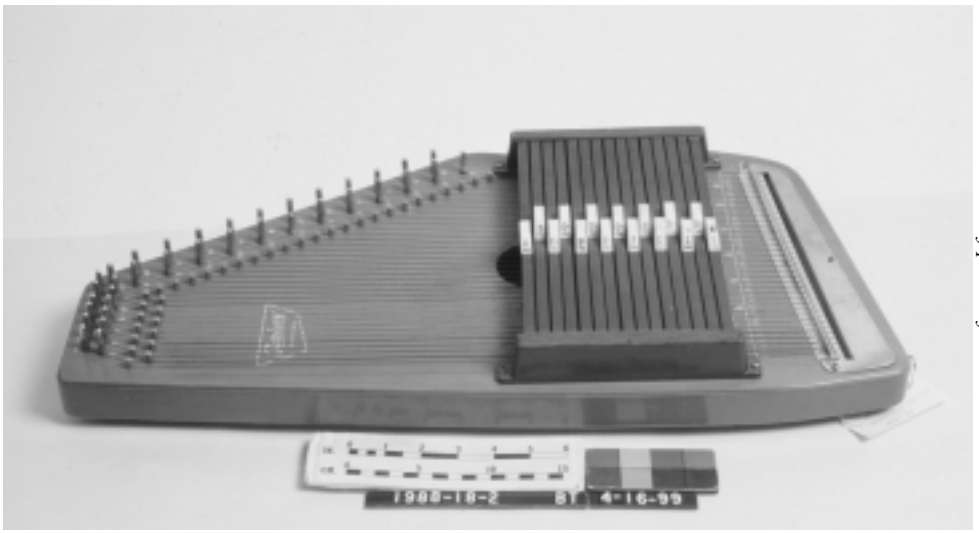
Caring for musical instruments: Part 1

by Paul S. Storch

This is the first of two Tech Talk articles about the challenges of caring for musical instrument collections. Paul S. Storch, the Minnesota Historical Society's senior objects conservator, looks at common types of instrument materials and how they react to their environment. Part 1 covers instrument coatings, leather and plastics. Part 2, in the June/July Interpreter, will cover instrument metals, wood and textiles and discuss how to handle, display and store musical instruments.



Minnesota Historical Society photos by Paul Storch

Fig. 1: This autoharp, donated to the Minnesota Historical Society by Garrison Keillor, shows the variety of modern materials – plastic, metal and paint – used in its construction. This high-density plastic is more durable than earlier plastics, which deteriorate with exposure to light and heat. When acquired by the Society, Keillor's autoharp exhibited dust and dirt but little deterioration.

Collections of musical instruments generally contain a wide variety of materials, shapes and sizes. That makes their preservation a challenge to collections managers and museum curators. But by applying basic principles of preventative conservation – condition assessment, proper handling, safe storage – even nonprofessionals can ensure the long-term preservation of this popular category of artifact.

This article serves only as an introduction to a very specialized and complicated topic. For more detailed information on instrument types and their care, or for a discussion of the ethics of using historic instruments, refer to the list of resources to be published in Part 2. The more you know about the instrument materials and the problems in your own collection, the better informed you will be when seeking assistance from a professional conservator.

The materials maze

To understand how to preserve musical instruments, you must first know what they are made of. The range of materials you are likely to encounter in your collection is considerable. You may find metal, wood, leather, plastics, textiles, even paper. And then there are the instrument coatings, both natural and synthetic.

The instruments that will be easiest to care for are those made of one primary material, such as brass for trumpets or wood for violins. Most instruments, however, have components of several different materials. Conservators call items made of multiple materials *composite objects* (see figures 1, 2 and 3). The care of these artifacts is much more difficult.

Several factors make the preservation of composite objects challenging. Sometimes the materials are not compatible. They may affect one another chemically. Or they may respond differently to changes in relative humidity. For example, wood and metal have different expansion rates so, when exposed to higher humidity, the wood on an instrument might split where it is restrained from expanding by a metal ring.

In Western instruments of the later 19th and 20th centuries, one may find materials that have an innate tendency to deteriorate. This is called an *inherent vice*. Examples of materials with an inherent vice are certain types of plastics, such as celluloid (cellulose nitrate), which turns yellow and becomes brittle over time upon reaction with atmospheric oxygen.

The condition of any musical instrument depends on these and many other factors – the original

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quality of the material, the amount of wear to which the instrument was subjected, the level of care it was given by its owner and the subsequent storage or exhibit conditions to which it was exposed. For an overview of instrument materials and the environmental factors that contribute to their deterioration, see Table 1. The characteristics of coatings, leather and plastics are discussed below. Metals, wood and textiles will be discussed in Part 2 in the June/July Interpreter.

