

The Chalk Spectre: An Investigation of the Application and Removal of Chalk on Blackboard

November 28, 2011
ultimatekiwi

Abstract

Blackboards erase in a curious manner. Sometimes a dark “shadow” can be seen. This experiment was designed to test the effect of differing pressure of both chalk and eraser on the manifestation of this effect. Results were entirely inconclusive due to insufficient data analysis.

Introduction

Chalkboards are a common medium for developing and conveying ideas. Calcium sulfate or calcium carbonate, known as “chalk”, is used to write or illustrate upon the chalkboard surface. Of course, the main utility of chalkboards is that once the contents of the chalkboard are no longer relevant they are easily erased with a handheld eraser made of felt. However, it has been noticed that after erasing a mark on a chalkboard, a dark “shadow” of the mark occasionally remains. See Figure 1.

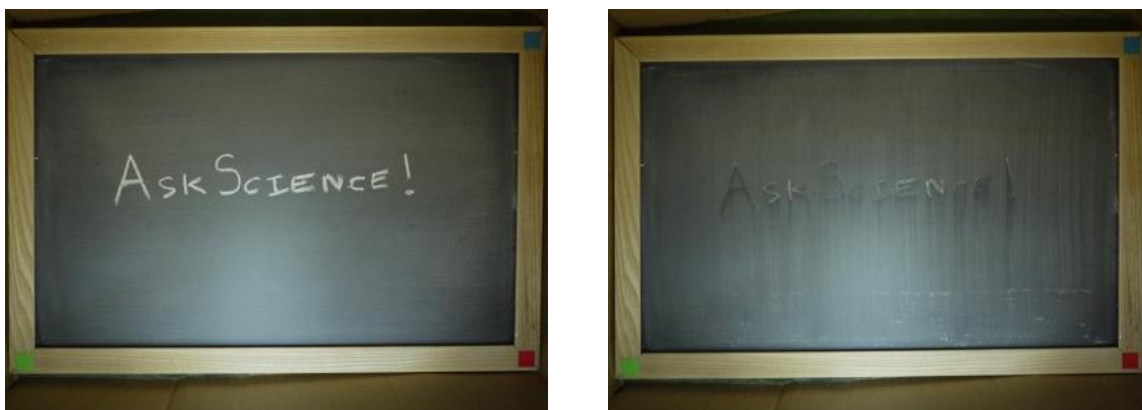


FIGURE 1

We will investigate the relationship between force of chalk application, force of erasing, and the manifestation of these “shadows”.

Methods

In order to examine this phenomenon, we quite obviously need chalk, a chalkboard, and an eraser. While an effort was made to find a slate chalkboard (as this is the type of chalkboard on which the author has previously experienced this

phenomenon), a non-slate, textured 28cm x 43cm chalkboard was used.

In addition to these crucial items, we use two small (10cm x 15cm) pieces of lumber, screws, hooks, and string for the purpose of developing a method of delivering consistent pressure to both chalk and eraser as they are used. See Figure 2.

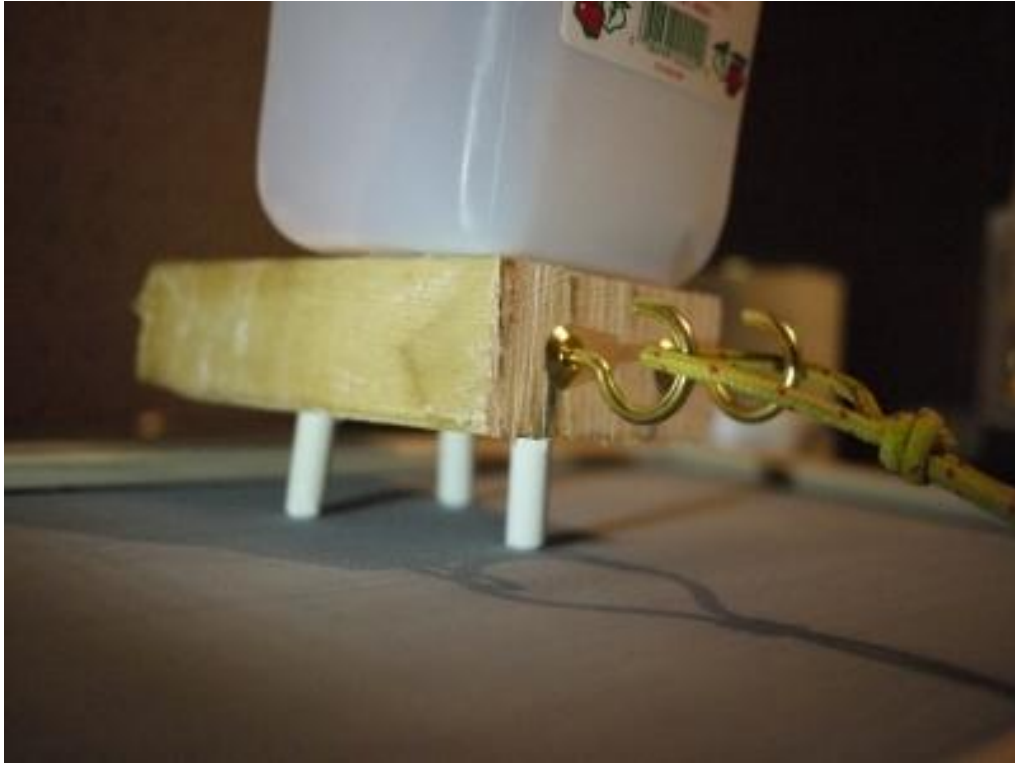
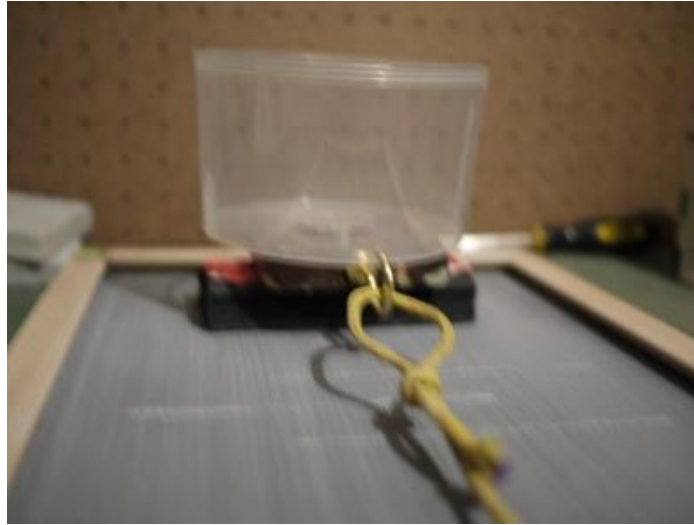


