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PREVENTIVE CONSERVATION AND IDENTIFICATION OF PLASTICS OF A RECENT ACQUISITION AT THE NATIONAL MUSEUM OF THE AMERICAN INDIAN

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ABSTRACT

In 2009, the National Museum of the American Indian (NMAI) acquired contemporary artist Brian Jungen's Crux (as seen from those who sleep on the surface of the earth under the night sky) [26/7253], a large mobile comprised of five animals made of plastic luggage, and a wooden rowboat. Mr. Jungen's work is often characterized by his use of mainstream consumer goods.

The installation of Crux in the main rotunda of the museum made it necessary to determine appropriate preventive conservation parameters for materials not often found in NMAI's collections. FTIR, Py-GC-MS, micro-fader testing, and spectrophotometer technologies, were used at the Smithsonian's Museum Conservation Institute, the National Gallery of Art, and at NMAI to identify and characterize the plastics present and determine an appropriate exhibit environment for Crux.

Of equal importance to the analysis was the opportunity to consult with Mr. Jungen about his perspectives on the long-term preservation and aesthetic expectations for Crux. Mr. Jungen is well aware of the potential for degradation of the materials with which he chooses to work. While consultations with Native constituent community groups are already standard practice in the NMAI conservation department, working with contemporary artists and their materials, which requires a slightly different approach, is a newer development.

1. INTRODUCTION

In the spring of 2009 NMAI, acquired Brian Jungen's *Crux (as seen from those who sleep on the surface of the earth under the night sky)*, seen in figure 1, a mobile comprised of a wooden rowboat and five large animals, made of plastic luggage. That fall, the museum installed *Crux* and *Strange Comfort*, an exhibit of twenty-four of Brian Jungen's pieces. This was the first solo exhibition of a contemporary artist at the NMAI Mall Museum since it opened in 2004 and it was the first time Mr. Jungen, who is of Swiss-Canadian and Dunne-za First Nations heritage, had exhibited his work at a Native American museum. Mr. Jungen is known for his use of mainstream consumer goods, such as golf bags, trash bins, and perhaps most famously Nike Air Jordan shoes, which he transforms into Native Pacific Northwest Coast inspired masks. As NMAI curator Paul Chaat Smith writes in his essay "Money Changes Everything": "Brian Jungen turns objects inside out. By deconstructing them, he changes not only the things themselves, but the ways we think about what they used to be, and what they've become. He begins with objects that are ordinary, useful, and comforting. When he's through, they are unique, expensive, and useless" (Smith 2010).

They also offer some conservation challenges. This paper will discuss aspects of the acquisition of the mobile *Crux*, its refurbishment by the artist, as well as consultations with Mr. Jungen, preventive conservation, and materials analysis. Part of this research was undertaken for Anne Gunnison's research project as an Andrew W. Mellon fellow in conservation. Ms. Gunnison served as the assistant to Susan Heald, textile conservator at NMAI and the conservation liaison for the *Strange Comfort* exhibit and installation. Jia-sun Tsang, senior paintings conservator at the Smithsonian Institution's Museum Conservation Institute (MCI) assisted on aspects of this project as she has done considerable research into plastics. The

conservation, refurbishment, and installations were truly collaborative projects and included not only NMAI and MCI conservators and fellows, but conservation scientists from MCI and the National Gallery of Art, as well as NMAI exhibit design, collections, registrar, and curatorial staff and contracted engineers, and perhaps most importantly, the artist himself.

Fig. 1. *Crux (as seen from those who sleep on the surface of the earth under the night sky)*. Collection of the National Museum of the American Indian. 26/7253. (Photograph by Anne Gunnison)

2. BACKGROUND

Crux was originally constructed and installed in an abandoned factory building on Cockatoo Island in Sydney Harbor, for the 2008 Biennale of Sydney. The animals, a life-sized crocodile, emu, shark, sea eagle, and possum, represent figures in constellations developed by Indigenous Australians. They were fabricated from purchased Samsonite and Antler brand luggage. Natural polymers, such as horn and beeswax, are prevalent in the collections of NMAI. While modern synthetics, like polyesters, are represented in textiles, such as modern pow-wow regalia, this is the first large piece of contemporary art composed of plastic materials in the NMAI collections.

