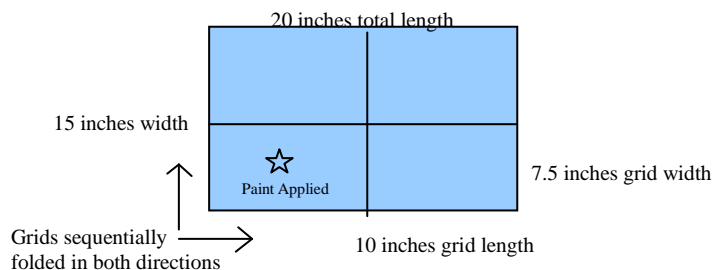


Get wet project one completed by Matthew Campbell. Creation of a Hele - Shaw flow pattern formation in a time-dependent gap<sup>1</sup> using oil paint, mineral spirits, and foam board. The intent was to observe and document the fluid motion of paint and mineral spirits when pressurized and separated between two flat surface planes.

Black and white foam board was cut into lengths of fifteen inches by twenty inches and then folded in half in both direction creating four grids of 7.5 inches by 10 inches. White and black oil paint were combined with varying solutions of mineral spirits and applied to one of the four grids. The grids were then folded upon one another in both directions (horizontally and vertically) and pressure was applied by a human hand and/or a rolling pin. Flow is encouraged by the pressurized dispersal in between two flat surfaces. The grids were then separated and returned to their original unfolded position. The resulting painted patterns were then recorded. The paint exhibited a Hele - Shaw flow pattern in which the fluid dispersed into branching channels and a vein like pattern.<sup>2</sup> Channels of the flow range from half an inch in width to fractions of a millimeter. The length of the channels range from 16 inches to fractions of a millimeter. The viscosity of the paint is much higher than that of the mineral spirits. The paint is diluted by the mineral spirits which creates a less viscous fluid that is more easily moved by the forces acting upon it. Pressure, gravity, and separation (by way of a time-dependent gap<sup>3</sup> and between the viscous paint and less viscous mineral spirits) create a variety of patterns and promote the motion of the fluid.



The materials that were used consisted of Winton titanium white oil paint, The Art Store ivory black oil paint, and orderless mineral spirits. These materials can be obtained at most art stores including Micheal's and Hobby Lobby. The paint to mineral spirit ratio ranged from 1:0 to 1:5. All of the materials used were at room temperature (72 degrees Fahrenheit). The amount of paint used ranged from 1/8 of a cup to fractions of a gram. The paint was applied directly in one area (piled in a blot) before the pressurized manipulation. Lighting was restricted to a single 250 watt halogen flood light with a UV filter that was purchased at a hardware store. I placed the light to the direct right of the area being captured on a stand 2.5 feet tall at a 45 degree downward angle. No flash photography was used during the process.

The photographic techniques used during this process varied for each image in the film. The majority of images were captured from a very close distance (2 feet to 3 inches). Most images were taken with an F-Stop of 2.8, ISO 80, with a shutter speed of 10/500 of a second, and a focal length of 4.8mm. The dimensions of the image files are 4000 (width) by 3000 (height) pixels. All images were

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1 Shelley, Michael J. "Hele-Shaw flow and pattern formation in a time-dependent gap" *Nonlinearity* 10 (1997):1471-1495.  
2 Shelley, Michael J.  
3 Shelley, Michael J.

captured on a Panasonic Lumix DMC-FZ35 digital camera. No modifications were made to the actual image files other than cropping, animating, and fading them to create a short film.

The images that were created reveal a barrage of fingering channels that could be viewed as veins, trees, nerves, rivers, and even landscapes. I enjoy the complexity and intricacy of these images. They create a very organic feel that seems interrelated to numerous phenomena that occur in nature. I feel that the fluid physics are displayed quite well, I feel I have fulfilled my intent, and I do not have many complaints about these images. The only improvement or further development I could make would be to experiment with other colors, liquid substances, larger surfaces, and to modify mixtures of these liquids. A few questions arose as a result of this project. The main questions were about how this phenomena interrelates to the creation of rivers and branches, since they display a similar fingering process.

Works Cited:

Shelley, Michael J, Tiany, Fei-Ran, and Wlodarski, Krzysztof. "Hele–Shaw flow and pattern formation in a time-dependent gap" Nonlinearity 10 (1997):1471–1495. New York University, New York: Courant Institute, Received 22 October 1996.