

# ULTRAVIOLET IMAGES

## A STUDY OF UV PRINTED PHOTOGRAPHS ON TEXTILES

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### Introduction:

This research project investigates the feasibility of using digitally printed images on cotton book cloth for use in book cover conservation, specifically employing a new printing technology termed "UV flatbed printing." In the field of book conservation one of the most time consuming restorative acts that can be completed is in the repair and restoration of a cover. The traditional method of repair involves a painstaking effort to colour match each different hue present, along with any marbling, patinas, intricate design work or lettering included. It is proposed that a high resolution image of a cover could instead be digitally restored and printed for use as an infill, allowing for an exact match with the original. Known for their ability to bind to almost any substrate, UV curable inks harden within milliseconds and are lauded for their lightfastness. If testing indicates it, restorations completed with this setup could be completed in a fraction of the time as a traditional restoration.

### Micro-Fade Lightfastness Testing:

A relatively new research tool, this technique employs an intense beam of light shone onto a sample and real-time colour reflectance spectra are measured and recorded in order to calculate and predict the rate of fading in the colours present. In order to determine where colours fall on a standard fading scale, data taken from the sampled artifacts are compared to blue wool standards #1 – 4 which have known rates of fading (Fig 3 & 4).

Actual colour changes can be seen using reflectance graphs (Fig 5)

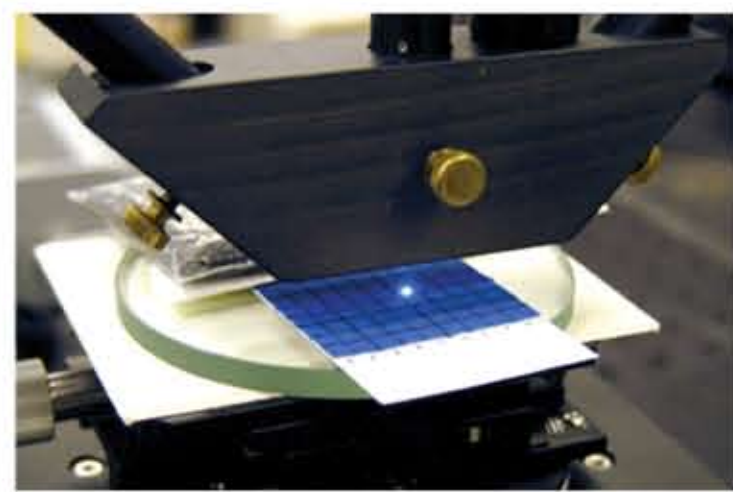


Fig 3: Testing of a blue wool standard to use as a comparison to actual samples.



Fig 4: Red being tested. The beam of light must hit a target thread at its highest point in the weave in order to have maximum reflectance.