3. REFURBISHMENT

After the piece was acquired, the artist wanted to change certain aspects of the animals, namely the crocodile and emu. He also wanted to incorporate a large wooden rowboat, which was originally on the floor in the Biennale, into the mobile. The rowboat was originally used by the artist to transport materials to Cockatoo Island from the mainland.

Crux arrived at NMAI in May 2009, followed closely by the artist at the end of the month. After the animals and rowboat were unpacked, the next order of business was to find green, blue, and black Samsonite F'Lite upright hardside plastic suitcases in the greater Washington, DC area so that Mr. Jungen would have the raw materials needed to make the changes. Working with Robert Patterson, an exhibits specialist and mountmaker, Mr. Jungen deconstructed the suitcases to make components for the crocodile and emu. To make the crocodile less flexible, Mr. Jungen and Mr. Patterson created an internal support system with aluminum tubing, as seen in fig. 2. The crocodile was partially deconstructed to create access points through which the internal support was fed. The head was taken apart; the upper and lower jaw had been attached, but Mr. Patterson welded a steel support structure, comprised of a steel plate and four steel rods welded to the plate, which would hold the crocodile's mouth open, to provide a clear view through the mouth. The support was secured with bolts to the plastic wall of the back of the head, the plastic wall of the body, and an arc welded steel "H" form in the interior of the body, which was attached with steel angle and bolts to the aluminum tubing internal armature. The bottom jaw was secured to the bottom two rods of the support with bolts. The top jaw rests on the two top rods. Mr. Jungen made the crocodile's tail more substantial with pieces of plastic luggage cut from the newly acquired black and green F'Llite suitcases. The pieces were secured to the internal armature with aluminum tubing and bolts.

Fig. 2. An internal support structure was added to the crocodile (Photograph by Anne Gunnison)

Fig. 3. Refurbishment of the emu (Photograph by Anne Gunnison)

Modifications were also made to the legs of the emu. The legs were attached at the top to the suitcase wheels with only one point of connection, which was causing disfigurement and whitening of the plastic material. On each attachment, a small piece of rectangular aluminum flat sock was attached at two points to the leg, and one point to the wheel. The metal was covered with pieces of luggage of the same color to hide the aluminum plate. Additional pieces of new blue F'lite luggage were added to the legs and attached to the lower leg with bolts. Mr. Jungen expressed dissatisfaction with the emu's head. The head was removed, and a new head, which had been previously made at the Sydney Biennale, was attached and a piece of luggage was added to the neck to make it more substantial. A large piece of blue F'lite luggage was also attached to the front breast of the emu.

4. CONSULTATION

During the artist's tenure at the museum, his time was in high demand. However, conservation and collections staff sat down with him to discuss his ideas about the future preservation and maintenance of *Crux*. Mr. Jungen is aware that the materials he uses in many of his pieces may degrade and fade or darken, and expressed a desire to mitigate the fading on *Crux* by displaying the piece for only a year.

At NMAI, interviews with Native artists and constituent groups, and the refurbishment of ethnographic objects in the collections by community representatives, are not new practices. While the museum is new to exhibiting fine art by contemporary artists, instituting protocol for interviews with these artists and working with them to modify their art is rooted in established practice. Many articles have been written by NMAI conservation staff regarding these practices, a list of which can be found at: http://www.nmai.si.edu under Collections and Research.

Distinguishing characteristics between Native community and contemporary artist consultations are found in the interviewees themselves: Brian Jungen makes decisions about Brian Jungen's contemporary art, purchased and owned by the museum; community representatives make recommendations for ethnographic objects, held in trust at the museum for

their community as a whole. While the dynamic of ownership may be different for each circumstance, the practice of stewardship of all objects by the museum, whether defined by the wishes of a contemporary artist for his own work, or an invested community for their cultural heritage, is of high importance. NMAI's Collections Management Policy states: "Beyond the basic professional tenets of preservation, NMAI also operates under the principle that it acts as the steward rather than owner of collection items in its care, and that preservation should be undertaken in consultation and collaboration with representatives of Native communities…" (National Museum of the American Indian 2008). This policy could be seen to extend to the preservation of contemporary work in consultation and collaboration with contemporary artists.

