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The Care of Things: Perspective on a Practical Problem

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When Mrs. Anderson asked me last summer to appear before you today, I proposed to speak from a text which I had prepared a few months earlier for a talk to the Syracuse University Library Associates, our friends group. They had seemed to find it useful, and I later prepared a more general version for last year’s edition of the Manlius Historical Society Antiques Show. That also seemed well-received, and it is a version of that talk I propose to share with you today.

More recently Mrs. Anderson has told me that among your concerns are family Bibles, documents such as deeds, family papers, naturalization papers, service discharge records, birth certificates, newspaper and magazine clippings, old fabrics and antique clothing, and photographs. If I fail to address these, or other, concerns directly enough, I hope you will ask follow-up questions.

I should admit from the beginning — it may become all too obvious from the examples I discuss — that the one area of conservation in which I can claim genuine expertise is that of paper and books. Paper, fortunately, is so widely used as a component of physical objects, from books to buildings, that nearly everyone interested in the preservation of objects must know something about it. Still, it is my ambition this afternoon to use my experience with books and manuscripts as the foundation on which to formulate a rather more general point of view on the problems of caring for objects of all kinds and character.

I trust that you will forgive me if I read prepared comments this afternoon. I do this not because I lack confidence in my ability to talk in a reasonably well organized way about my subject, but because I want to keep my presentation to a half hour or thereabouts in order to permit the questions I hope you will have; and, second, because I don’t think I can lay a decent groundwork for discussion unless I constrain myself to a structured argument.
I first understood the need for careful preparation of complex argument early in my undergraduate career as a mathematician. The fourth or fifth course I registered for, advanced algebra as I remember, was taught by a professor of considerable reputation. His method of instruction quickly became clear. He would arrive at the appointed hour and display a theorem before us on the blackboard. He would then spend the class hour attempting to prove the theorem — rarely with success. As the hour closed he would apologize for his lack of preparation and promise to produce a proper proof at the next session. This promise he promptly forgot, of course, and the next session would find us silently encouraging him in yet another unsuccessful assault.

While Professor Lashof’s presentation of theory was perhaps the lousiest I ever observed it was curious what began to happen to the class* The mind he brought to each class was brilliant, and his attempts at proofs, often cast in far different terms from those in our text-book, or indeed anywhere in the literature, were ingenious, and, when successful, quite beautiful. Some of the class fell away after a few sessions, but those who remained came to understand, I think, that while it was a poor way to learn algebra, the class offered, albeit unintentionally, a first-rate opportunity to learn to formulate and attack mathematical problems.

I mention this experience because in a few minutes here today I am not going to teach anyone very much of such theory and knowledge as there is about the care of things; and I am certainly not going to send you back to homes and workplaces with simple techniques which you can safely apply to the pleasure of those objects you care about. I do hope to persuade you to a way of thinking about the problem of conservation — to the Perspective on a Practical Problem my sub-title promised.

I mention the experience for a second reason. Much of mathematics has an application in the world. Once the theory has been articulated, and the relationship between theory and reality has been established by science, useable results can be achieved by anyone able to select the proper equation, substitute real data for mathematical symbols, and perform the indicated calculations; or, to make the point fully contemporary, anyone
able to push buttons on an electronic calculator in just the right order and read the result from a Liquid Crystal Display. I wonder if there is an astute collector assembling early models of such electronic calculators among us today.

Conservation may, someday, have theories. Certainly conservators and conservation scientists are working toward such knowledge. Even if we had good theory, however, the proper identification of variables (that is, the proper characterization of particular properties of specific artifacts) can rarely, if ever, be achieved without long training and accumulated experience. Conservation is not yet a matter of "this is paper; therefore do that to treat it. This is a wooden chair; therefore do this." Rather one must know, or be able to determine, what paper; made where; by whom; with what kind of fiber and water; what fillers and processing it has had; what environment it has lived in; what conditions it will need to face in the future. Or, in the case of a chair, what kind of wood; how shaped or carved; how assembled; how finished; perhaps how many times refinished or covered over and to what effect on the wood; to determine if it to remain a working piece of furniture or protected as a museum object.

