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SEND THEM OUT OR KEEP THEM HERE? - THE DILEMMA OF LOANING HARVARD'S GLASS FLOWERS

Scott E. Fulton and Susan M. Rossi-Wilcox

Abstract

The year 2000 marked a milestone in the history of the Ware Collection of Blaschka Glass Models of Plants at Harvard University. This was the year that a selection of these intricate constructions, popularly known as *The Glass Flowers*, made a historic return trip to France, the first since their celebrated showing at the Paris Exposition of 1900.

This paper will present an overview of the history of the Glass Flowers and their creators; the materials, techniques and methods of fabrication; and a brief discussion of the conservation of the collection, before broaching the topic of traveling these objects. Aside from the inherent conservation challenges and unique packing problems presented by the fragile models, there were unavoidable issues of compromise and decision-making between collections manager, curator and conservator. This paper touches on one international venue, the 2000 French National Millennium exhibition *La Beauté* in Avignon, the problems faced in packing and transporting a select group of the Glass Flowers, the lessons learned, and the subsequent successful outcome.

The Creators and the Collection

Around 1886 George Goodale, the director of the Botanic Garden of Harvard College, realized a need for an alternative to exhibiting perishable plants in the natural history museums being planned for Harvard University (Fig. 1). It was at this time that Goodale became familiar with the well known glasswork of Leopold and Rudolf Blaschka, a father and son lampworking team of Dresden, and their precise reproductions of invertebrates. Inspired by what glass could bring to a collection of botanic models for his department, he invited the Blaschkas to take on a small commission. The first group of models arrived in Boston later that year. Ultimately, the commission continued for 50 years, with the last models received at Harvard University in 1936. Currently about three-quarters of over 4300 individual models are on permanent exhibition in the Harvard Museum of Natural History, and the remaining portion is in storage awaiting various degrees of conservation treatment.

Initially, when Harvard's museum collections were used for teaching, the models served to supplement plant dissection in the botany labs. Today the Botanical Museum collections are no longer used for teaching, especially as the emphasis in teaching botany has changed from the classification of organisms to one weighted in favor of genetics and molecular analysis. The function of the Glass Flowers as a collection also necessarily changed from being thought of as a set of teaching tools that were potentially

replaceable, to becoming a world renowned tourist attraction possessing intrinsic value as irreplaceable art objects. In effect, they became emblematic treasures of the Botanical Museum and, in the context of an international exhibition such as *La Beauté*, they served as ambassadors for Harvard University (Piechota 2006).



Figure 1. *Centaurea cyanus*, Bachelor Button with moth #761 (1913).

Materials and Techniques of Fabrication

With little information on the Blaschkas' working methods available in the archival record, the major portion of our understanding of their techniques comes from consulting with present day flame-workers and glass specialists. Not surprisingly, the models were created from a combination of organic and inorganic materials. Leopold and Rudolf Blaschka used their knowledge of jewelry making to produce a copper wire understructure. Like a necklace, sections of glass tubing were fashioned into the likeness of stems and branches that were strung like beads on a central armature. The leaves and flower parts typically have a wire that is fused to the base with frit or glue and fed into the hollow of the stem piece (glass tubing) where the part was held in place with animal glue or flame-worked with glass frit (Fig. 2 a, b).

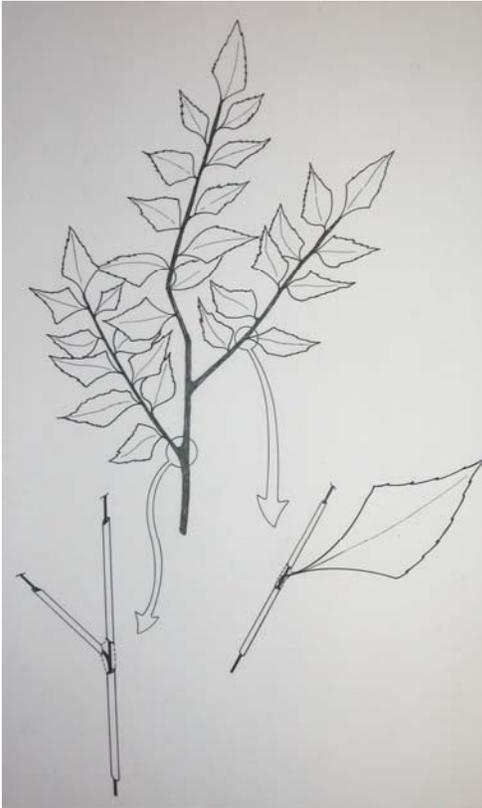


Figure 2a (left). Schematic drawing showing techniques of construction.
 Figure 2b (right). *Gentiana andrewsii*, Closed gentian #282 (1892).