Coatings

Coatings are applied to musical instruments usually to alter or disguise the surface appearance. Many types of coatings have been used by various cultures throughout the centuries. The major categories of coatings found on the structural materials, or basic substrate, of instruments are pigment; paint (pigment or dye with a binding medium); lacquer or varnish; oil or wax; veneer; paper, leather or textile; enamel or glaze; and plating and patination (on metal).

Fig. 2: The mix of wood, textile and paper components on a Civil War-era concertina makes the instrument a composite object. Care of such items, made of multiple materials, can pose special challenges.

Wherever these surface coatings are applied, there is the potential for physical and chemical interaction. When the coated surface is obscured by dirt and tarnish, as in the case of metal instruments, it may be difficult to identify the coating and to discern the original appearance of the instrument's surface. It is important, therefore, that surface coatings be carefully examined and fully documented by someone with knowledge of the instrument's construction *before* making decisions about care and treatment.

Perhaps the coatings most commonly found on instruments in museum collections are lacquers and varnishes (see fig. 4). Both coatings are made of natural or synthetic resins or gums, deposited on the instrument surface through the drying of a solvent. Varnishes may also contain drying oils, such as linseed. Lacquers (the term is used here in its European sense) and varnishes differ from paints in that they are transparent. They may, however, contain pigments or dyes to color the instrument surface.

Both lacquers and varnishes are sensitive to ultraviolet light, which can degrade the coating materials, leading to yellowing, cracking and brittleness. And, as with paint, when complete films of lacquer or varnish are applied to objects that expand and contract, the coating can crack and loosen. This problem is seen mostly on wooden surfaces, but transparent coatings on metals that have been heated and cooled may show the same problem. The breakdown of lacquers on metals can lead to spotty local corrosion; cellulose nitrate coatings are particularly prone to this.

Fig. 3: A bottom view of the concertina in fig. 2 reveals damage from improper handling: the bellows are badly worn and the leather strap is torn.

Leather

Leather is used in various forms and preparations on both European and non-European instruments. To make it durable and moisture-resistant, raw hides to be used for instrument construction must be treated with chemicals known as tanning agents. Vegetable tanning is used where flexibility and water resistance are required. Mineral tanning agents such as alum impart durability but do not have great water resistance. Their use also results in lighter surface colors. Organ bellows, bagpipe bladders and other instrument components of European manufacture are generally made from vegetable-tanned or combination-tanned cowhide or goatskin.

Condition problems that apply specifically to leather objects include surface abrasions, tears, distortion of the original shape, excessive dryness and, less commonly, excessive wetness, mold, insect infestation and the fading of dyes and colorants. A condition called red rot, caused by excessive acidity in the leather, often affects late 19th-century instruments. Red rot is evidenced by loss of the grain layer, exposing the inner fibrous layer; by a powdering of the exposed surfaces, creating a reddish-orange color; and by a darkening of the leather on contact with water. Leathers in this condition must be handled very carefully to avoid irreversible damage. An instrument exhibiting the effects of red rot must not be played for any reason.

In many non-European instruments, and some European ones, the skin material of choice for drumheads is untanned rawhide. In some African instruments, semi-tanned fur skins are used. Rawhide is prepared by removing decayable matter and hair from the hide and allowing it to dry into the desired shape. Rawhide is extremely susceptible to damage by insects, fungus and fluctuations in temperature and relative humidity (see figures 5 and 6).

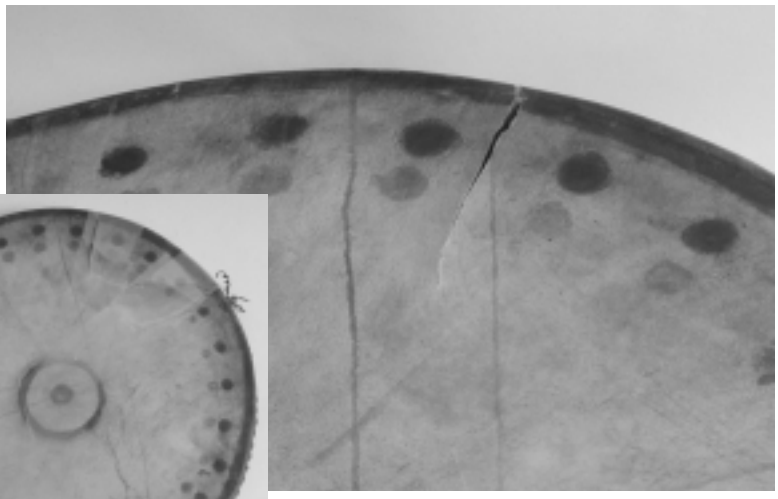

Fig. 5: This detail of an Ojibwe rawhide drum, made in the Mille Lacs area during the late 19th or early 20th century, shows how changes in temperature and relative humidity over the years caused the drumhead to split.

