

Latté Art
Group Project 3



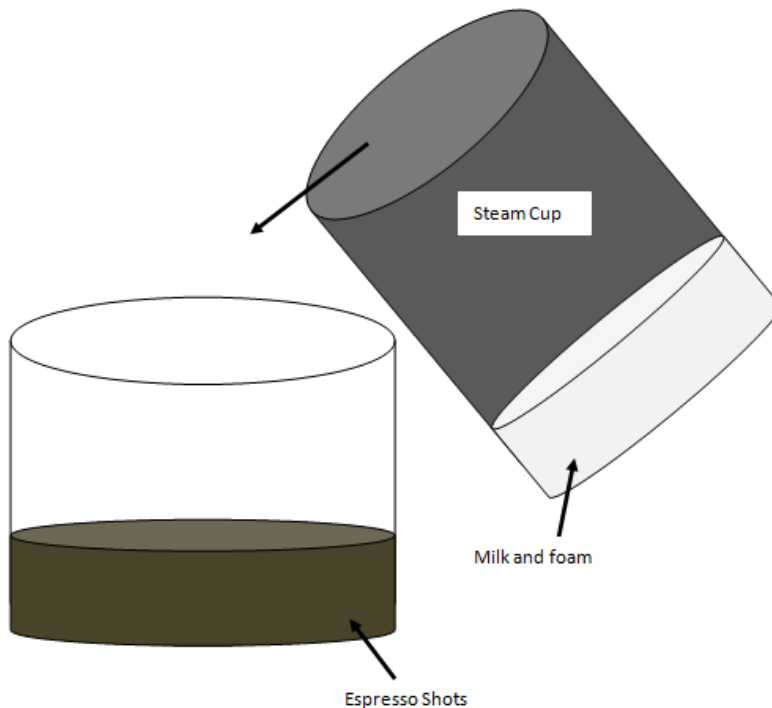
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MCEN 4228: Flow Visualization
May 3rd, 2010

Intent

The purpose of taking the photo of the latte art was to explore the physics behind pouring varying densities of milk into a cup. There are so many creative patterns that can be made by varying the pouring method of the milk and the foam, and I wanted to try it out myself. The color interaction between the dark espresso and the milky white foam is beautiful, and I wanted to capture that within a photo.

Description of Apparatus

A mug, steam cup, 2 shots of espresso and whole milk were required for this photo. I began by having the espresso shots in the bottom of the cup. I swirled the milk first to make sure there were no big bubbles and began to pour it in, while keeping the steam cup very close. The denser and less foamy milk sunk to the bottom while the less dense foam stayed on top. As the dense milk ran out, I moved the steam cup side to side to make the pattern, spreading out



the foam, creating more whitespace. At the end of the pour, I lifted up the pitcher while pouring and moved the stream of foam directly forward to the other side of the cup.

This end result was an image of a leaf on the top layer of the latte. I have also seen images of bikes, llamas, hearts and trees as well. These are more advanced, and I hope to learn how to create them at some point.



Physics behind Latte Art

Latte art is a mixture of two colloids. A colloidal system consists of two separate phases: a dispersed phase and a continuous phase. The dispersed phase is the crema, or the espresso, and the continuous phase is foam of air in milk. These are both unstable substances. The crema dissipates from the espresso, and the foam separates into the drier foam and the liquid milk within.

The foam is made up of 95% gas 5% liquid. The individual bubbles clump together to form foam through a phenomenon called jamming. The bubbles pack so tightly together that when the foam is pressed down, they can't hop around one another. The more that the bubbles are jammed together; the greater the pressure is within each individual bubble. This causes them to take on more of the characteristics of a solid. Once the latte art is created, if it is swirled around, it maintains its shape fairly well.

Foam has a very unique set of mechanical properties that makes it very useful for everyday applications. Fairly recently, a foam has been used to neutralize toxic chemicals and biological agents such as anthrax and sarin nerve gas. This "anti-terrorism foam" was used at the congressional office buildings and within the mail rooms in Washington, D.C. to decontaminate. The foam's surfactants digest the chemical agents and neutralize the toxic substances. Foam research has the potential to explain the ways in which biological systems emerge and evolve, such as the structure of plant cells. [2]

Photographic Techniques

The lighting was supplied by the bulbs within The Laughing Goat. There was a 60 Watt bulb about 6 ft above the table on which it was taken. The photo was taken using a Canon EOS Digital Rebel XSi. Photoshop was used to crop the initial photo and to increase the contrast.