For the most part, the Blaschkas' early work used clear commercial glasses to create the model parts. The reflective glassy surfaces were reduced with coatings of animal glue, gum Arabic, or other applied varnish. Paint and organic binders were used to show details like venation on leaves, pubescence on stems, or bark on branches, particularly on the early models (Fig. 3).



Figure 3. *Phyllitis scolopendrium*,
 Hart's tongue fern #710 (1903).

Over the decades, many of the Blaschkas' techniques and colorants changed dramatically (Fig. 4). From archival records we know that Rudolf Blaschka was interested in developing workable red-colored glasses to replace fugitive red pigments used on the earlier models (Pitman 1994). At the beginning of the 20th c. he began experimenting with home-manufacturing of small batches and, by 1906, he was using a six-crucible iron furnace specially designed for his home studio. A blueprint of the furnace, books on glass formulas, his correspondence, and glass cullet he left behind testify to his experimental zeal and his varied successes and failures (Fig. 5). Ultimately, he created well over one hundred colored glasses in roughly half-pound batches or smaller. Many of these were opaque greens, yellows, and reds that captured the subtle nuance of shades necessary for reproducing various leaves, flowers, fruits, and insects. These colored glasses were softened, stretched or blown into their base-forms, or crushed into enamel slurries that were fused in the flame for realistic surface detail. Rudolf Blaschka's experimental work was so successful that by 1928, when Mary Lee Ware, the financial benefactor, visited him, she reported in her October 3rd letter from Dresden that he was making "a large part of the glass and all of the enamels, which he powders to use as paint" (Ware, 1923).



Figure 4. *Erythrina crista-galli*, Cockscomb #104 (1889).



Figure 5. Rudolf Blaschka's glass cullet, ca.1913.

Condition, Conservation and Preservation

The Blaschkas' early techniques worked well for over a decade of botanical model making, but many of the thin broad leaves and petals of the earlier models (pre-1895) were not stable over time. They are prone to de-lamination and splitting as a result of shrinkage of a problematic surface coating identified as animal skin glue (McNally and Buschini 1993) that is known to be dimensionally unstable in fluctuating environments (Fig. 6). To date, nearly 30 sets of models have been removed from exhibit because of this ongoing deterioration.



Figure 6. Cactus leaf showing surface delamination of the glass caused by shrinkage of animal glue coating.

With the passage of time, even some of the glass formulas used after the turn of the 20th C. have become unstable and opaque discoloration on some parts (Fig. 7). Over the years, broad seasonal changes in the gallery environment have exacerbated the problem by providing favorable conditions for this slow but steady degradation process. This visual change can be explained as the re-crystallization of hygroscopic constituents in the glass, mostly lead compounds, that now appear as a whitish efflorescence (Pantano et al, 1998). Out of approximately 250, about 64 models from Rudolf Blaschka's later work are affected with this condition (Fig. 8). Initially, an accurate identification of glass corrosion was impeded because the models were created to depict stages of fungal disease in common orchard fruits such as apples and pears. The purposefully rendered "blights" appeared similar to corrosion-related efflorescence, and the true cause was only realized later when healthy fruit were recognized as being affected by the same efflorescence phenomenon.



Figure 7. *Malus pumila*, Apple #609 (1933), closeup showing lead salts efflorescence.



Figure 8. Blaschka's "diseased" fruiting branch, *Malus pumila*, Apple #813 (1932).

To better understand the Blaschkas' work methods and glass formulations, several projects have been undertaken to analyze the material characteristics affecting the collection. In 1991, conservators from the Center for Conservation and Technical Studies, Harvard University Art

Museums, undertook the first conservation survey of the Glass Flowers (McNally and Buschini 1993). Their seminal study included technical analysis of the materials used to make the models, environmental recommendations, and conservation treatment proposals for a select group of the models. Their investigative groundwork confirmed several details related to the Glass Flower's structural and chemical stability:

- The glass used was a binary alkali “soda” glass commercially made w/ silica, sodium and a smaller amount of potassium.
- Pre-1895 glasses were cold-painted and varnished w/ various organic binders and coatings to create realistic effects (with some overlap into post-1895).
- Post- 1895 models are generally characterized by experimentation with colored glasses and lead glass enamels using various metal oxides as colorants.
- A number of adhesives were identified ranging from the original use of animal glues, to cellulose nitrate and more modern adhesives used for repairs.

