

Sound Painting

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1 Introduction

For this assignment, I set out to emulate an artistic method known as sound painting. I first saw an example of sound painting in a commercial for the Canon Pixma printer^[1]. In this technique, a speaker is used to excite liquid paint into unique and interesting shapes. My interest was sparked by the bright, interesting colors, and the fact that every image was different from the next.

Since I originally planned to attempt this method using a high-speed video camera, the realization of my plans was a bit more difficult than anticipated. This project ended up being a valuable learning experience from both artistic and technical aspects, and I was very happy with several of the final images I captured.

2 Flow Apparatus

The setup required to capture this photo was straightforward, but fairly involved. The speaker I used was a small *Altec Lansing* subwoofer that is paired with a set of desktop computer speakers. The subwoofer was laid down so the speaker cone faced upwards. The cone and side of the speaker were covered with a single piece of black plastic, commonly used as a drop-cloth for commercial painting. This plastic was thick enough to protect the speaker and hold up to the stresses from the subwoofer, but flexible enough to move with the application of sound. This plastic-covered subwoofer functioned as the 'stage' for the fluid movement.

This setup was placed in a semi-enclosed environment in order to protect as much equipment as possible, as well as provide a clear background. To light the shot, a total of 9 lights were used, ranging from small CFL bulbs to high-powered halogen shop lights. This large amount of lighting was necessary due to the extremely short shutter speed, but also virtually eliminated any shadows in the

paint. This was very important to me, as I wanted to capture as much color and structure as possible, without losing any details to a lack of lighting. A labeled photograph of this studio setup can be seen in Figure 1 below.