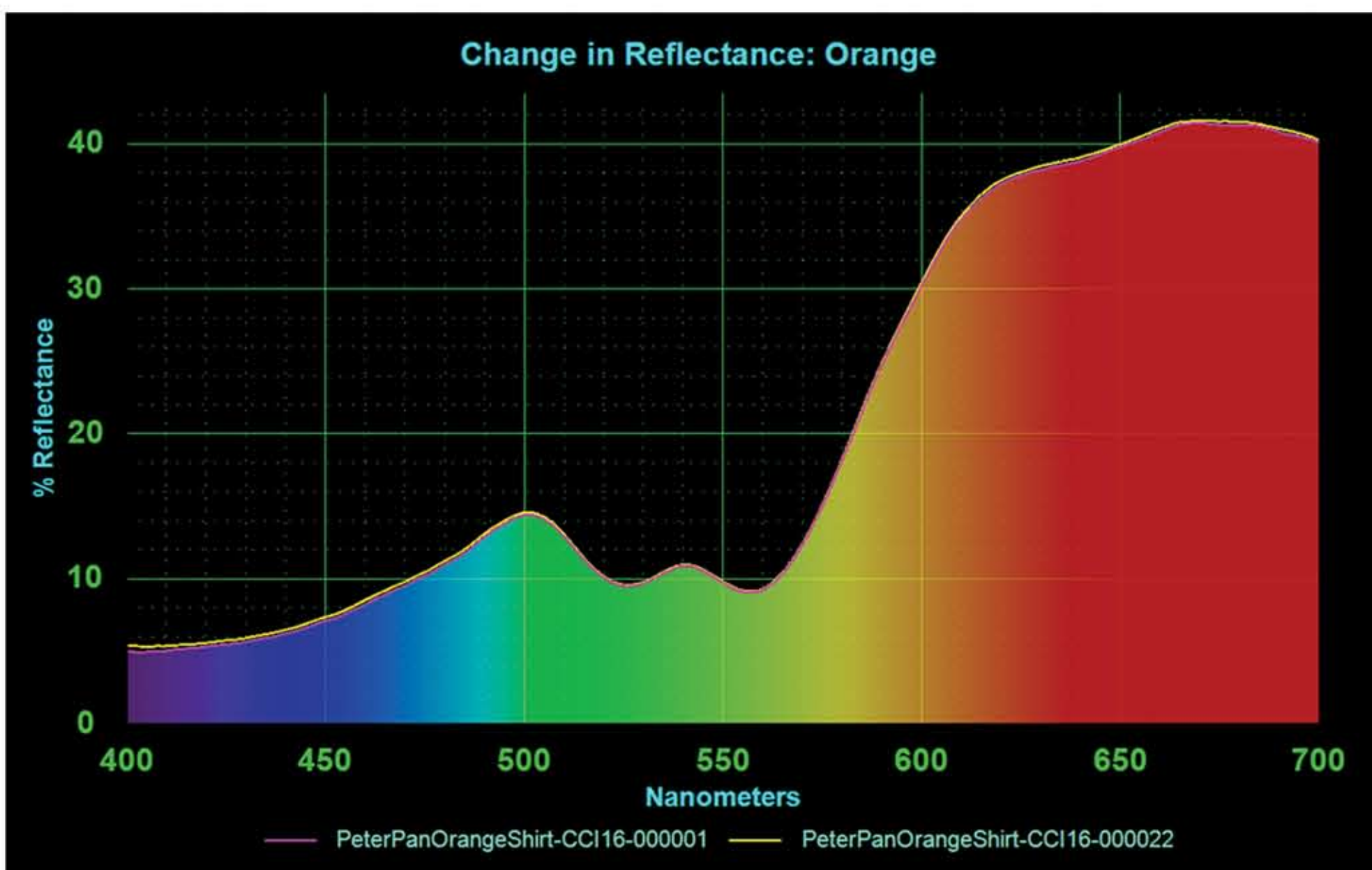


Fig 5: After testing the orange colour present on Sample Book 1, the resulting graph indicates little to no change in that colour after a ten minute exposure. The pink line shows the reflectance before testing and the yellow line shows it after.

### Offgassing:

Samples were tested at the Canadian Conservation Institute using a headspace analysis method. They were first gently heated to approximately 40°C for thirty minutes and a solid phase microextraction (SPME) fiber placed into the headspace of the vial to absorb any volatile gasses that may have entered the upper portion. The fibers were then analyzed using a gas chromatograph linked to a mass spectrometer. A high level of off gassing materials were detected, mostly tri(propylene glycol) triacrylate (an acrylic polymer) and 1-hydroxycyclohexylphenyl ketone, a highly reactive free radical photoinitiator.

### Experimental:

Two sample books were digitally photographed (Fig 1 & 2) and a number of samples printed from their covers. The wet and dry fastness of the ink, its lightfastness, its flexibility when attached to the substrate, ability to accurately reproduce colours and surface textures as well as potential for harmful off-gassing were assessed.