Later compositional analysis by the Botanical Museum using EDS-microprobe and XRD further contributed to an understanding of the changes in palette and materials used over a 50 year span (Pantano et al 1998). A parallel (unpublished) study in 1995 by Timothy S. Hughes at Pennsylvania State University using a hot-stage microscope, helped to correlate some of the original glass formulas used and their associated glass-transition temperatures (Hughes 1995). In 1998, a comprehensive condition survey was undertaken in conjunction with the Peabody Museum Conservation Department and an outside conservation consultant. Ultimately, the survey became useful as a background checklist for determining their suitability for traveling.

Traveling the collection

Given the fragile nature of this collection, loans have always been of utmost concern. The original packing design from the late 1880's included materials that by our current standards would be considered inferior, including acidic paper- pulp board, cork and crumpled tissue paper. Although the archives do not mention any specific damage or loss in shipment, virtually the same packing methods and materials were used repeatedly for 50 years (Fig. 9 a, b). There is no way of knowing, but the Blaschkas and their clients at the time may have held in common a somewhat post-industrial attitude about the shipping of what were seen as replaceable objects, a view different from that of museums. Tacitly, they may have agreed, for instance, that 5-10% breakage was an acceptable loss and priced the models accordingly.

The primary conveyance from Germany to America between 1886 and 1935 was by ocean-going freighter. One can use one's imagination with regard to the bone-jarring transport preceding the voyage, including horse-drawn carts over rough roads, followed by rail cargo to a port, and then loading by hand into the cargo hold of a ship. Undoubtedly, en-route across the Atlantic, conditions in the hold would have produced massive low-frequency vibration from the ship's turbines for durations up to a week. Although the Blaschkas typically shipped the models during seasons when the seas were calmer, the exposure to shock from rough waters was also a reality.



Figure 9a. Original packing ca. 1890's (a).



Figure 9b. Original packing ca. 1890's (b).

Sending examples of the Glass Flowers to France in 2000 offered a unique opportunity to broaden public exposure for an international audience. The loan was a noteworthy event in the history of the Glass Flowers because it marked the 100th anniversary since they first traveled to France. In the life-time of the collection, only a small selection of models have been loaned since they were first commissioned in 1886. The venues included the 1893 World's Columbian Exposition in Chicago, the Paris Exposition of 1900, and the 1904 Louisiana Purchase Exposition in St. Louis. Three other significant loans of the Glass Flowers were granted more recently,

including a 1991 exhibit at the Corning Museum of Glass, the 10th anniversary exhibition at the Andy Warhol Museum in Pittsburgh (2005), and, as addressed in this paper, the extravagant Millennium exhibition in Avignon. Because of the complex issues (variations of size, weight, shape) involved in packing twenty Blaschka glass models for air-travel, preparations and packing design of necessity involved close collaboration between conservator and art packaging professionals.

The challenges faced in taking the loan to Avignon are not entirely comparable to conditions surrounding the historic journeys by ocean-going freighter, but they are not necessarily less risky for the models, including:

- High frequency vibrations of jet travel.
- Sudden drops and jerks in landing and by way of airport fork lifts.
- 500 miles of overland truck travel from Paris to Avignon.
- Unloading at Avignon with the rigors of trundling across cobblestone to the inner sanctum of the Palace complex.
- Unexpected circumstances including the absence of a freight elevator to the exhibit area, one flight below a winding staircase.
- The reality of a two-way shipment with the repetition of similar conditions on the return trip.

Criteria for Lending

A standard for lending the Glass Flowers was designed to exempt the most significant and fragile models from the loan. Only the more stable specimens whose physical condition and chemistry were better understood were considered as possible candidates. These criteria were developed by both the administrator for the Glass Flowers and the project conservator, with further input from the curator and exhibit designer which influenced the final selection.

In consideration of the didactic value of the collection and the possibility of damage or loss, the chosen models needed to be well represented by species or genera in the rest of the collection. In addition:

- Travel mounts for the models had to double as exhibit mounts to minimize handling risks and to simplify installation.
- The models chosen had to be of relatively simple construction with low weight-mass and with few elevated or extended parts that would be subject to flexing en-route.
- Stabilization treatments had to be straight-forward; repairs would ideally contribute to an evolving methodology of treatment procedures and materials for the collection.