Then, having answered these questions, the data must be matched to a range of possible treatments and predictable outcomes. One must know that this varnish will have that effect. And finally, theory explored and a choice of methods and materials made, only highly skilled hands and eyes can translate them into desired changes in the object. We all, I'm sure, have had the experience of trying to repair something, knowing what to do, but failing to achieve satisfactory results because our hands do not do what the manuals say they ought to do.

The equations become yet more confusing when not only the properties of paper, say, or wood, must be considered, but in the same artifact a multitude of components. The properties of ink, the dyes used to produce color, the multitude of materials — cloths, decorated papers, leathers, plastics, woods, metals, even precious stones — which appear as components in books, for example. Most artifacts, indeed, combine several materials
with quite different characteristics and conservation needs.

Many objects are also, structures which must retain certain characteristics — such as shape — while remaining extraordinarily flexible in others. As a book conservator, for example, I often marvel at the ability of a properly constructed book to retain its shape when closed and shelved but open immediately and flexibly for reading. In preserving these characteristics, conservation is often an engineering science. The strength and durability of the bridge, or the articulated city bus as Grumman and New York City have recently learned, depend on the specific qualities of the component materials and on the way these materials are organized and assembled. Some conservation treatments may strengthen one set of components at the expense of the over-all structure, and this is rarely satisfactory.

I do _not_ want to convince you that we have no knowledge, that nothing can or should be done to conserve artifacts. I _do_ want to convince you there is no geometry — no algebra — of conservation, no set of useful rules you can go forth and apply with safety to diverse individual artifacts. If you care about some specific things, then to care for them you must reconcile yourself to learning some chemistry; a bit of physics; a good deal about the history of various industrial and manufacturing processes; must sharpen your ability to identify correctly the wide range of component materials; and finally, must reconcile yourself to the limited options often available. In the end, as you'll discover, all too often the better thing to do seems almost nothing.

Let me begin to bring my rather abstract point down to cases.

We might return to the distinction I made a moment ago regarding the ambiguity of the phrase, "caring for things." First, it is important to note, one may care deeply about some kind of thing and yet have little or no feeling about any of the particular examples of that kind of thing. The distinction is clear in the base of books — I might be much involved with them, perhaps as containers for ideas, and yet have no special feelings toward any of those physical objects which we call "books" — but
the distinction applies to physical objects of all kinds. I would agree that our world would be poorer for the absence of baseball cards, 18th century snuff boxes, 19th century bottles; but I cannot work up any personal enthusiasm toward any of these things. I can be grateful that the great Oxford University printer, John Johnson, had the foresight to collect thousands of examples of Victorian ephemera — thousands of cigar bands printed on metal foils, hundreds of tissues printed in three and four colors for use as fruit wrappers — but I feel no need to own examples myself.

Second, there is a difference between caring about things (in the sense of some specific things, such as the bottles or books I own) and caring for them. The reason for observing this distinction is that, for the most part at least, one must be fairly clear about how one feels about a thing in its physical form before it makes much sense to ask how to care for it.

I, for example, care rather little about the paperback detective thrillers I buy a couple of times a week. I only wish they fetched a better resale price since they look to me still quite new after I've allowed them to distract me briefly. [I suppose in this those who draw their sensationalism from television have an advantage over those of us addicted to the printed page: when the program is over, and the wallowing in emotion done, there is no physical object left lying around to clutter up one’s life.]

On the other hand, I have a modest collection of bookbinding manuals which I should dislike intensely to see deteriorate. They are nonetheless working books for me, and only two or three can I regard as intrinsically important in the copies I hold.

As a special collections librarian, by contrast, I can only find myself the all too temporary custodian of the books and manuscripts in my charge. These objects are fragments of our common cultural heritage, of our civilization if you will, and while one of my responsibilities is to insure that the heritage itself is continued by promoting their use, another,
and perhaps the more fundamental, is to provide with the greatest care for their continued physical existence. As a special collections librarian I do not have one of the options which those of you who are collectors and owners of books enjoy: I cannot transfer my responsibility as custodian to a library. Libraries, I remind you, stand almost endlessly ready to accept, with gratitude, precisely those “problems” which bother you most deeply.

