

# **Instant After Skip: Report**

**Martin Allsbrook // IV 1: Get Wet // ATLS 4151-001 (Undergrad)**





## BACKGROUND

This image was taken on 09/03/22 during a short camping trip in Arapaho National Forest. I had taken many images, both on the trip and before, that were all possible candidates for my IV 1: Get Wet project submission, but this image was selected as I thought it had a nice balance of artistry and science. I originally intended to capture an image of the waves produced by a rock skipping multiple times, but during the imaging process I noticed that pictures closer to the instant of the skip were much more thought provoking. Once I noticed this I focused on capturing that moment and ended up with the image I chose.

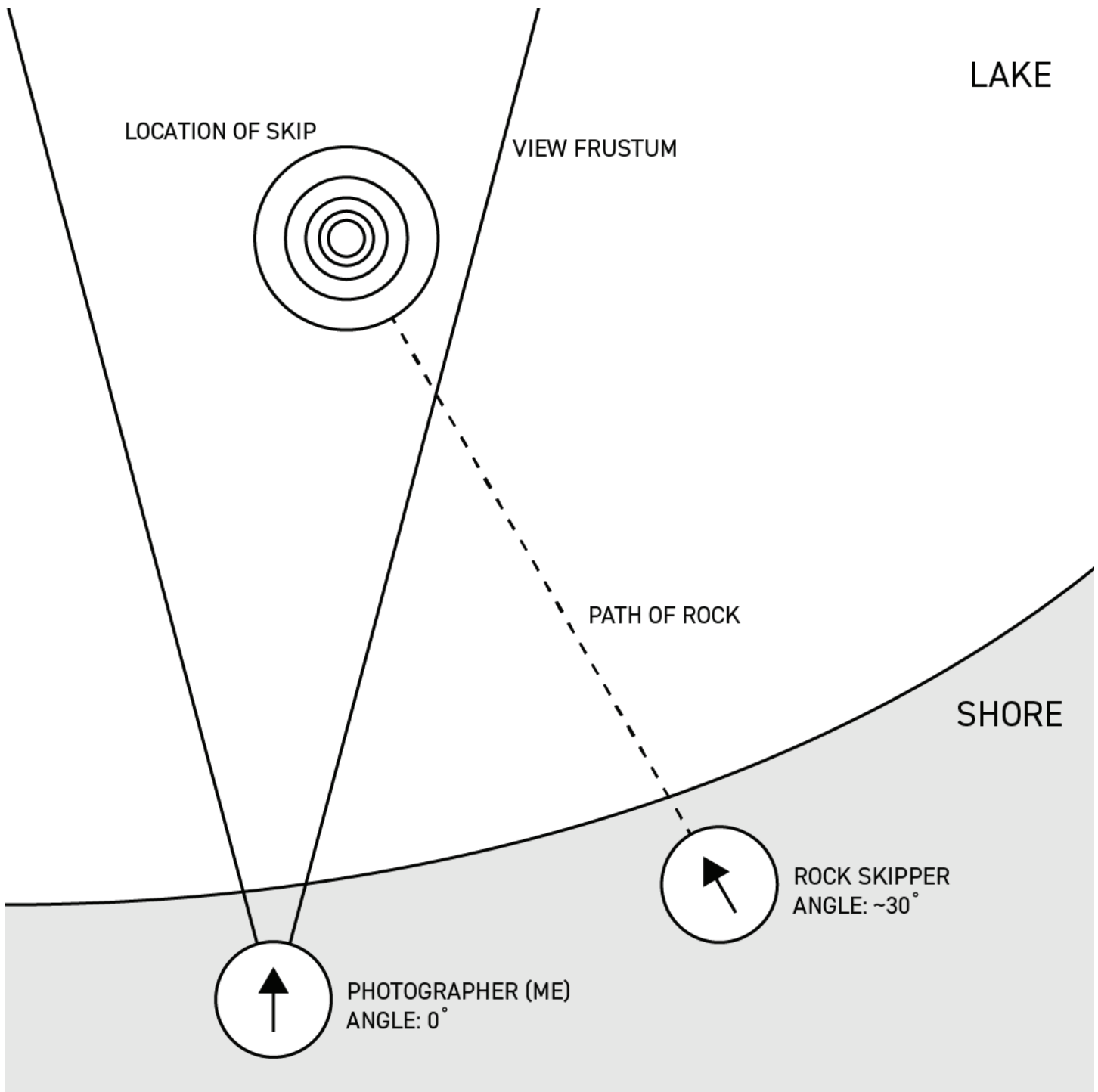
## UNSELECTED SPLASHES:

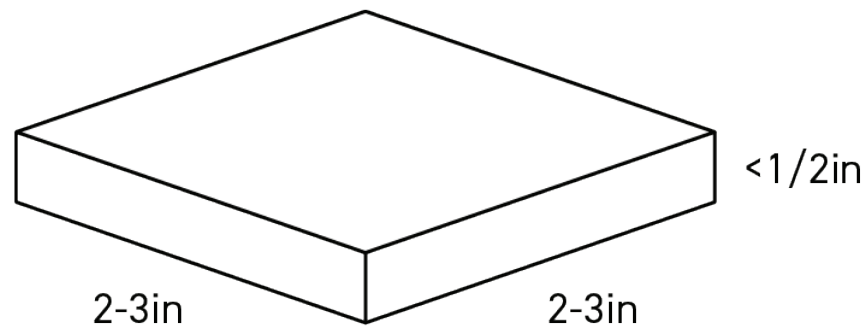


## SETUP

This image was taken in a relatively non scientific environment but the circumstances are still reproducible. The image below gives a top down look of what the set up was like. My friend was positioned about 10 to 15 feet to my right and was skipping rocks across my cameras field of view. The rocks were being thrown about 30deg left of the direction I was facing, and normally landed somewhere on the right side of my camera's field of view.