5. LIGHT MONITORING & INSTALLATION

While the light levels of the proposed exhibit space for *Crux*—in the main rotunda of the museum, where there is a sky-light, called the Oculus, and in front of a wall of north-facing windows—had already begun to be monitored, the artist's concerns about fading acted as the guide in determining and suggesting effective methods of mitigation.

As noted in the book *Plastics: Collecting and Conserving*, light is "one of the most detrimental factors in a plastic's long term stability. Visible light, and especially ultraviolet, can induce damaging photochemical changes. Light effects are cumulative, with each excessive exposure contributing to deterioration." (Pagliarino and Shashoua 1999, 92-93) These changes include increasing brittleness and color change. Increasing brittleness may lead to structural failure, which for a piece like *Crux*, could possibly end in disaster. To mitigate light-inflicted damage to plastic objects, light levels should be approximately 50 lux. The recommended UV light level should not exceed 75 microwatts/lumen (Pagliarino and Shashoua 1999).

HOBO data loggers were hung from the ceiling of the north side of the main rotunda of the museum, in front of the windows where *Crux* was to be hung to monitor visible light levels from both the windows, as well as from the Oculus. The north-facing windows had consistent and sustained high visible light levels, which were more than twenty-four times higher than recommended levels, indicating that *Crux* would be prone to cumulative damaging exposure. While light from the Oculus could reach up to 14,800 lux, these spikes occurred only very briefly during the day, and thus would not be likely to have a profound effect on the piece. The Oculus also had a UV film in place, whereas the north-facing windows did not. A spot reading indicated UV levels at 190 microwatts/lumen from the north-facing windows, which far exceeded the recommended levels.

As a result of this light study, it was recommended that UV and visible light blocking film be placed on the north facing windows. 3M Scotchtint Night Vision Window film, which comes in various shades, which block different amounts of visible light, and all block 99% of UV light, was recommended. Because of aesthetic concerns about the film, the type which transmits 45% of visible light was installed. It was only installed on the top bank of windows, the ones in front of which the mobile would hang, because of end-of-the-fiscal-year restrictions.

With this preventive measure in place, the piece was ready to be hung. Mr. Jungen wanted the rowboat to become part of the mobile itself, hung upside down, the keel facing the ceiling, and animals hanging from the boat. Mr. Patterson, other members of the exhibits team, and a contracted engineer engineered the installation, doing trial runs to correctly balance the animals using fork lifts, weights, and human strength in the NMAI exhibits shop. In September 2009, the piece was installed. It hung nearly perfectly balanced; an approximately four pound

bag of #2 lead pellets had to be placed on the back of the crocodile to achieve the final equilibrium.

6. ANALYSIS

While perhaps taking preventive conservation measures was sufficient, it was also worthwhile to undertake further investigation of the plastics that comprise *Crux*, to identify their types, which were initially believed to be ABS plastic, and perform color change and fade tests on the samples. When *Crux* arrived at NMAI, a box of cast-off materials, included identification tags from the luggage. This helped determine what types of luggage Mr. Jungen had used. The Design Center Coordinator at Samsonite luggage was contacted to request any materials information they could provide on the luggage, but there was no response.

6.1 FTIR & PY-GC-MS

Ms. Tsang and Ms. Gunnison worked with Jennifer Giaccai, a conservation scientist at MCI to identify the plastics. Samples of the luggage were taken from off-cuts produced by the refurbishment of *Crux*, pieces from the sea eagle were procured in the packing material, and small samples were cut from the possum and the shark. Ms. Tsang, Ms. Giaccai and Ms. Gunnison first examined the plastic samples with FT-IR. The samples were then further analyzed by Pyrolysis-GC-MS (Py-GC-MS) by Ms. Giaccai.

The crocodile, emu and sea eagle luggage samples showed the same infrared spectrum, indicating that all were made from polypropylene or a mixture of polypropylene and polyethylene. High temperature Py-GC-MS of the samples was similar for these same samples. The peaks were mono- or polyunsaturated hydrocarbons, characteristic of polypropylene. The most prominent peaks were from cyclopropane, isobutene and dimethylheptene, all degradation products of polypropylene. There were no unsaturated hydrocarbon peaks suggesting the presence of polyethylene, therefore it appears that these luggage samples from the crocodile, emu, and sea eagle are composed only of polypropylene.