In preparation for the loan to *La Beauté*, basic conservation treatments for the chosen set of models ranged from a light dusting with a soft brush, to reattaching a separated part, in-painting disfiguring old repairs, or, for one model, replacing an element of missing glass with pigmented Japanese tissue to reintegrate an obvious void (Fig. 10).



Figure 10. *Lathyrus magellanicus*, Lord Anson's Blue Pea #144 (1890) during treatment.

Packing for Avignon

The models were mounted on travel pallets made of black Gatorfoam, which doubled as exhibit mounts with the models already secured in position. For additional support, small individual cushions were cut from black Plastizote and were attached to the pallet, under the models, at strategic points. A stem, for example, may have required three or more small, carefully placed cushions under the tie-down points to bolster and cradle the model against movement. The positions of the mounting wires were marked and holes were drilled with a flexible shaft drill (Fig. 11). These primary and permanent foam supports were tacked in place with hot-melt glue. Silicone tubing covered the wires to protect the model while it was secured to the pallet.



Figure 11. Packing design and travel mounts: drilling holes in foam-core for wires.

A secondary series of removable foam supports and pillows made of high-density polyethylene sheet filled with polyester batting were tailored to fit under the parts that projected from the body of the model (Fig. 12). These temporary supports were placed at the vulnerable points to provide additional cushioning. Each support was numbered using color-coded dots. The exact positions of the supports were documented using photographs to aid in repacking the models for the return trip (Fig.13). Small pieces of double-sided archival tape held the pillows and supports in place while traveling, but were easily removed without damaging the surface of the pallet surface at the time of installation.

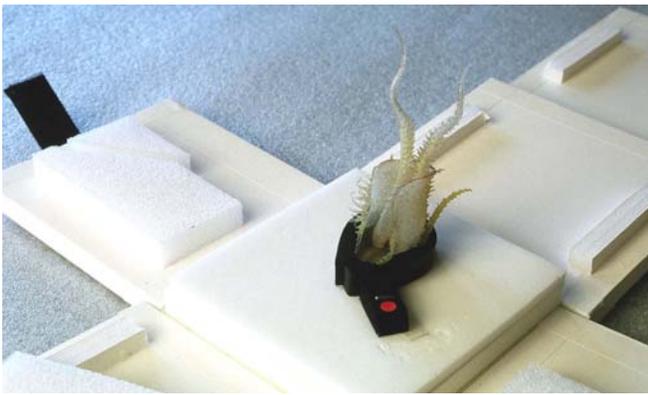


Figure 12. *Passiflora caerulea* L., Passion Flower #775 (1923), detail of “pillow” supports.

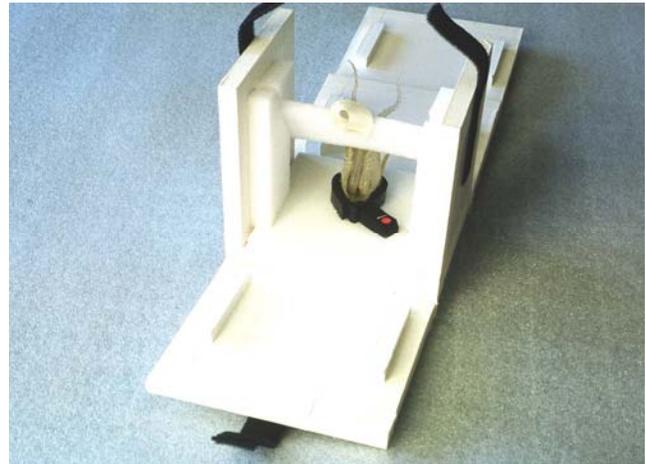


Figure 13. *Utricularia purpurea*, Purple bladderwort #638 (1898), close-up of documentation method using red labels and foam supports.