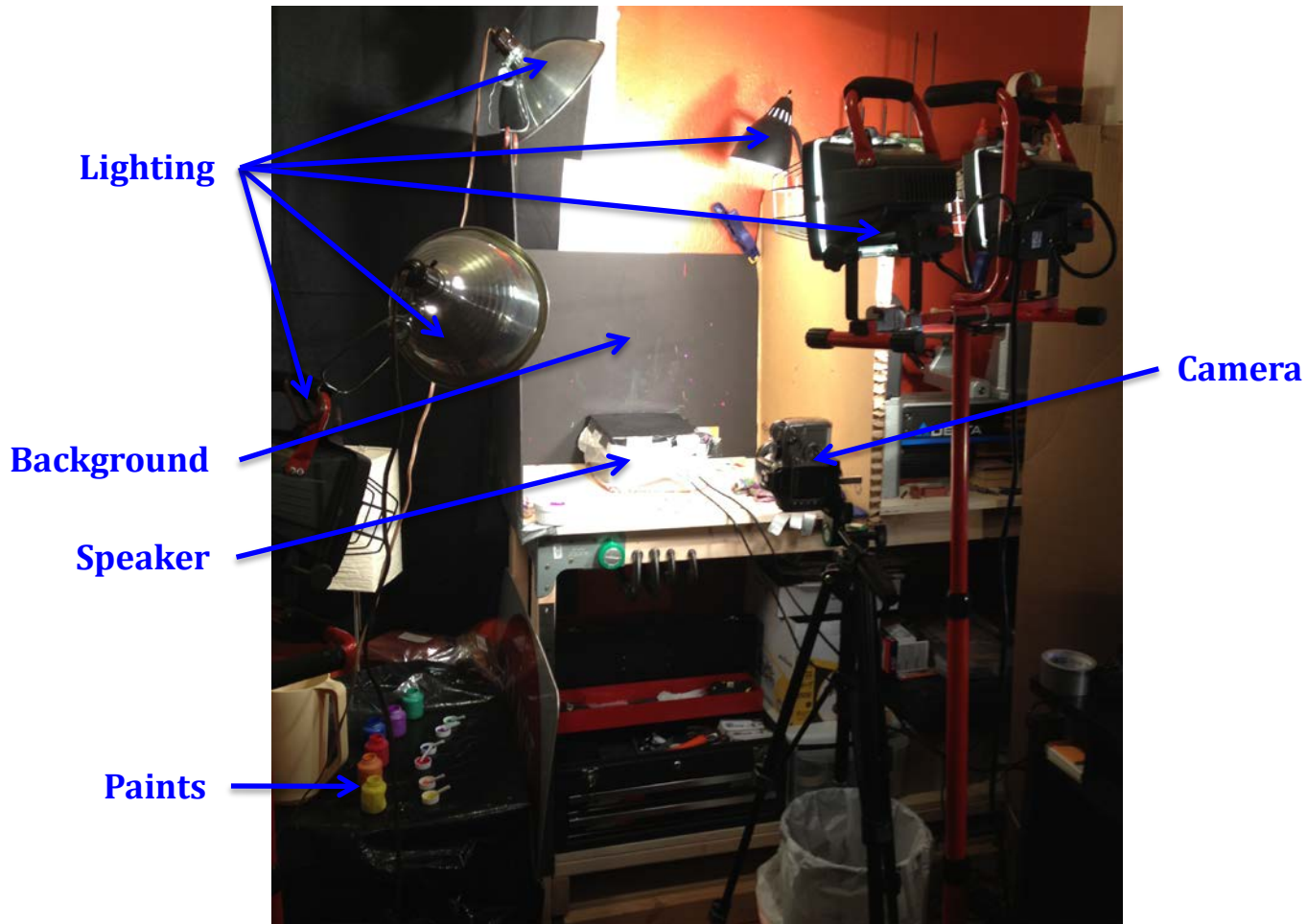


Figure 1: Studio Setup

To capture each image, paint was applied to the center of the plastic-covered subwoofer. Although virtually any type of paint could be used, I chose water-based children's craft paint. This choice allowed for easy cleanup, many color choices through mixing, and the ability to thin the paint with water. Only a small amount of paint is needed to achieve the desired effect, particularly when diluted with water. In this image, the paint was about the size of a silver dollar before excitation. Once the paint was set up, a 1 Hz signal^[2] was fed into the subwoofer at the loudest possible volume setting.

3 Flow Analysis

The fluid movement in this photograph is very fast and complex. Although some complicated physics are likely involved in the formation of these patterns, some more simple concepts can describe the behavior of the paint that resulted in this image. When the speaker pulsed, it first pulled the fluid downwards, and then quickly flung it into the air. At that point, the speaker surface will come back down, bringing some of the paint with it. However, the momentum in some of the paint will cause it to continue upwards. Due to hydrostatic forces, ligaments are formed between the various globs of paint. Shortly after this photo was captured, those ligaments broke, and the paint droplets continued away from the speaker.

Without the use of a high-speed video camera, it is difficult to explain some of the more complex patterns and shapes that are seen in this image. However, the velocity of the paint can be estimated with the use of other images captured with different camera settings. In a photo captured with a $1/80^{\text{th}}$ second shutter speed, the paint appeared to move approximately 2 inches. This yields a velocity of 4.57 m/s.

4 Visual Technique

The visualization technique used in this photo was simply water-based paint, specifically *Crayola Washable Kids Paint*. Although some photos were taken after diluting the paint, this specific image was not. The yellow paint had the lowest viscosity of all the paints, and was used as the base for this example, so dilution was not necessary.

To properly light this setup, 9 different lights were used from several different angles. The top, sides, and front of the apparatus were all well lit, with the most light coming from the front. I chose to light from several directions to minimize shadows and capture the most color possible. Additionally, in order to capture a proper image with such a fast shutter speed, lots of light was required.

5 Photographic Technique

To capture this image, a digital Canon Rebel EOS camera was used. I chose to take the photo with a macro lens (Canon EFS, f/2.8, 60mm) because it had the ability to capture more detail, and let more light through compared to my other lenses. The splatter in this image is approximately 4 inches tall, and the camera was about three feet from the paint. The original and final images can be seen in Figures 2 and 3, respectively.



Figure 2: Original Image (2048x3072)

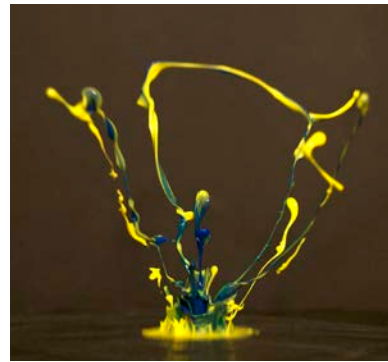


Figure 3: Edited (1385x1280)

Before taking more complex images, I tested different shutter speeds and aperture settings. I found that setting the shutter speed very high, and using an automatic f-stop setting worked best. The final specifications for this image are the following: ISO800, f/2.8, 1/1000.

As you can see, the original image was very zoomed out compared to the crop. This was necessary because some of the paint splatters were shooting much higher than this example, so I had to keep the camera zoomed out. Because I was using the burst shutter setting on the camera, it was really just lucky timing that determined what stage of paint splatter was captured. Aside from the cropping, only slight color level adjustments were made, and a wet mark on the background was clone-stamped out.

6 Conclusion

I am very happy with the way this image turned out. Although I was not able to match the professional quality of images by artists using a similar technique, I was able to produce a very cool image with limited resources and experience. My favorite part of the image is the detailed and colorful mixing of the paint as it flies upwards. It is really neat to get a glimpse in to the interesting formations and patterns that form so quickly. If I were to repeat this process, there are two areas I would try to improve. The first would be getting more of the fluid in focus, perhaps by changing camera settings and adding more light. The other change would be the background. I would like to get a much cleaner, darker black so the paint pops out better. I think these changes could potentially produce a much more professional quality image.

7 Appendix

[1] <http://vimeo.com/15704267>

[2] http://www.youtube.com/watch?v=9Xp28l2_UDg