Low temperature Py-GC-MS of the samples showed small amounts of phthalate plasticizers. The samples had been stored in plastic sample bags, so plasticizer could have been transferred from the plastic bag to the samples. In addition most samples also contained squalene, which is found in lubricants and some hand creams. Its presence could be a part of the luggage manufacture, creation of the work, or as contamination from the sample storage bags or handling.

The infrared spectra of the samples from the shark and possum all showed the presence of the same polymers—acrylonitrile (likely ABS) and polycarbonate—but with different ratios of each polymer.

Squalene was present in both the red possum and the sample from the black luggage used in the shark. It was not observed in the sample from the gray luggage from the shark. As with the polypropylene samples, it is possible that the plasticizers were contamination from the plastic bags used to store the samples.

The major peaks from the high temperature pyrogram of the possum indicated that the plastic is composed of both ABS and polycarbonate, while the major peaks from the high temperature pyrogram of the black shark sample are from polycarbonate with the exception of one polystyrene peak. Minor peaks show the presence of acrylonitrile and ABS monomers,

indicating that ABS is a component of the black shark plastic, but there is less present than the possum; polycarbonate appears to be the main polymer component.

The pyrogram from the gray shark sample also showed both ABS and polycarbonate peaks, but between the higher-ABS ratio of the possum sample and the higher-polycarbonate ratio of the black shark sample. This is consistent with the IR results where the acrylonitrile peak was largest for the possum sample and smallest for the black shark sample.

As noted in the book *Conservation of Plastics*: "Due to lack of resources, these 'high-risk' materials [which is defined by the author, Yvonne Shashoua as cellulose nitrate and acetate, poly (vinyl chloride), polyeurthanes, and rubbers] have been the focus of research projects looking at how to prolong the useful lifetime of plastics, at the exclusion of others. Polyester, polyethylene, and polypropylene plastics are increasingly showing signs of degradation in museum collections and are expected to be the focus of conservation research projects in the near future." (Shashoua 2008, 229). Shashoua references the study "Lights Out! The Conservation of Polypropylene Wall Tapestries" by Thea B. van Oosten *et al*. In this study, the issue is raised that polypropylenes can be sensitive to the effects of UV and the photo-oxidation process of polypropylene is described: "Polypropylene is highly sensitive to UV, which is responsible for the radiation induced polymer photo-oxidation… which causes development of surface cracks, discoloration, darkening and a… gradual loss of mechanical properties and, ultimately, embrittlement" (van Oosten *et al.* 2008, 97-105). Of course, not all polypropylenes are the same, and vary batch-by-batch, manufacture by manufacture. Further testing of these effects on *Crux* need to be pursued, but efforts were made to filter out any UV light in its display area.

6.2 MICROFADE TESTING

In an effort to gauge what type of fading one might expect from some of these plastics in *Crux*, Dr. Christopher Maines, a conservation scientist at the National Gallery of Art, was asked to test samples of the plastics from the crocodile, emu, and sea eagle from *Crux* with a micro-fade tester, or MFT. The MFT detects light-sensitivity and light-fastness of the materials. A light source, tenths of a millimeter in diameter, filtered of UV and infrared light, is directed at an area on the surface of the samples, without leaving visible evidence of the test on the object. The reflected light from the surface of the object transfers through a spectrophotometer, which measures the color change and fading over a period of a several minutes. The results are compared with the fading and light-fastness of ISO Blue Wool Standards.

While the data from the MFT was apparently quite noisy, Dr. Maines believed that there were trends that were quite clear: the light-fastness of the samples could be considered no worse than Blue Wool 3 and were most likely less sensitive than that. Because of the general noise level of the data, Dr. Maines could not give any further evaluation beyond general evidence of light sensitivity.

6.3 SPECTROPHOTOMETER

Samples of plastics for color change testing were created to be placed at various locations around the museum. Though all the plastics could not be represented, larger pieces leftover from the refurbishment of *Crux* were cut to approximately 2 inch by 1 inch. As can be seen in figure 4, half of each of the plastic sample was covered in aluminum foil. One was placed in the area where *Crux* is hung, one on the floor directly above in the museum's Resource Center, also facing the north-facing windows, and one, outside, on the director's terrace, facing east. All were

left for a 4 to 6 month period. The samples on the director's terrace survived the two foot snow drifts of the DC blizzards of 2010, but the one in the display area fell over at some point face forward; it grew a surprising amount of mold, as a result of condensation.

