RESIZING FOLLOWING AQUEOUS TREATMENT: CURRENT AMERICAN PRACTICE

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As Karen Garlick mentioned in her talk, this project arose out of our concerns about our own practice, our uncertainties about the nature and role of resizing, and about the rationale that underlies it. After discussions with colleagues and an examination of the existing literature certain questions persisted. Could resizing be said to constitute a mature praxis, one with its own set of well defined theoretical underpinnings, its own lore, or was it rather, simply a marginal procedure, seldom used and little considered? It was our hope that a survey of practicing American book and paper conservators would provide a foundation upon which to begin to construct an answer.

The population was defined to be members of the Book and Paper Group in 1982, when the survey was conducted. Excluded from the population were non-conservators such as scientists and administrators. The population size, then, is a known quantity, given as 226 and the 94 responses we received are treated as if the represented a random sampling. The issue of randomness will be taken up elsewhere, but for today, suffice it to say that we are highly confident that the sample adequately represents the population from which it was drawn.

Because the sample represents such a large proportion of the underlying population, we have what is, in effect, a very large sample and certain statistical corrections are appropriate. The precise sizes of the three subpopulations, book conservators, paper conservators, and book-&-paper conservators, of course, were unknown to us, and were estimated using conventional hypothesis testing techniques. Estimates of maximum subpopulation sizes were as follows:

Book	109
Paper	146
Book-&-Paper	52

The survey form, designed after informal discussion with colleagues, attempted to elicit a broad range of information concerning the function of resizing, the criteria that formed the basis of the decision to resize, and the procedures and sizing agents used. While we were, and are, primarily interested in resizing artifacts in conjunction with aqueous treatments, we also inquired about ancillary sizing practices connected with leafcasting and pulp-filling and some portion of the latter data has found

its way into the current presentation.

In order to allow the respondents to treat the issues as thoroughly as possible, answers were elicited as free narrative or anecdote. These narrative answers were later classified into naturally-occurring categories for the purpose of analysis. Thus a given category may subsume a considerable range of varying but similar responses. In cases where a category represented an unmanageably small number of responses they were merged into appropriate broader categories

The first question we addressed was how commonly conservators resized items following aqueous treatment. (See Graph). Specifically, we asked what percentage of such items were resized. Without question, the survey responses support the hypothesis that resizing is an uncommon event, with the mode, or most popular response, being 0% (that is, they never resize). Half of the respondents resize 5 percent or fewer of the items that they treat aqueously and three fourths of the group, 20 percent or fewer. The mean, by the way, is 13.9 with a standard deviation of 20.4. 15 conservators either failed to answer the question or answered in a manner that could not be quantified. These, anecdotal answers, typically of the type "I rarely resize" or "I size only once in a while", are entirely consistent with the above conclusion but are treated as missing data in the calculations.

In general, the number of respondents who resize a given percentage of items falls off as that percentage increases, ranging all the way through the scale, up to a single individual who reports resizing 95 percent of aqueously treated items. The relationship, however, is complicated by an intriguing pattern in reporting. Respondents who resize very infrequently tended to report with excessive, and spurious, precision, citing percentages such as .01 or .05 percent, while people who resize more frequently tended to report their answers to 'nice' round numbers such as 50 or 75 percent. This situation, which is quite understandable given the difficulties of trying accurately to answer so sweeping a question, has made it impossible to present a meaningful graph of the data, since such graphic presentation would tend to overemphasize the importance of the spurious observations.

Instead, this graph presents a slightly idealized view of the data. The x-axis, labelled "Sizeavg", represents the percentage of items resized following aqueous treatment, and the y-axis, labelled "Freq", the number of conservators who resize that often.

The Exponential distribution is one of several right-skewed distributions, (including the Gamma (of which the

exponential is a special case) and the Log-Normal), commonly used in reliability testing for describing such events as time-to-failure of light bulbs. The distribution you see here is an Exponential with a scale parameter (which in the case of the Exponential distribution is equal to the mean) of 14.3, very close to our sample mean of 13.9 After Smoothing our data to correct for the "rounded" responses, we detect a goodness of fit chi-square that is not inconsistent with the hypothesis that percentage of items resized following aqueous treatment is exponentially distributed.

