Chris Bonilha
MCEN 5228
Group 3 – Water Talks

The interaction of a liquid drop with a surface below often makes for beautiful imagery. Many photographers have developed sophisticated techniques to capture the resulting phenomena and it has also generated much attention in academia from researchers looking to understand what physics are revealed. It was the purpose of this project to capture the rebound effect at a close range. It was also the intent to have a small depth of view while several other rebounding effects were captured out of focus! This shot was inspired by another image of the same type that had many more rebounding effects apparent but the rebound height was much smaller. With some patience and determination, a beautiful image was able to be captured.

This set up for the image was as such; a pool of tap water located in a clear Tupperware basin with a second reservoir in a plastic bag suspended about three feet up in the air. With holes punched in to the bag to allow small drops to precipitate out, water was allowed to accumulate on the outside of the bag and drop after its weight was great enough to separate itself from the bag. Other processes will use a more controlled apparatus to produce liquid drops, such as a syringe, but no such product was available at the time [1]. Drops were allowed to continuously fall into the pool of water below while images were being taken. The effect that was trying to be captured was the rebound jet created from a low viscous fluid collision with another low viscous surface and the capillary waves that result from surface tension as well [2]. The effect of the rebound jet or a crowning effect that is possible on the free surface pool is greatly dependant on the pool depth and the speed of the water droplet [3]. The pool depth was greater than 4 inches, allowing upward recoil of the water to create the jet. The drop height was about 2 ft, having enough energy to displace a significant amount of fluid upon impact.

To visualize this phenomenon better, blue die was added to the water and a white backdrop and base were set up around the image location. Lighting was used both through the camera flash and the surrounding ambient light, a fluorescent ceiling lamp and two 100W light bulbs located 3 feet adjacent and above the setup.

As it was mentioned earlier, one of the key features of this photograph was to have a small depth of field. This was successfully obtained with a depth of field that was less then a few inches. The in focus drop was approximately 1 ft. away from the camera while the zoom was turned up to get in closer to the jet formation. The focal length was set for 15 mm and shutter speed set to 1/60 sec. Turning down the ISO from its automatic setting helped in capturing this image. As a result the aperture increased, letting more light in and decreasing the depth of field. Some Photoshop work was done for post processing. The image was cropped from 2304x3072 pixels down to 1965x810 and rotated. Some small drops that were visible around the in focus jut were removed in order to heighten the attention on the larger details and the levels of the image were automatically adjusted as well.

This image was a success for the most part. As much as it matched with the original intent, there were a few details that I had wished were a little different. I was hoping to get smaller jets but more of them in a single shot. To achieve this next time, I would increase the rate at which the water falls but lower the suspended bag as well.

[1] Heon Ju Lee and Ho-Young Kim, Control of drop rebound with solid target motion, Physics of Fluids, 16:10 (2004) p. 3715-3719
[2] Q. Deng, A. V. Anilkumar and T. G. Wang, The role of viscosity and surface tension in bubble entrapment during drop impact onto a deep liquid pool, J. Fluid Mech., 578 (2007) p. 119–138.
[3] S. L. Manzello and J. C. Yang, An experimental study of a water droplet impinging on a liquid surface, Experiments in Fluids, 32 (2002) 580–589