A Borrowed Technique:  
The Use of Bulked Epoxy for Scaleboard Loss Compensation

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Scaleboard: “the cheapest boards of all”

Scaleboards are mass-produced pieces of thin wood (oak, beech, ash) used in a variety of industries throughout the 17th, 18th and 19th centuries. When other options for bookboard materials proved too expensive, binders turned to scaleboard. This occurred most commonly in the early colonies and states of America, where the papermaking (and consequently board-making) industry lagged behind that of Europe.

Scaleboard is an especially fragile material, due to a number of factors:
• Very thin (typically 1 to 3 mm)
• Flawed grain orientation, weakening the wood’s dimensional strengths
• Meager covering materials (often paper in the U.S.)
• Typically found on more ephemeral publications (sermons and schoolbooks)

As observed in a major survey by Miller (2013), roughly 30% of books with scaleboards suffer significant losses to the wood.

Though most scaleboard books suffering from losses can be treated with appropriate housing, a more interventive treatment may be desired to protect the text-block from heavy usage or to restore the object’s dynamic appreciation.

Scaleboard presents particular problems when performing fills:
• The wood’s sheer thinness presents a very small surface area for repair and does not allow for methods that require material removal
• The breakage often occurs against the grain and leaves highly complex edges, making carved wood fills virtually impossible

A method borrowed from furniture conservation: bulked epoxy fill with a reversible barrier layer

Epoxies:
• Thermosetting adhesives that harden through chemical reaction of prepolymer and polymers
• Typically two-part adhesives (a resin and a curing agent) that react when mixed together, allowing the parts to permanently cross-link into a molecular matrix
• Little or no shrinkage upon curing (0-5%)  

Reversible barrier layer:
A soluble material applied in a thin layer between mating surfaces prior to the application of a non-reversible fill (i.e., the epoxy), allowing the fill to act as a separate, easily-removed unit

Bulking agent:
A material (cellulose powder, wood dust, microballoons) added to the epoxy to create a fuller, lighter, softer, and more easily shaped end-product.

Abatron® WoodEpox® was selected as the epoxy for this project. Developed for wood replacement in architectural restoration, WoodEpox is pre-bulked with glass microballoons and intended to mimic the physical qualities of wood.

A series of oak scaleboard samples were created, half exhibiting short-grain, and half exhibiting long-grain.

Two tests were conducted:
• A load-bearing test helped to observe the repair’s strength in comparison to the original wood. The scaleboard samples were subjected to an increase in load until breakage (Break A). The epoxy fills were applied, and then the samples were broken again in the same manner (Break B). In Break B, the samples withstood about 40% of the weight they withstood in Break A.
• A reversibility test compared the removability of the repair with three concentrations of gelatin barrier layer (10%, 30% and 50% w/v) against a control repair with no barrier layer. The repairs were subjected to a constant weight within in a humidity chamber. All three samples fell apart within roughly 1 hour, while the control sample withheld 24 hours without removal.

Application to a historical example

The American Preceptor, Boston: 1811, before treatment

1. A barrier layer of gelatin (20% w/v) was applied to all breakage surfaces and allowed to dry overnight.
2. A jig was fashioned to fit the projected dimensions of the original board. All surfaces of the jig were covered with polyester film to avoid adhesion. Polyester film was also used to protect the original board.
3. Isopropanol was used to lubricate the WoodEpox during application, as well as all tools used in shaping the fill.
4. Following 48 hours of curing, the jig was removed. The fill was shaped using a pairing knife and sandpaper. Color-matching was completed with acrylic paints.

Conclusions: The repair proved relatively quick and easy to apply, and the resulting fill is of a feel and weight appropriate to the original wood. Strength-testing showed the repair method as appropriately strong, with high break “success” (i.e., breaking without damage to the original material). Reversibility testing also showed the repair to be easily removed with gentle humidification.

Works cited