We were very interested to determine whether or not there were any measurable differences in the behavior of the three specialties: book, paper, and book-&-paper. Indeed such differences obtained, but not in the manner we had imagined. One "special" group emerged. Those individuals who reported that they work equally often on books and flat paper constitute a distinct group with respect to how commonly they resize; they resize more frequently than either the book conservators, the paper conservators, or both groups viewed together as a class. Each difference is significant, with a one-tailed probability of .005. The mean of the "special" group is 37.5, with a standard deviation of 33.1. Please note that this "special" group is distinct from the others only with respect to this particular variable. When we deal with other issues, the group, for a number of reasons, largely anecdotal, is quietly merged with the book conservators. We trust neither group will mind.

Table 1

Functions

Increase Strength (43.0)
General Protection (23.7)
Preparation for Inpainting (22.6)
Improve Hand (21.5)
Improve Appearance or texture (18.3)

The figures in parentheses represent the proportion of the sample, expressed as a percentage, that fall in the category. Please note that if we exclude from consideration those individuals who do no sizing or who did not respond to the question, the figures for each proportion (with an exception that will be discussed later), would be 10 to 15 percent again as large.

Some other functions, cited infrequently include: consolidation, acting as a sealant against gaseous penetrants, improving soil resistance, and decreasing

absorptive qualities of sheet

Table 2

Criteria for resizing

Hand (80.9)
Condition (19.1)
Other Criteria (13.8)
Intention (12.8)
Existence of Mold (8.5)
Appearance of Sheet (8.5)

"Intention" here refers to a variety of statements that centered around what was intended to happen to the sized sheet in the future: further treatments, such as inpainting, exhibition etc.

Table 3

Procedures

Brush (56.4)
Immersion (46.8)
Spray (23.4)
Other (9.6)

The category "Other Procedure" included: incorporation of an internal size into a pulp slurry, floating the sheet on a sizing bath, and application of size with a brayer.

Table 4

Internal Sizes Used

Cellulose Ethers (34.4)
Proteins (11.8)
Starches (7.5)
Other Internal Sizes (5.4)

This is the exception mentioned a few moments ago. The numbers in parentheses describe the percentage of the entire sample who use the specified sizing agents for internal sizing. However 60 percent of the group do no internal sizing. Of the group that does internal sizing, 82 percent use ethers, 28 percent proteins, 18 percent starches, and 12 percent use other sizing agents.

Table 5

Surface Sizes Used

Cellulose Ethers (79.6)
Proteins (49.5)
Starches (24.7)
Other Surface Sizes (14.0)

Not surprisingly, the order of preference is the same here as it was with the internal sizes. Within the ethers, methyl cellulose was most frequently cited, followed by sodium carboxymethyl cellulose, hydroxypropyl cellulose and methyl hydroxy ethyl cellulose. Within the proteins, gelatin was cited about 3 times as frequently as vellum offcuts. Polyvinyl alcohol and Aquapel were the most popular surface sizes in the category "Other".

Let us now turn to the question of relationships between variables. Because all of the categorical variables we examined are multiple response or multiple dichotomy groups, neither the groups nor the subgroups that make up the variables are mutually exclusive. For example, an individual conservator might have reported that, for surface sizing, he used methyl cellulose, sodium carboxymethyl cellulose, Lab grade gelatin, and vellum offcuts. This individual would then be categorized in the multiple dichotomy groups <Cellulose Ethers> and <Proteins>. That is, the same individual falls into more than one category and the categories are not mutually exclusive. Because of this we are severely constrained in the choice of exploratory techniques, because the conventional methods for handling nominal data, (be they classical, nonparametric, distribution-free, or "assumption-freer"), for the most part, assume that an observation falls into a neatly delimited, mutually exclusive and mutually exhaustive category, such as 'Male-Female' or 'East Coast- Midwest-West Coast- Other'. If we have learned nothing else from this survey, we have learned that book and paper conservators resist strict categorization. To say that a respondent is female guarantees that she is not male, but to say that a conservator uses methyl cellulose says nothing whatever about whether or not she also uses gelatin and starch.