Photograph Date	April 24th, 7:43 AM
Distance from Lens to Object	3.2 ft
Field of View	1.5 x 1.6 ft
Focal Length	200 mm or 0.66 ft
Image Size	1287 x 1242 pixels
Shutter Speed	1/50 sec
ISO Setting	200
Aperture	f/4.4

Horizontal field of view:

$$HFOV = d * \frac{i}{f} = 3.2 * \frac{0.32}{0.66} = 1.5ft$$

$d = \text{object distance}$
 $i = \text{image dimension}$
 $f = \text{film distance}$

Vertical field of view:

$$VFOV = d * \frac{i}{f} = 3.2 * \frac{0.24}{0.66} = 1.6ft$$

$d = \text{object distance}$
 $i = \text{image dimension}$
 $f = \text{film distance}$

Image Discussion

I am very pleased with my final image. I was impressed with myself that I was able to create a leaf on my first try with latte pouring. I thought it was very beautiful, and revealed the fluid phenomena well. The colors of the espresso and the foam mixed well with the copper color of the table, and gave it a warm feel. If I could do anything differently, I would want to try to make something more interesting, such as a bike. I also want to record an artistic video that reveals the correct form to pour latte art as well as the fluid physics behind the foam.

References

1. "Happy Friday and Latte Art." *Style and Inspiration*. Web. 03 May 2010. <<http://styleandinspiration.blogspot.com/2009/08/happy-friday-and-latte-art.html>>.
2. "Foam Physics, Trinity College Dublin." [Trinity College Dublin - The University of Dublin, Ireland](http://www.tcd.ie/Physics/Foams/). 03 May 2010 <<http://www.tcd.ie/Physics/Foams/>>.

Appendix



Image Assessment Form

Flow Visualization

Spring 2010

Name(s) Allison Hamrick

Assignment: Group Project 3

Date: April 24th, 2010

Scale: +, ! = excellent √ = meets expectations; good. ~ = Ok, could be better. X = needs work. NA = not applicable

Art	Your assessment	Comments
Intent was realized	+	
Effective	√	
Impact	√	
Interesting	+	
Beautiful	+	
Dramatic	√	
Feel/texture	+	
No distracting elements	+	
Framing/cropping enhances image	+	

Flow	Your assessment	Comments
Clearly illustrates phenomena	+	
Flow is understandable	√	
Physics revealed	√	Video would be better
Details visible	+	
Flow is reproducible	+	
Flow is controlled	+	
Creative flow or technique	+	
Publishable quality	√	

Photographic technique	Your assessment	Comments
Exposure: highlights detailed	√	
Exposure: shadows detailed	+	
Full contrast range	√	
Focus	+	
Depth of field	+	
Time resolved	+	
Spatially resolved	√	
Clean, no spots	+	

Report		Your assessment	Comments
Describes intent	Artistic	+	
	Scientific	+	
Describes fluid phenomena		+	
Estimates appropriate scales	Reynolds number etc.	~	
Calculation of time resolution etc.	How far did flow move during exposure?	+	
References:	Web level	+	
	Refereed journal level	~	
Clearly written		+	
Information is organized		+	
Good spelling and grammar		+	
Professional language (publishable)		+	
Provides information needed for reproducing flow	Fluid data, flow rates	N/A	
	geometry	N/A	
	timing	N/A	
Provides information needed for reproducing vis technique	Method	+	
	dilution	N/A	
	injection speed	N/A	
	settings	+	
lighting type	(strobe/tungsten, watts, number)	N/A	
	light position, distance	N/A	
Provides information for reproducing image	Camera type and model	+	
	Camera-subject distance	+	
	Field of view	+	
	Focal length	+	
	aperture	+	
	shutter speed	+	
	film type and speed or ISO setting	+	
	# pixels (width X ht)	+	
	Photoshop techniques	+	
	Print details	√	
"before" Photoshop image	+		