I do not have the exact dimensions of the rock used in the image, but generally we were using square rocks with a side length of 2-3 inches and a height less than a  $\frac{1}{2}$  inch. The rock imaged did not have rounded edges. The rock was skipped off of a freshwater lake, and there was a slight wind blowing back toward the camera that produced some small wakes on the surface of the water.



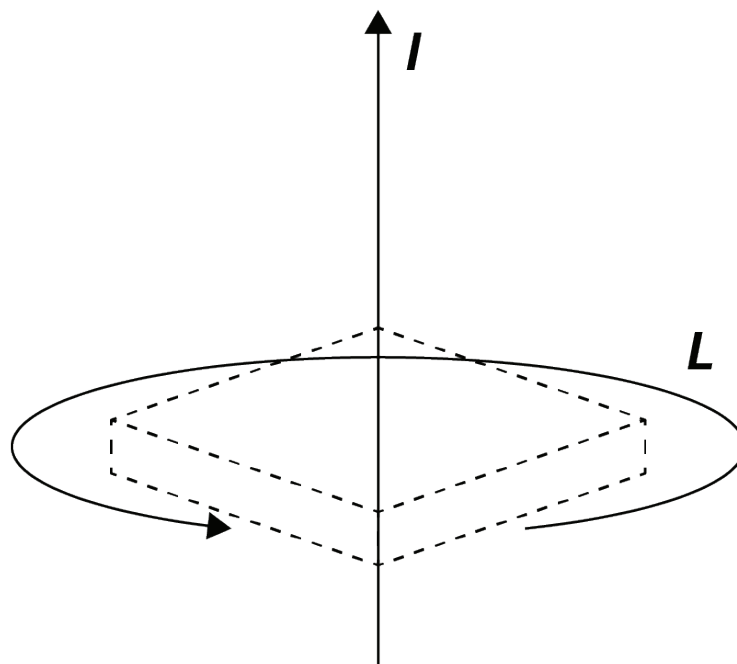


## PHYSICS

Simply put, this is an example of newton's third law; the rock imparts a force on the water that creates the hole we see, and the water imparts an equal and opposite force on the rock, causing it to skip. But why is the hole in the water circular, and why does the rock have to be spinning to skip well?

The hole in the water ends up being circular due to the way the forces or pressures propagate through the water. The instant the rock is hitting the water the pressure is concentrated in a small area under the rock. This small area quickly spreads through the water forming a circle and forcing the water in its path out of the way. The water being displaced also needs a place to go, and since the lake is full the only place it can go is out, causing the two large water jets observed in the image.

Ok, then why does the rock have to be spinning to skip well? This is due to newton's first law, an object in motion stays in motion, and in this case it's applied to the conservation of rotational momentum. Since the rock is spinning it acts like a gyroscope, trying to hold its moment of inertia at a constant angle. This makes it so that when the rock hits the water it doesn't start spinning out of control, instead it holds its current attitude, keeping it at the right angle for another skip.





# VISUALIZATION TECHNIQUE

We are visualizing the flow of water through the air, and we can see the boundary between air and water quite clearly, making this a very simple boundary visualization. The only lightsource used was the sun, and environmental reflections, making the lighting setup for this shot quite simple as well.

# PHOTOGRAPHIC TECHNIQUE

The image was taken with a Canon EOS Rebel T7. The focal length was 49mm, ISO was 200, f-stop was 7.1, and the shutter speed was 1/1000sec. Off the bat I knew I was going to need an extremely fast shutter speed in order to capture the instant I wanted to, without making the image blurry. I then lowered the f-stop and raised the ISO until the image was reasonably bright. I didn't want to raise the ISO too much in order to avoid a grainy image but I was fine lowering the f-stop as the subject was at a distance and I only needed a small depth of field. I'm very happy with the image I ended up with, there's almost zero motion blur and the subject is perfectly in focus.

In post processing I cropped the image to focus solely on the subject, in this case the splash. I also lowered the highlights to remove some distracting reflections on the waves as well as reveal some of the droplets kicked up by the splash.

Unedited



Edited



# REFLECTING

I'm super happy with how this image turned out. In the future I might have played around with a few different cropping options but I couldn't be happier with the image as a whole. I find the symmetry of the splash extremely interesting, something I would have never expected if I was asked to predict the situation. I also think it's awesome that the rock was still in frame when the image was taken, providing some context as to why the splash occurred. Overall I'm super happy I attempted to capture this, and that I ended up with an image I'm proud of.