Improving the Legibility of Faded Handwriting on Furniture by Digital Modification of Infrared, Ultraviolet, and Polarized-Light-Filtered Photography

ABSTRACT—This paper discusses various photographic techniques and digital enhancements used to clarify illegible handwritten inscriptions on furniture. Graphite, chalk, and ink inscriptions discovered on an early 18th century American escritoire were photographed with a modified DSLR camera, with the modified images revealing information relevant to the early history and use of the object. Different lamp and filter setups for visible, cross-polarized, infrared, reflected ultraviolet, and ultraviolet-induced visible fluorescence are discussed, as is the digital modification of photographic files using the imaging software Adobe Camera Raw and Adobe Photoshop.

1. INTRODUCTION
During an ongoing review of American furniture at the Museum of Fine Arts (MFA), Boston, a team of curators and conservators discovered a number of illegible inscriptions on the objects. The search for suitable photographic techniques to more clearly reveal this handwriting led to experimentation with different kinds of illumination and digital image modification.

The primary focus of our experiment was an 18th-century escritoire from Rhode Island which was recently added to museum’s collection (fig. 1). Although similar escritoires are attributed to British makers, this object was evidently made in America, because the main secondary wood is chestnut. The escritoire displays a sophisticated layout of compartments in its upper case, and the craftsmanship is at a very high level for its time (fig. 2). Several legible names written on secret compartments in its upper case constitute strong evidence for the early provenance of the piece. The inscriptions name three children and a cousin of the Childs, a family of shipbuilders in Warren, Rhode Island (fig. 3). Further, the escritoire is mentioned in the 1738 estate inventory of Thomas Child (Carr 2014).

In addition to the children’s names, the escritoire carries 50 additional inscriptions located throughout the upper case. Most of them are written on the unfinished wood of 24 hidden compartments, some of which have paper labels glued on
of the 18th century to utilize natural graphite of inferior quality. In such instances, the graphite was pulverized, purified, mixed with clay, and finally pressed into cylindrical rods (Watrous 1957).

Natural graphite would have been likely used for markings and inscriptions at the time our escritoire was created in the early 18th century.

2.1 graphite inscriptions
A limited amount of handwriting in graphite is present on the escritoire. Apart from numbers that name the location of the individual drawers, four graphite inscriptions are written on top of the four open twin compartments. The words “left”, “left of center”, “right of center”, and “right” are legible in visible light. Below this, on the two outer boxes, appears a four-digit number. Presumably a year, the number’s second digit, indicative of its century, is not legible (fig. 4). The missing digit is lost to abrasion caused by wear, and the lack of contrast between the light-colored chestnut substrate and the silvery line of the writing makes it difficult to read.

2.2 setup of reflected IR photography
Since the inscription is written in graphite, and therefore contains carbon, it seems that the best method of detection would be reflected IR photography (Warda 2011).

The setup of reflected IR photography requires light sources that emit radiation in near-IR, and a lens filter that cuts out all other radiation, such as visible light and UV radiation. A regular DSLR camera, from which the built-in UV and IR filters had been removed, was used. The camera was tethered to a computer to allow focusing of the image on the screen.

2.3 digital modification
The images were enhanced in Adobe Camera Raw, a plugin to Adobe Photoshop which allows easy adjustments to pictures taken in the RAW format.

The initial IR image has a color cast, typical for an image shot in RGB mode. To allow the eye to focus on the contrast between the wood and the graphite writing, the color should be removed entirely until the image appears black and white. Camera Raw achieves this by lowering the saturation to a minimum. Adobe Photoshop allows similar adjustments, obtained by converting the color mode from RGB to Grayscale. Camera Raw can further enhance the contrast if the “clarity” slider is moved to a maximum setting. The adjustment of the “tone curves” on the second tab of the Camera Raw menu provides further contrast. By giving the linear graph in the marked window a slight S-curve, the difference between light and dark areas is heightened (fig. 4).

2.4 evaluation
It is clear that the year in question is “1967”, and not “1767” as speculated. At this point, further investigation of this particular handwriting became unnecessary; its presence simply illustrates that the compartments were known and used in the second half of the 20th century. However, the application of IR...
photography and simple adjustments in Adobe Camera Raw proved to be useful in reading the illegible graphite inscription.

3. WHITE CHALK AS A WRITING MEDIUM
Chalk is a friable writing medium, and often meant as a temporary, easy to remove material. While it adheres to a raw wooden substrate reasonably well, it sits loosely on the surface and does not penetrate. Often, chalk inscriptions on furniture are placed in areas prone to wear such as drawer bottoms and sides, dust boards, and the backs of case pieces. Occasionally, a chalk inscription degrades to lines just slightly lighter than the oxidized wood surrounding, with few remnants of the actual pigment left.

When considering the photography of chalk inscriptions, it is important to realize that what is often called chalk was in fact made from a vast variety of different materials. Most chalks are different from the one geologically genuine chalk. In America, little high-quality natural chalk existed (Gettens et al. 1974).

According to current knowledge, none of the chalk inscriptions found on furniture has ever been scientifically analyzed. Taking into account the different materials possibly used as the medium chalk, more systematic research and scientific analysis would help to understand which materials were available to furniture makers throughout history for marking and inscribing their work.

Few authors refer to chalk as a writing tool. Most of them consider chalk as a pigment for artists, but often references to the use as a writing medium are made. Watrous reviewed primary literature for instructions on drawing media and states that natural soapstone was used as tailor's chalk. According to his research, references to tailor's chalk made from soapstone mostly date to before the end of the 17th century, while the more common white chalk appeared from the 17th through the 19th century. Tailor's chalk, or soapstone, was recommended by Cennino for the drawing of designs on cloth although not for drawing studies (Watrous 1957).

However, Corrigan examines different sources of chalks in the context as a drawing medium on paper, and lists five different raw materials (Corrigan 1997). The most recent and extensive review of white chalk for drawing was published by Mayhew in 2012. He gives an overview of natural and fabricated chalk, as well as other pigments and media which had been used historically as chalk by artists (Mayhew et al. 2012).

Since ancient times, natural chalks have been used for drawing. Natural chalk used through the 17th century offered sufficient cohesiveness to be sawn into durable drawing sticks and used in its natural state. Over time artists fabricated other types of white chalks made from different materials, both natural and artificially synthesized, which often required the addition of a

Fig. 4. Screenshot of adjustment in Adobe Camera Raw.