FIGURE 2

The chalk-delivery device was made by drilling three chalk-sized holes into a piece of wood, screwing a container on top (in order to hold varying weights), and adding hooks onto the front so that a string could be attached that would allow for the contraption to be pulled across the surface of the chalkboard. The eraser-applier was created in a somewhat similar fashion:



Procedure:

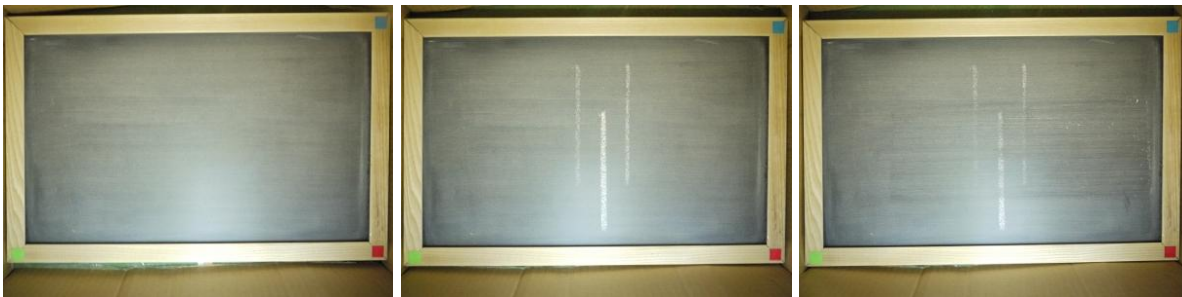
- 1. Clear blackboard with eraser until it seem to be fairly uniformly erased.*
- 2. Put cardboard box over the blackboard, turn on headlamp that is shining in it.*
- 3. Place camera at top of box, take picture of blackboard using camera settings of:
f 1.7, 1/10s, ISO 1600, WB: 3100K*
- 4. Remove box. Place chalk-delivery device on blackboard, and put either 0, 1, or 2 weights (for this experiment I used the precisely-calibrated brass doorknobs I found lying around) in bucket on top of device.*
- 5. Pull string horizontally to apply chalk to blackboard.*
- 6. Photograph, as in 3.*
- 7. Place eraser contraption similarly to placement of chalk-delivery device. For this experiment we pulled the eraser in the direction perpendicular to the lines the chalk has been applied in.*
- 8. Photograph, as in 3. and 6.*
- 9. This completes a “run”. Repeat with varying masses on both chalk and eraser.*

Data Analysis

Data analysis was limited, as certain ideas critical to it were not implemented. In particular, note in Figure 1 that the wooden blackboard frame had three coloured

squares taped to three distinct corners. The intended method of investigation was to write a script in R that detected the location of each of these three squares relative to each other in every photograph taken. Then, within each run (see procedure), we would be able to compare precise locations on the blackboard in order to see how the surface changes as chalk is erased. This would have allowed us to figure out if the “shadow” effect was more pronounced given variations in chalk-pressure and eraser-pressure.

Several runs were attempted (with photographs taken), although unfortunately the masses that were used did not seem to be enough to produce the desired effect.



Run 1

Here are some images from Run 2 that were converted to Grayscale and then filtered with the condition of intensity being greater than 0.78:



FIGURE 3

Conclusion and Thoughts For Future

To do this experiment well in the future, there would be several things that ought to be done. Firstly, get the darn computation part working! Secondly, I would make sure

to have a wider variety of weights available, as it would appear that sufficient force is necessary in order to produce the shadowing effect. I would also make sure that the lighting was more consistent when photographing the blackboard, as Figure 3 shows in the first pane that there was some brightening that occurred in the camera due to the light glaring off the blackboard surface.