Thus we are prevented, by the inherent structure of the data, from looking for associations of a broad, general type. That is, we are unable to look for a general association between, say <Function of sizing> and <Sizing Agents Used.> Since the only mutually exclusive and exhaustive categories we have open to us are those determined by whether or not a respondent cites a particular item-- for example, either does or does not use methyl

cellulose --we are limited to looking for associations between specific responses to one (independent) and specific responses to another (dependent) variable.

Naturally, we could have avoided this difficulty by asking our respondents, for example, to rank the surface sizes used in order of preference and then examined the favorites, but this would have resulted in a subtle but critical shift in the conceptual foundation of the study; we would have been looking at preference rather than practice. As the object of the survey was to assess current practice, to focus the analysis on one component of that practice -- preference -- would have been misleading.

Hence, while we cannot look for a general association between, say function and sizing agents used, we can look for associations of the form:

<one of the responses about Function
was 'Improve Hand'>
associated with
<one of the responses about Sizing agent used
was 'Gelatin'>

Of course, we are able to class several sets of responses into grouped variables and look for associations of this form:

<one of the responses about Function
was 'Improve Hand'>
associated with
<one of the responses about Sizing agent used
was in the class 'Proteins'>.

Operationally, this translates into the analysis of a large number of 2 by 2 tables. With approximately 130 dichotomous (True-False) variables available for analysis, each one potentially associated with each of the others, we obviously needed some means of restricting the number of relationships to examine. Therefore, a preliminary chi-square test was performed on each of the tables and we eliminated those tables in which there was a strong indication that the variables were independent of each other. Because the chi-square test is rather finicky about the conditions under which it performs and because "adverse" conditions are encountered often in this dataset, in some instances we retained tables with small chi-square values. In most cases, however, we retained only those tables whose chi-squares, after Yates's Correction for Continuity had significance levels below .05.

We then calculated several measures of association suitable for nominal data, among which were: Goodman and Kruskal's lambda, Pearson's r, Odds Ratio and Log Odds

Ratio, Yule's Q and Yule's Y.

Based on these measures we isolated approximately 40 variable relationships, (excluding those that were utterly trivial, such as those involving the categories 'Missing Data' or 'Not Applicable') in which a significant association was in evidence. Of these, we shall present only highlights, those variable relationships that are of some interest. In virtually all the relationships, the following patterns hold true:

1) With a single exception, all of the associations are positive. That is, a value of 'True' in one variable is associated with a value of 'True' in the other.

2) All of the variable pairs are only weakly associated, but the associations are highly, even unquestionably, significant. Put another way, in each case there exists a very real association that is relatively slight in magnitude.

The associations we present here are of the magnitude implied by Pearson's r's in the range .20 to .45 and Goodman and Kruskal's lambdas in the range .10 to .23, with a few lambda values that are smaller

Table 6

Specialty: Paper is predicted by

Functions:	Improve Hand, Preparation for Inpainting
Criterion:	Appearance
Internal Size:	Cellulose Ethers
Surface Size:	Starches
Procedures:	Spray, Other

Goodman and Kruskal's lambda, a common measure of association applied to nominal data, is a Proportional Reduction of Error (P.R.E.) technique that offers perhaps the most intuitively clear context for considering these sets of data. Simply, it works this way: If we knew nothing about the independent variable -- the categories in normal typeface -- and tried to guess whether an individual fits into the dependent category (at the top of the table), our guess would have some degree of error. If, on the other hand, we know that the individual falls into the independent category, and if an association exists between the variables, then we could reduce the error of our guess. In the slide you see here, if you know that an individual believes that improving the hand of the sheet is one of the

functions of resizing, then you could guess that the individual is a paper conservator and be wrong 10 to 20 percent less often than you would be if you knew nothing about his attitude concerning function.

Some of these relationships must be seen as obvious and predictable. If, as seems reasonable to assume, paper conservators do more inpainting and pulp filling than book conservators do, then the link between <Specialty> and <Preparation for Inpainting> or <Internal sizing with Ethers> is to be expected, although one wonders why an association with the other internal sizing agents is not discernable. In support of this notion, note that there is also a somewhat stronger than usual association between function being <Preparation for Inpainting> and the use of cellulose ethers (as well as proteins) for internal sizing. Along the same lines, the link with <Other Procedures> is hardly surprising since one of the procedures classed into that grouping is incorporation of a sizing agent into a pulp slurry for fills, that is, internal sizing.