The same reasoning applies, I believe, to objects of all kinds. The staffs of local historical societies feel much the same way, I'm sure, about the historic objects in their collections. Museum curators around the world are dedicated to the same objectives of education and preservation. Your best first step, then, in caring for your things will be to investigate your feelings about them. It is highly unlikely that all of the things that have been and are being produced can or should be preserved. Do the things you enjoy have some permanent value? Is their value for you in the collecting of them? Are they individually valuable or is it the number you have been able to bring together which makes you value them? Do you feel they should be enjoyed by others, even if that might make their preservation more difficult, or is it more important to you that they be the finest, even the rarest, examples of their kind?

Having, then, reviewed the things you own and categorized them in this probably unfamiliar way, you may begin to think more seriously about the preservation of some or all of them. It is reasonably obvious that you want to do what you can to prevent their loss or damage by reason of flood or fire. This may be more difficult than one thinks, and the record of human folly in this regard is pretty long. A few weeks into winter, at the end of December, we had a telephone call from a man whose pilot light had gone out while he was away for a weekend and whose water pipes had burst — immediately over the three hundred or more art books he had carefully, expensively, accumulated over a decade. He began his plea for advice by saying, "I know I should have known better than to create my study in the basement and to shelve my books under pipes. In 1968, when I was a student in Italy, I helped carry books from the Bibliothèque National in Florence just after the Arno flood...." That flood, many of you will remember, damaged a large number of historic, buildings and the contents of many, many museums, churches, and libraries.
Fire, in spite of foresight, planning, and careful housekeeping, all too frequently destroys or damages collections, and it is nearly always accompanied by extensive water damages as well. Accidents are often freakish. A few years ago, over a long holiday weekend, a cold water pipe placed above a well-insulated steam pipe in the basement of the Northwestern University Library, developed a small but definite leak. The cold water soaked through the insulation, was converted to steam as it came in contact with the hot pipe, and the steam rose along a nearby shaft to fill the special collections reading room where, housed in glass fronted display cases, were shelved many of the older books in the collection. The steam pipe contained equipment to signal automatically any loss in pressure, but no one had foreseen reason to alarm the cold water pipe, and it was some thirty-six hours before the accident was discovered. The steam stripped all of the varnish from the wainscoting, the display cases, and the reading room furniture. It was the loveliest stripping job I've seen. The steam eventually condensed, but little water damage resulted. A great many bindings were damaged, particularly leather bindings which shriveled with the heat and moisture, although cloth bindings survived "steam-cleaning" rather well. Books in slipcases and protective boxes were rarely damaged as they were not directly exposed to the steam.

So you have organized your safeguards against fire and water, as best you can, particularly as they might affect your most valuable items. You may want next to consider insurance. It will not replace material of great cultural interest, and it involves you in another series of decisions: what is the value of these objects? Has that value been adjusted frequently to account for changing market interest and inflation? Insurance also requires a continuing financial commitment, and since few of us enjoy unlimited resources, we may be able to provide insurance only if it seems more important than just a few more books or another example of this or that collectible thing. Still, it may be wise to have insurance to protect investment and to permit continued collecting should disaster strike.

Next you might responsibly consider insects, mold, and vermin. In this climate these things are not great threats under the conditions that most collectibles are commonly stored, but should you need to pack material for storage in a basement or an attic, or for shipment, you'd certainly be wise to review the literature, your packing materials, and your storage arrangements. Some materials are far more vulnerable than others -- fabrics and clothing, for example, to insects, or metals to rust.
In tropical climates the threat of insect and mold damage is so constant that it seems nearly impossible to expect that organic materials can long survive. I'm told that during the Second World War, the U.S. Armed Forces solved the problem of deteriorating paper by totally replacing every few months all the servicemen's libraries in the Pacific theatre: a new library would be waiting shipment in San Francisco while the preceding one was serving as mulch in the Marshall Islands. I am not at all sure that I could keep intact my mind, let alone my sense of purpose, in the face of the challenges my African and Asian colleagues accept as daily routine in this regard.