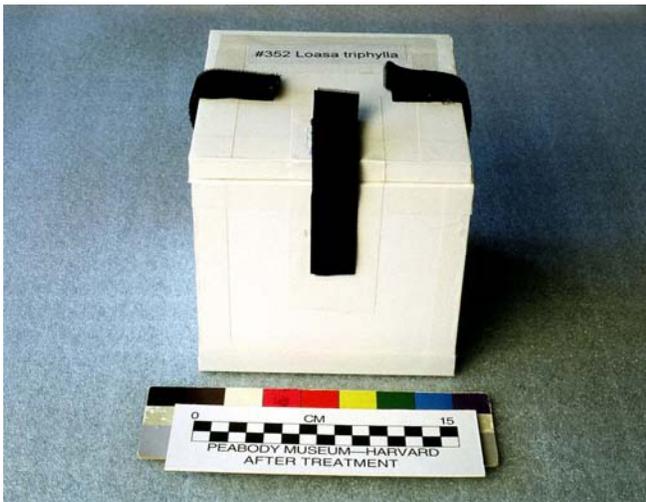
Working in collaboration with Fine Arts Express of Boston, the overall packing design was based on the principle of double-crating. It was intended that the objects would be supported in an inner crate that was in turn cushioned against shock and vibration by the outer crate, using separate foams of differing densities. The inner crates utilized housings of Gatorfoam board lined with Ethafoam 220 polyethylene foam sheet. These were designed to accommodate the pallets to which each model was secured. Most of the inner boxes held a single life-size plant model on a pallet, but several contained small models of plant parts or custom-designed housings for odd-shaped models (Fig.14 a - d).



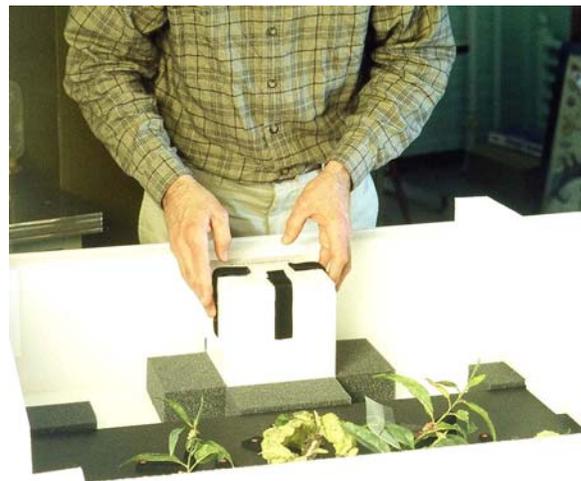
a.



b.



c.



d.

Figure 14a-d. Four steps in the packing of a magnified plant part, *Laosa triphylla*, #352 (1893).

The two outer crates were of uniform size and designed to be front-loaded to allow efficient access to each of the drawer-like inner boxes when the front panel was removed. At the corners and on the sides of a crate, blocks of urethane foam were glued in position to snugly cushion the load and to prevent movement of the inner packing crates (Fig. 15).



Figure 15. Outer crate showing interior foam cushioning.

Conclusion: Managing risk against the benefits of exhibition

From the beginning of the loan review period, it was understood that there was a significant degree of risk involved with this loan. It was acknowledged that minor unexpected damage was likely to occur, and, despite our concerted efforts to prevent it, ultimately some damage did happen. There were isolated small losses of painted surface detail on select models, probably from high-frequency vibration in-flight; and there were two failures of old glue joints of leaves to a stem. With this, fortunately, there was no collateral damage and the model was repaired on-site in Avignon (Fig. 16).



Figure 16. *Prunus persica*, Peach #798 (1929), detail of repair.

Damage resulting from loans can sometimes be difficult to characterize, let alone identify, and there are many questions that need discussion:

- How do we define damage?
- To what degree is alteration of the original considered acceptable?
- At what point do pigments or particulates left behind on packing materials alter an object's identity?
- Can we accept some damage if the object doesn't appear different?

In anticipation of lending a fragile collection, the dilemma to loan or not between the lender and the borrower, is collectively shared and, unavoidably, becomes an exercise in compromise for each. Responsible risk management often requires finding the middle ground and, if managed well, the risks will be off-set by the benefits gained in introducing the collection to a broader public.

Acknowledgements

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Suppliers

Gatorfoam:

Charrette Office Supply, P.O. Box 4010, Woburn, MA 01888-4010, (800) 367-3729

Paraloid B-72:

Conservator's Emporium, 100 Standing Rock Circle, Reno, NV 89511, (775) 852-0404

Hand tools, brushes:

Talas, 20 West 20th Street, New York, NY 10011, (212) 219-0770

Ethafoam, Plastizote:

United Foam Plastics, 172 E. Main Street, Georgetown, MA 01833, (978) 352-2200

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