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Some notes on conservation treatments.

In order to enlist scientific aid in the areas where it is most required, it will be useful to mention here some of the conservation techniques being employed. But the list which follows should not be regarded as complete. Rather, it is an outline of some of the methods which happen to have come to the attention of the author. It is difficult to remain impartial on these matters (and indeed the author is not impartial on them), but for the purposes of this annoucement we hope that our presentation is not biased. Perhaps the situation is best summarized by stating that all of the treatments have their advantages and their disadvantages under differing circumstances.

Although treatments vary widely, most schemes can be resolved into four basic operations, excluding those which are primarily architectural. These operations, which are dealt with separately below, are :

1°) Cleaning
2°) Restoration
3°) Consolidation
4°) Preservation.

1°) Cleaning. The main objective is to remove weathering products (which occur in many different forms) and accretions of foreign matter, so as to restore the transparency and color of the glasses. The greatest difficulty is in removing the weathering products and accretions without affecting the " paint " which delineates the designs on most glasses. Among the reagents used have been water, ammonia, mineral acids (even hydrofluoric acid), phosphate solutions and complexing agents such as EDTA. Mechanical means are often necessary. Tools commonly used

are scraping instruments, dental tools, ultrasonic baths, and air-abrasive systems employing soft materials. Some restorers grind away the weathering products and surface accretion and then polish the glass surface.

2°) Restoration. This consists mainly of the repainting of lost parts of painted designs, and reattachment of existing paint which may have become loosened. The decision of how much touching up should be carried out is essentially a question of conservation philosophy and esthetics, and one in which the scientist need not become involved.

The subject is hotly debated, with some experts feeling that repainting is necessary to convey the integrity of the original design, and others contending that anything done now is at best a guess at what the artist originally intended and is therefore unjustified. The reattachment of loosened paint has been attempted by the application of epoxy resins or by refiring. In only this one instance will the author take the liberty of commenting upon a treatment. Under none but the most deperate situations should any piece of early glass-stained glass windows or otherwise-be subjected to any treatment which involves heating the glass. For various reasons, too complicated to go into here, the risk of damage to the glass itself and the risk of alteration of the painted, stained, or weathered regions, is far too great to justify heating the glass for any purpose.

3°) Consolidation. After a piece of glass has been cleaned, it may also have to be consolidated, if there are fragments to be cemented together or if the glass is so thin and fragile that it could be broken easily. Organic resins including polyesters, methacrylates and epoxies have been used for consolidation. In some workshops the cleaned glasses are " plated " that is, they are mounted on a separate supporting piece of window glass or sandwiched between two such pieces of glass prior to being releaded.

4°) Preservation. Probably the most difficult step in the conservation process is the preservation of the glass, that is, the application of a suitable treatment or use of a suitable method of installation, so as to protect the glass from damage in the future.

The most common treatments are applications of coatings which are intended to protect the glass surface from the chemical attack of water, either in the form of rain or condensed layers. The coatings used are usually organic resins such as the polyesters, methacrylates and epoxies mentioned above; but inorganic substances such as silicones, or thin films of titania, zirconia or silica have also been tried. A major problem here is that the materials must not only protect the glass surfaces, but they must also be stable towards degradation by water, light, heat, pollutants and atmospheric oxidation. Many organic materials will discolor or become embrittled as they age. A great danger is that after a protective coating has been applied, it cannot always be easily removed without inflicting damage on the glass itself or its painted decoration. Reversibility must always be a consideration in any conservation treatment. A great deal more research must be done with organic, inorganic, and metallic coatings and films before we can feel confident that the best possible protective materials have been found. Lamination of the early glasses between sheets of organic materials, followed by sandwiching between pieces of plate glass, has also been used for preservation. The finished pieces resemble the laminated glasses used for automobile windows.

Double glazing is a method often used for protection of stained glass windows. A separate window is placed outside the stained glass window to protect it from the direct action of rain, snow, wind, and light. The main risk is that unless the system is suitably vented; a microclimate may be set up between the two windows which can lead to a refluxing system in which periodic or almost continual condensation can occur. The presence of a film of condensed moisture is regarded by many persons as a more dangerous condition than that in which rain can fall directly on the glass removing weathering products and even washing the glass to a certain extent. The installation of proper atmospheric controlling devices in a double glazed system might offset many of the hazards to which windows would otherwise be exposed. Such devices are likely to be very expensive, but they might constitute the only feasible alternative in some cases, to the removal of windows to museums.

5°) Some special considerations. All schemes of treatment must be evaluated in terms of certain criteria. A few are listed below, but most conservators could readily add other favorites to this list, not the least of which is financial practicability and availability of adequate facilities and trained personnel.

a) Is the treatment applicable on a scale which must deal with thousands of individual pieces of glass, or only on a scale dealing with a dozen or so specimens treated under special conditions in the laboratory?

b) Are the treatments compatible with plans for related problems, such as releading or simultaneous architectural modifications ?

c) Must the window be dissembled or can the treatments be applied in situ ?

d) Is the process truly reversible in a practical sense or only on a theoretical level ?

e) Will the materials used be stable in regard to moisture, oxidation, light, temperature variations, microorganisms, and any special environmental conditions peculiar to the particular windows involved (for example, the persistent presence of bird droppings) ?

f) Does the treatment destroy a significant portion of the glass ?

g) What effects does the treatment have on the existing remains of original stained and painted designs ?

h) Can the scheme be carried out without heating or desiccating the glass so as to avoid any risk of cracking the glass, of developing inherent crizzling, or of altering the color and painted design ?

i) Does the treatment bring the windows back to an appearance resembling that of the original state in color, luminosity and overall esthetic effect ?

j) To what extent, if any, does the patination of the glass contribute to the esthetic effect ?

k) Is the weight of the window increased to such an extent that it may not be architecturally sound ?

l) Does the proposed method of application of any coating tend to seal moisture or other harmful substances into the glass ?

m) What is the proper balance to be aimed for between the benefits of tight adhesion of a protective coating, and its attendant danger of spalling away glass from the surface if shrinkage or other mechanical strains are set up at the interface?

n) Does the treatment increase or diminish the likelihood of accumulation of foreign matter in pits or joints, or through electrostatic attraction? Such accumulations could subsequently act as absorbants for moisture or other harmful substances.

o) Are the treatments effective in offsetting increasingly more corrosive conditions brought on by air pollution?

p) If similar treatments have been used before in similar situations, how successful have they proven to be, and over what period of time?

q) Are there suitable accelerated ageing tests which can be used to evaluate the treatments beforehand?

r) To what extent are vibrations and sonic effects damaging to the windows, and can the danger of such effects be offset by the treatments under consideration? For example, would the use for non-rigid caulking materials be beneficial since they might tend to dampen out vibrations more effectively than rigid, hard-setting putties?

s) Can use be made of the conducting properties or other properties of the caming network to control or inhibit electrostatic accumulation of particulate matter, or to control the surface temperature of the window?

t) Are permanent preservation treatments really possible, or should one concentrate for the present on shorter-term treatments which incorporate plans for occasional cleaning and retreatment?

u) If no feasible treatment can be conceived should the windows be removed to a museum where a controlled and less hazardous environment can be more easily established?

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