If you have made adequate provision against fire, water, insects, mold, and vermin, you have done a great deal. Way back, though, I promised some chemistry, and matters quickly become yet more complicated.

Some knowledge of chemistry is vital in at least three respects. First, virtually all materials are subject to what is charmingly termed "inherent vice." Their components, that is, are unstable and tend to degrade regardless of the circumstances in which the materials are stored and used. Degradation rates, of course, vary enormously. Second, objects can rarely be entirely separated from a surrounding environment with which they interact, usually for the worse. The effects of hydrocarbon pollution have been well publicized, for example, or in a much larger context, the role of sulfur-containing coal in producing the phenomenon called "acid rain." Third, virtually all attempts to apply conservation treatments involve the use of materials which may or may not be chemically sympathetic to the artifact.

Let me again take paper as an example. By far the largest proportion of the mass of paper is cellulose, a complex molecule whose base unit is a sugar. The cellulose molecule can be regarded as a kind of "chain," with, normally, a couple of thousand "links." If the chain is broken once at its middle, two chains with 1000 links result. If each of these is, in turn, broken, one has four chains of 500 links. A third round of breakage leaves chains of 250 links. Cellulose molecules much shorter than 250 units are too weak to fold or even to support the weight of the sheet. Almost any handling is likely to produce dust.

Many factors contribute to "breakage" in the cellulose molecule. The processes at work are chemical, and most chemical reactions double in speed with each ten degree rise
in temperature. Conversely, lower the temperature by ten degrees and you will reduce
by half the speed of the reactions at work. Put this another way: you will double the
life of paper by lowering the average temperature of the environment in which it is
stored by ten degrees; and double it again for another ten degree reduction. A paper
manufactured today – newspaper say – which might become dust in 50 years if stored at
a temperature of 70 degrees would last 100 years at 60 degrees and 200 years at 50
degrees. This fact has led to the proposal that at least one copy of rapidly
deteriorating nineteenth century publications, printed on extremely unstable papers,
be removed from major research libraries and stored in salt mines where low temperatures
can be economically maintained for long periods of time.

In normal practice, however, there are constraints. If you lower the temperature of
a book much below 60 degrees, then bring it back to normal room temperatures in the
high 60’s, you are likely to have water condense on the volume; that is, water in the
air in likely to collect on the book as it does on, say, the wine glass chilled in the
refrigerator and brought out for serving. Special collections libraries, and museum
storage areas generally, attempt to maintain a consistent temperature around 62°.

Another central factor in cellulose degradation is relative humidity. Air at a
particular temperature is able to hold a specific amount of water without the water
condensing out. The air is said to be saturated, and the relative humidity 100%. If
the air contains only half the water that it could hold at a particular temperature
the relative humidity is 50%. The ability of air to hold water increases very rapidly
as temperature increases. The relative humidity may be 60%, say, on both a bitter winter
day and on a pleasant spring one; the actual amount of water present in the air is
considerably different.

Relative humidity is important to paper conservation in two ways. First, if relative
humidity rises much above 65% while the temperature is over 75°, the conditions for
rapid growth of mold are present. Second, most of the degradation reactions in cellulose
require water as a component of the reaction. The more water present, the more likely
it is the “chain” of the cellulose molecule will be broken.

As with temperature, however, there are reasonable boundary conditions. Relative
humidity above 65% makes paper uncomfortably vulnerable to mold. Relative humidity
below 30% is generally difficult, and expensive, to maintain, and in addition, paper
at low humidity tends to become more brittle. Most libraries and museums attempt to stabilize relative humidity around 50%.

The attempt to establish an environment which changes little or not at all is important. If the atmosphere is polluted with hydrocarbons from automobile exhausts or industrial residues it may be extremely important. Paper takes up water easily, and loses it with no greater difficulty. As relative humidity increases, paper, like a sponge, soaks up water; as it decreases, it gives up water to the air. Since relative humidity changes dramatically with smaller changes in temperature, both must be controlled. Modern Heating/Ventilating/Air Conditioning machinery is designed to accomplish just this. Unfortunately, as energy costs rise institutions are under increasing financial pressure as they attempt to operate this equipment to specifications. Those in older buildings designed for other uses may also find it difficult to adapt air conditioning systems to conditions for which they were not designed.

