Malta Library, Msida, Malta from 21 to 25 May 1996. The theme of the conference will be: *The Electronic Library at Work*. Papers will cover a range of topics related to this theme in the fileds of preservation, access, collections and management. Further general information about the conference is available form the

General Secretary, Dr Ann Matheson,
National Library of Scotland, George IV Bridge,
Edinburgh, EH1 1 EW, Scotland
fax: +44-31-220 6662
email: a.matheson@admin.nls.uk.

Local information is available from
Miss Roselyn Tabone, University of Malta Library,
Msida, Malta; fax: +356-314396.

Future LIBER Annual General Conferences will take place in Bern (1997), Copenhage (2000) and London (2001). Details of further Conference locations will be published in due course.