Yoonjo Lee, an Andrew W. Mellon Fellow in conservation at NMAI, was pursuing research into the use of the spectrophotometer and she tested these samples with a portable Minolta CM-2600d spectrophotometer. The spectrophotometer measures the spectral reflectance from or the transmittance through materials as opposed to a colorimeter, which directly measures CIE colorimetric coordinates under standardized conditions. Before testing, the samples were gently cleaned with water to remove dirt, which would affect the readings. The unexposed side, under the aluminum, was measured three times and averaged to produce colorimetric coordinates. Areas on the exposed side, which did not have the aluminum foil cover, were tested in the same way. The two average measurements were then compared for color differences.

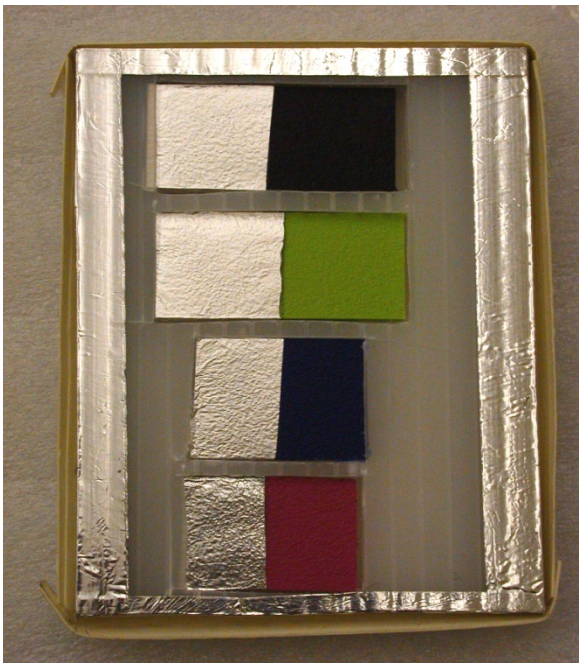

Fig. 4. Plastic samples for color change testing (Photograph by Anne Gunnison)

Figure 5 is an example of the results, this one from the green luggage sample on the director's terrace. The negative L* represents a darkening of the material, a* represents a shift towards red, and b* represents a shift towards blue, and the delta E*ab, the overall change. Because they fell over and possibly because of the UV filtering on the windows, the samples in the display area showed negligible amount of change. The samples from the director's terrace and the Resource Center showed similar trends. Most of the samples from the director's terrace showed slightly more color difference than the samples in the Resource Center with some exceptions. In general, the results indicated a slight, non-visible shift, which tends towards darkening of the plastics.