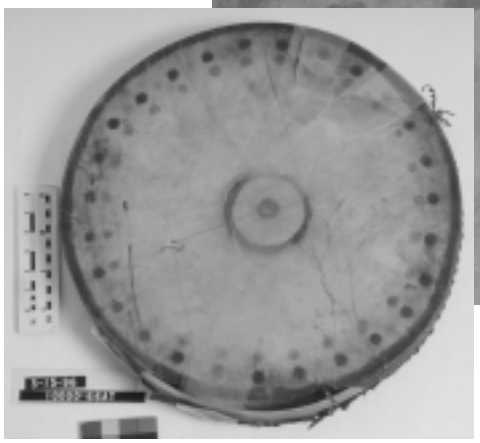

Fig. 6: Conservation treatment repaired the split drumhead. To prepare the object for storage, it was bound with a polyethylene strip to support the repairs.

Plastics

Plastics came into use in musical instruments in late 19th century. The term as used here denotes synthetic organic polymers and covers a wide range of materials. The earliest plastics – applied as decorative elements or as replacements for natural materials such as wood, bone and ivory – were celluloid (cellulose nitrate) and Bakelite (phenol formaldehyde composites). Modern plastics include high-impact polystyrene and high-density polyethylene and polypropylene (see fig. 1).

Plastics are most affected by long-term exposure to light, heat and certain chemicals. They are particularly susceptible to deterioration if the quality of the plastic was poor to begin with. Certain plastics, such as cellulose nitrate, have an inherent vice – an innate tendency to deteriorate. Though little can be done to prevent deterioration of an item with an inherent vice, the process can be mitigated with proper handling and stable exhibit and storage conditions.

Fig. 4: The shellac coating on this violin brings out the luster of the wood. Note the white powder under the bridge – a dusting of rosin left by the bow during playing. Conservators chose to leave the rosin deposit in place as evidence of the instrument's use.

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Table 1: Materials and the effects of deterioration agents

Material	How used	Deterioration agents
Coatings – natural and synthetic	Surface protection, sound modification, decoration	Mechanical stresses; ultraviolet (UV) light; high relative humidity (RH) (>60%); oxidation; improper cleaning
Leather (tanned) and other skin products (untanned, semi-tanned)	Gaskets in wind instruments, organ bellows, pads, drum heads, banjo membranes	Very high (>60%) or very low (<20%) RH; insects; air pollution; inherent vice: "red rot" (see text)
Plastics	Instrument bodies, drumheads, organ and piano keys	Inherent vice: excess plasticizer; UV light; oxidation; mechanical stresses
Metals	Instrument bodies, frames, strings, wires, cables, drums, mechanical parts	High RH (>38%); acids from finger oils and dressed leather; mechanical stresses
Textiles	Reinforcements for wooden constructions	Extreme fluctuations in RH and temperature; light exposure causing brittleness or fading of organic colorants
Wood	Instrument bodies, sticks, bows, moving parts, cases, frames	High RH (>60%); very low RH (<20%); fluctuations in RH and temperature; insects; fungus (>65% RH); mechanical stresses; improper maintenance

Watch for Part 2 of "Caring for Musical Instruments" in the June/July Interpreter. It will cover instrument woods, metals and textiles as well as recommendations for the handling, display and storage of a variety of instruments. Part 2 also will feature a list of references for further reading on the care of instrument collections.

'Sounds Good to Me'

Exhibit takes a tuneful trip through Minnesota's musical history

There are musical instruments aplenty in "Sounds Good to Me: Music in Minnesota," an exhibit now on display at the Minnesota History Center in St. Paul. "We wanted to show the role music has played in the lives of ordinary Minnesotans," explains curator Benjamin Filene. So instead of being organized by chronology or musical genre, the exhibit features a series of settings where music is produced and enjoyed – a home parlor, ballroom, concert hall, high school bandroom, deejay booth, tent and music store.

The centerpiece of the exhibit's parlor setting is a piano, a prized possession in many middle-class homes around 1900. Visiting students can make music the easy way with this 1914 player piano, which promised "perfection without practice." For exhibit hours, call the Minnesota History Center, 651-296-6126 or 1-800-657-3773.

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