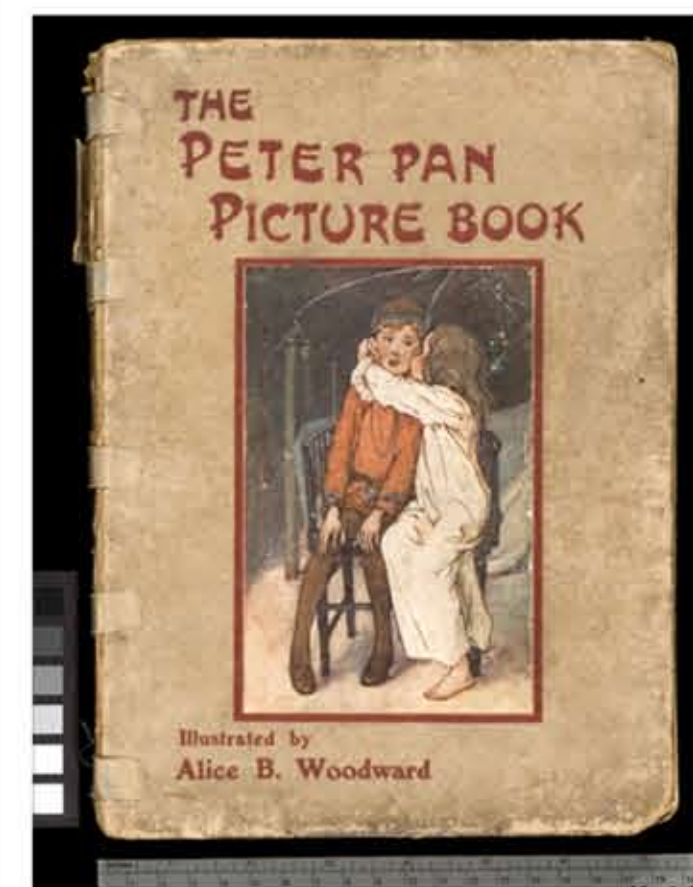


Fig 1: Sample Book 1

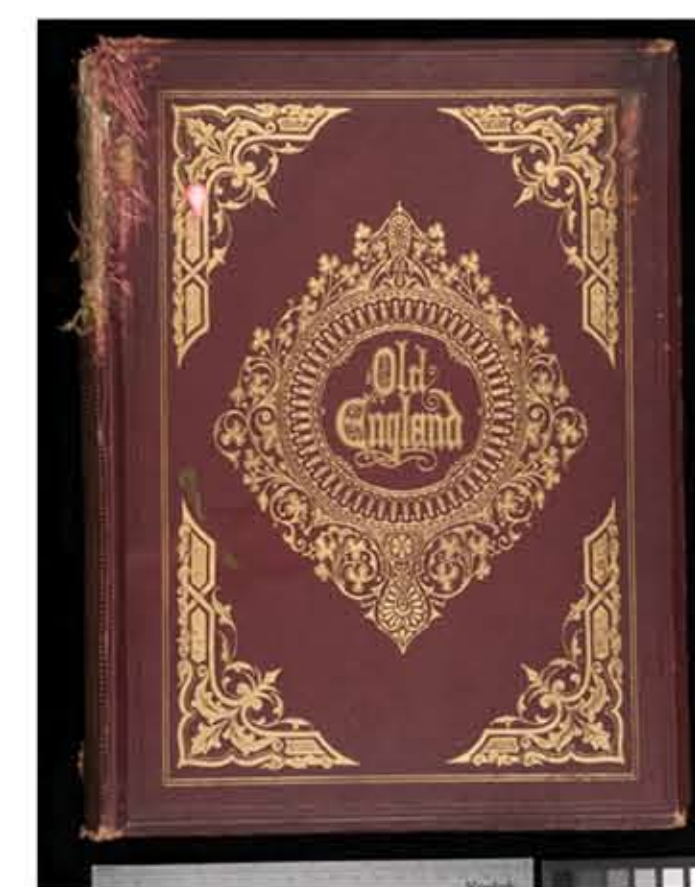


Fig 2: Sample Book 2

### Wet and Dry Inkfastness:



Fig 6: To test the wetfastness of the UV curable inks, a sample was first left to soak in water for 24 hours. Four columns were drawn and a piece of blotter paper held at even pressure was rubbed across the surface of each column. Column 1 was rubbed two times, column 2 was rubbed four times, and so on. There was very heavy ink losses present in all columns. The same rubbing setup was used to test for dryfastness with insignificant ink transfer.

### Conclusions:

While the lightfastness of the UV curable inks are adequate for conservation use and the potential for colour matching is commendable, the very poor wetfastness of the inks, their tendency to crack and flake when flexed, as well as their tendency to offgas harmful and volatile compounds, even months after printing, negates the hypothesis that ultraviolet flatbed printing would be a quicker and more convenient type of book cover conservation. Continuous development in the ink technology will hopefully allow for their use in the future.