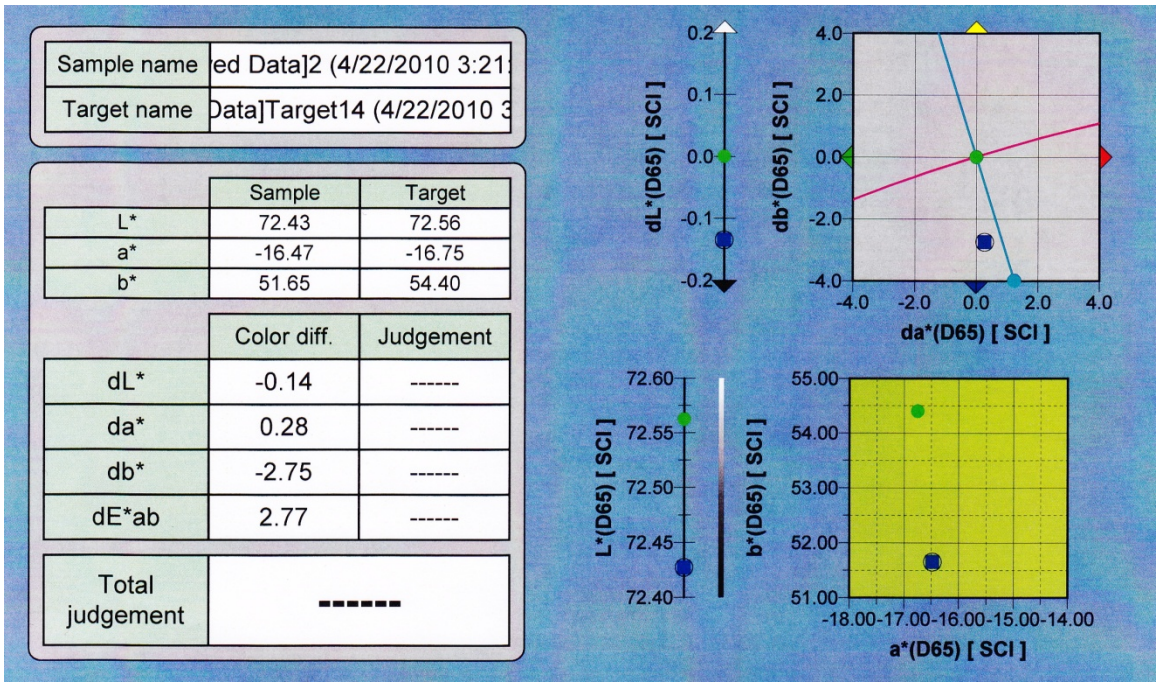

Fig. 5. Example of spectrophotometer results (Produced by Yoonjo Lee)

6.4 TENSILE STRENGTH

Dr. Marion Mecklenberg, a Senior Research Scientist at MCI, was asked to examine the animals in *Crux* to determine whether he foresaw any problems with the hanging mechanisms imparting too much stress and strain on the plastics. His main concern was the stress imparted on the tail of the possum. There was a small hole drilled in the tail, through which the possum was hung when on display. Dr. Mecklenberg determined the maximum stress, the force applied to the sample divided by the cross-sectional area, on the possum tail is 640 PSI, or pounds per square inch. He believed the possum would be able sustain this stress because the allowable tensile strength for a polycarbonate-ABS blend plastic is 5040 PSI.

7. BLOGGING

During all of this testing and installing, Ms. Gunnison wrote posts for the NMAI blog (blog.nmai.si.edu), at the wishes of the curator. The blog was written from the conservation perspective, in order to engage the public and create greater awareness of *Crux*, *Strange Comfort*, and the conservation issues they present. The Czech avant-guard counter-culture rock group Plastic People of the Universe, the hi-top fade haircut sported by 1980s hip-hop star Kid of Kid-N-Play, and Dannon Yogurt's decision to stop using plastic lids were all invoked to discuss a range of issues including plastics preservation, microfader testing, and the importance of consultations with contemporary artists.

8. CONCLUSIONS

The acquisition, exhibit, and the artist's tenure at the museum during installation provided opportunities for consultation, collaboration, and examination as Mr. Jungen's work became part of the exhibit and the museum's collection. While more materials testing can be performed to understand and anticipate changes that may occur to *Crux*, appropriate preventive conservation measures were taken and the artist's desire to only display *Crux* for limited amounts of time will be heeded. Change is expected to occur to these materials, but it cannot be expected of Mr. Jungen, who acknowledges and recognizes the long-term instability of his chosen materials, to change the materials he works with. These commercially made and obtained materials, the shoes, the trash bins, the luggage, are the crux, if you will, of Mr. Jungen's art. As Paul Chaat Smith writes: "Some artists paw through dumpsters for their art, an interesting and honorable strategy… Jungen simply buys what he needs, in the same way and at the same stores that you and I frequent…True, before long they go under the knife, drill, or table saw, and through this creative destruction they increase in value exponentially, but they all begin as ordinary items on a shopping list" (Smith 2010). So it is the conservators' job, to understand these materials, to mitigate the changes that could occur, so that these ordinary items on a shopping list retain their value as the art objects they have become.

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SOURCES OF MATERIALS

Microfader Tester
Oriel Instruments
150 Long Beach Blvd.
Stratford, Ct 06615-0872

Four Hour Day, Inc
214 N. Greene Street
Baltimore, MD 21201

Edmund Industrial Optics
101 East Gloucester Pike
Barrington, NJ 08007-1380

Minolta Spectrophotometer
Konica Minolta Sensing Americas, Inc.
101 Williams Dr.
Ramsey, NJ 07446-1293

3M Scotchtint Night Vision Window Film
3M Building & Commercial Services Division
3M Center, Building 223-2S-24
St. Paul, MN 55144-1000

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