If relative humidity is allowed to fluctuate, two things occur in paper. First, the paper is subjected to mechanical wear as the cellulose fibers swell and contract with the gain and loss of water. Second, as the paper absorbs water in polluted atmospheres, the pollutants will be drawn into the paper with the water. These may cause yet more rapid degradation. The yellowing around the edges of paperback books, which can become visible in a few years, is an often perceptible result of this activity.

There is another important conclusion from these considerations of temperature and humidity. If you have not reasonably stabilized the environment in which you store paper, there is very little point in commissioning preservation work for it. In general the repaired structures will break down more quickly than the originals. In a large collection you will need to be repairing the repaired items long before you’ve reached the last of the original items requiring repair.

Paper and books and many other objects can be protected from the effects of environment by storage in appropriate boxes and other storage containers. Experiments have shown that such protective containers provide a quite good buffer against short term fluctuations in temperature and humidity. They may also help to control some of the warpage which fluctuations may cause, particularly in sensitive materials like vellum. Paper in such a container comes into equilibrium with a new environment only after two or three days. Such containers also protect against light, exposure to which may cause
fading of inks and dyes as well as degradation in paper, and other materials -- fabrics are often particularly sensitive -- and may provide limited protection against fire or water damage. They also serve, of course, to protect fragile items and to prevent the loss of fragments when the items are not in active use. Sealants like varnish or stain serve many of the same functions for materials like wood or the surfaces of oil paintings. Some metals must be oiled to protect them from rust. Houses must be sealed to prevent a variety of maintenance problems.

Another example of the problems of "inherent vice" is the modern photograph. A quite recent book on *Light: Its Interaction with Art and Antiquities* has a concluding chapter on photography. Reading it, I was quite surprised to learn that many details of the basic chemistry of photography are still not understood. Film manufacturers have learned to manipulate a variety of factors to produce a wide range of films with greatly differing characteristics, but the underlying chemistry is still elusive in its details. Finally, the author, Thomas Brill, comments:

> Photographic Processes have taken on a new dimension in complexity with the advent of instant color film. For example, the Eastman Kodak process announced in 1976 uses no dye couplers in the film, but no less than nineteen layers are used to produce imaging. The various layers contain dye releasers, dyes, scavengers, ultraviolet absorbers, activators, etc. The Polacolor process developed by the Polaroid Corporation is similarly complex. Restoration of such films will be virtually impossible.

It is often difficult to predict the interaction of materials with their storage environments. I was startled some months ago to come across an article in the Numismatics column of the New York *Times* titled “Little ‘PVC’ Holders Can Cause Big Problems.” Apparently the most popular container used by coin collectors is a "flip" constructed from poly vinyl chloride plastic. The PVC degrades under heat and light and releases hydrochloric acid which can severely damage the coin. The article went on at some length to consider alternative holders made from other plastics, from cardboard, and from other materials, and concluded: "There may well be no such thing as a perfect holder for coins." I’m sure many of us have often reached a similar feeling as we pursue the "best" method of storing or protecting some artifact dear to us.

This problem is made more complex when the methods of manufacturing an artifact or the
components of one have changed radically over a period of time. What may be suitable treatment for material manufactured in one way may actually be destructive to similar materials manufactured in others.

As both librarian and amateur bookbinder, for example, I have had to learn a good deal about the manufacture and the conservation of leather. Oiling leather is almost universally recommended and practiced widely. Yet the good it does is hard to perceive while the damage is often all too apparent.

First, only tanned leathers are candidates for treatment. They must be distinguished from other forms of processed animal skins — vellum, for example, which is produced by drying wetted, cleaned skins under tension; or tawed skins which are produced by forcing large quantities of aluminum salts into the raw skin. All three forms of "leather" have been used for centuries, and oiling vellum or tawed skin is destructive.