The association between an individual being a paper conservator and citing improving the hand or feel of the sheet runs counter to our expectations at the outset of this study, as we had imagined that book conservators might be more likely to be concerned with hand, it being a critical element in the functioning of a textblock. However, it should be recalled that the hand of a sheet was the most commonly cited criterion for resizing, with approximately 80% of the respondents in each specialty represented by this category; there was no significant difference between the two groups for that association. Clearly, there is a degree of redundancy involved here and we would counsel sternly against drawing any overly drastic conclusions.

Table 7

The Use of proteins is predicted by

Criteria: Appearance, Hand, Existence of Mold
Function: Improve appearance or texture, Consolidation
Procedure: Immersion (symmetric)

Though it may not be evident, this table refers to the use of proteins as a surface size only. The startling relationship here is that between the existence of mold as a criterion for resizing and the likelihood of using proteins for surface sizing. Anecdotal material has indicated considerable concern on the part of many conservators about the possibility of gelatin sizing supporting mold growth, so this association has us perplexed. It is not at all inconceivable that there is an interaction effect at work here; some unknown variable, one that we have not been able to locate, may account for some part of the association. On the other hand, it may be the anecdotal material that is misleading.

In the last association on this table, 'Symmetric' indicates that <immersion> is about as effective at predicting the use of proteins for surface sizing as the use of proteins is, immersion.

Table 8

Procedure: Brush is predicted by

Function: Preparation for Inpainting
Surface Size: Cellulose Ethers

The first of these is intuitively obvious but the second is perhaps more mysterious.

Table 9

Procedure: Immersion is predicted by

Surface Sizes: Cellulose Ethers, Starches, Proteins
Criteria: Hand

The first of this set of associations is largely self-explanatory. People who use ethers, starches or proteins for surface sizing are also like to use immersion as one of their sizing procedures. This is hardly surprising, but neither is it terribly illuminating. The second of the set is more interesting. People for whom the hand or feel of the sheet is one criterion for the decision to resize are likely to have cited immersion as one of the procedures they use, a relationship that invites speculation.

----------Conclusion----------

When we decided to conduct this survey of current American resizing practices, there were several preliminary speculations, or informal hypotheses that we suspected might be verified by the survey. The first of these hypotheses, that resizing is a relatively uncommon event, derived from our own experience and what we assumed to be the experience of our colleagues. We further hypothesized that there might well be some measurable differences between the resizing practices of book conservators and paper conservators, in terms both of the frequency with which treated items were chosen for resizing and the rationale underlying that decision. Moreover, if resizing was a well established practice we ought to be able to detect some clear and meaningful patterns developed within the community, consistent sets of indications and contraindications, for example, or a general unanimity of attitude toward the purposes of resizing. Such patterns would provide some sign of a general consensus. If, on the other hand, resizing was a relatively marginal procedure, we could expect to find an overall amorphousness to the survey responses.

For the most part, it is this latter condition that seems to prevail. Overall, the responses to this survey suggest that resizing artifacts following aqueous treatment is an infrequently performed procedure about whose value or function there is little consensus. While there is a clear preference for cellulose ethers for both surface and internal sizing, and there appears to be a substantial consensus for hand as a criterion for resizing (in fact, there is a difficult-to-quantify but nonetheless unmistakable tendency toward an intuitive and aesthetic approach to resizing), it is not possible to discern the well developed network of correlations that would indicate the practice is, to any significant degree, systematic. There is, however, enormous interest in the subject-- the gratifying number of responses to the survey would alone justify this conclusion, and a large number of the respondents expressed an enthusiastic curiosity. Clearly, the subject demands a serious and systematic research effort and such an effort would well benefit us all. Resizing, as a focus of research activity, as a matter of practical investigation, and as a subject for collegial discourse, is ripe with possibility.

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Exponential Distribution

Expected Frequencies