Tanned leather is manufactured by soaking the prepared skin in a solution of tannins — these occur in the tea we drink but also in a wide variety of plants and trees, and only some produce leathers with the properties desirable for special purposes such as bookbinding. The soaking and other processing changes the skin chemically, irreversibly, and, manipulated by the tanner, produces the leathers of distinctive character most of us are familiar with: the "pebbly" goatskins or thin, strong kidskins; the very smooth calfskin; distinctive pigskin, particularly in its sueded forms; the soft sheepskin difficult to distinguish from calf. Identification is not made easier by the fact that leather can be made successfully from almost any animal skin, and skilful preparation and finishing can give one leather the usual character of another. I recently saw advertised a wallet constructed from "reconstituted leather fiber grained to resemble elephant or ostrich," your choice.

Tanned leathers retain a fair amount of oil at the end of the tanning process. It is part of what makes them supple. The oil can be lost by oxidation. The leather will remain more flexible if oil is added.

But. Two further complications. From quite an early date, leather artifacts were shellacked or varnished. Unless the shellac or varnish is removed, oil will be rejected, not immediately but over a period of months, and become a sticky residue on the surface of the object. It can be removed — by using hexane, a highly flammable petroleum derivative which it is not wise to breath — but this requires considerable rubbing and
may not remove stains from other objects the artifact been stored with.

Second, after about 1850 the methods of leather manufacture began to change and a wide assortment of chemicals, particularly metal ions, were introduced to the manufacturing process. One happy result has been the extraordinary diversity of leather products, many of them with special characteristics yet impossible to duplicate in man-made products. Some modern leather should not be oiled, however. Those selling shoes, for example, will often recommend mink oil to waterproof one style, but silicon treatments for another.

For the bookbinder, and derivatively the librarian, things have changed mightily since the days when a monastery raised its own animals, prepared its own skins using traditional methods and materials, probably assembled from the local countryside, and bound the books it wrote or copied. Craftsmen so close to the entire process may well have been able to give helpful advice on the maintenance of their work. Today, a binding leather is likely to come from an animal grown in India, its skin shipped in preservative solutions to North Africa for partial native tanning, then forwarded to one of a handful of tanneries in England or Europe for finishing. The final product is distributed by one of three or four binding supply houses in the United States. No one, literally no one, knows what went into the making of any particular skin.

If a knowledge of tannage is necessary to conservation advice, and the recent research of the British Leather Manufacturers Research Association suggests strongly that it is crucial, caution is surely indicated. It is also important not to apply too much oil. It will often be drawn into adjoining materials and hasten their degradation. You may therefore have left the leather happier but at the expense of the artifact as a whole. What are you attempting to preserve – the leather cover or the records in the family Bible?

There is one final set of considerations regarding conservation, I am struck when walking around the booths of the dealers represented at any antiques’ show by two contending aesthetics. Some offer objects cleaned, refinished, spotlessly "new" in appearance though more than a hundred years old; others offer mostly objects honorably worn and wearing on their surfaces the effects of time. The best, or most heart-rending, example of this conflict of taste known to me involved a friend who was able to acquire, while on a trip some years ago to Eastern Europe, a religious icon several centuries
old. He hung it with pride on his apartment wall, and returned one day find that his conscientious and efficient maid had cleaned and polished the icon to a high gleam, removing in a few minutes the patina slowly and lovingly contributed by owners and worshippers year upon year. Museum quality pieces, most of us know, must be as close to original condition as possible. In removing grime traces of history may go as well, and this plus the overlay of modern materials generally makes reconstruction of the original appearance impossible.

We should not close on what you may legitimately consider a depressing point. Let me restate the thrust of my argument. Artifacts protected from fire and water, from insects and mold, stored at reasonable temperature and humidity, used with consideration, for the most part exhibit great durability. If, in addition, you can develop your own awareness of the nature and needs of the objects you love, and cultivate an appreciation for them in others; if you can identify those artifacts which are not merely important to you but to the civilization we inherit; and if you can arrange to transfer them intact to the custodianship of someone who will love them as you have loved them, or to an institution which, regardless of its feelings, discharges its responsibilities faithfully; then you can take pride in accomplishment.

Why push your luck?

Who has a question?