

Version 8/21/2023. Check the schedule on FlowVis.org for updates.

**Initial Assignments**  
**Flow Visualization: The Physics and Art of Fluid Flow**  
**Fall 2023**

**Due Friday 9/1/23, start of class:**

1. **Copyright Agreement Form** in DocuSign. You will get an email.
2. **Syllabus Agreement Form** in DocuSign. You will get an email.
3. **FlowVis.org** login. You will receive an invitation to join as an Author at your CU email address. **CHECK YOUR SPAM FOLDER.** Use this invite to set your password. Go to <http://flowvis.org/wp-admin> to log in. Contact Shrey Naresh Solanki <[Shrey.Solanki@colorado.edu](mailto:Shrey.Solanki@colorado.edu)> if you have any trouble.
4. **Join Slack:** Our workspace is [flowvis2023.slack.com](https://flowvis2023.slack.com): <https://join.slack.com/t/flowvis2023/signup> There is also an invite link on flowvis.org if you are new to Slack. Any Colorado.edu address can join; ask for a separate invite if you use a different address. I will post class announcements on Canvas, but Slack is better for informal, team and personal DMs. My email can get clogged up and I like Slack to keep comms organized.
5. **Join iClicker:** <https://join.iclicker.com/ZAXL>. We'll use clickers for class activities, but not for roll call. We won't be doing roll call at all.

**Due Friday 9/8/23, start of class**

6. **CATME survey.** This survey will ask about your schedule and some demographic information. I'll use this info to create teams for the team assignments and critiques. You'll get a survey link at your CU email.
7. **Best of Web.** For this assignment, choose an online image or video (i.e. a visual) that you feel exemplifies the best art/science flow visualization, and write a few sentences about what you appreciate in both the science and art. This will be due as a post in flowvis.org. Look over course materials, and previous years' visuals and reports. Explore the links page, Youtube, etc. too, but remember we are looking for a balance of aesthetics and science. You need to know what has been done in order to push the boundaries of new work. One caveat: **your submission must include attribution to the original authors of the visual.** A link to something that has been reposted is NOT sufficient. If you can't find out who the original author is, you must choose a different work. You will be asked to vote on your classmates' choices (and they will vote on yours). Note, if you are posting a Youtube link, append **?rel=0** to the end of the link. This will suppress some of the more inappropriate 'related' videos that show up at the end. There are some instructions on how to post below, and I'll do a demo in class.

**Due Monday 9/11**

8. **Vote** on 'Best of Web'. Read all the posts in the 2023Fall Best of Web category, and use the comment feature to state 'First Prize' 'Second Prize' and 'Third Prize'. Again, a short statement about why you have made this choice should be included.

**Due Weds 9/13 by 4 PM:**

9. **Get Wet: Vis Assignment 1.**

The purpose of this assignment is to "get your feet wet". Make a picture or video of fluids (air or water, gas and/or liquid, any fluid, any combination of fluids) that both (1) demonstrates

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the phenomenon being observed and (2) is a good picture or vid. Use any imaging technique you are familiar with, analog or digital, still or video, black and white or color, flash or available light, etc. Make the clearest, sharpest, cleanest, most interesting picture/vid possible.

This means you will probably need to set up a situation, control your variables, do it once, observe the results on a big screen and do it again and again and again, maybe with variations... Plan to play with flow vis every couple of days for short periods; this will allow you to iterate to get the best results, and frequently bring joy and wonder into your life. Leaving assignments to the last minute often results in sadness and regret.

**Keep notes** on what you've done for your write-up, including photographing the packaging for food dye, etc. You should expect to spend 20 hours on this assignment, including the write-up. See the [Report Guidelines document on Flowvis.org](#) for info on what you'll need to record.

If you are shooting a still image, **DO NOT SAVE as jpg** if you can possibly avoid it. Save as a raw or native camera format if you can: CRW, CR2, NEF etc. HEIC, PNG or Tiff are also acceptable. If your camera only saves jpg choose the highest resolution, smoothest, largest file you can.

You are welcome to use help from other folks to create the visual you want, but you are individually responsible for your own final visual. This will be true for all assignments, even the 'Team' assignments.

### 10. Class Critique

Everyone's visuals will be displayed and critiqued in class on Zoom beginning Friday 9/15.

*You will be expected to verbalize and enter comments on everyone's visuals on Flowvis.org.* We will spend 3 or 4 class sessions going over all the visuals. ***Come prepared to talk*** about how you made your visual, and what you think is going on in the physics: why does it look like that? Have a classmate take notes on the verbal feedback you get in class, or you can record your zoom (recommended!), and use this info to write **your** report which will be due Monday 9/25.

See the [Report Guidelines document on Flowvis.org](#) for info.

## ***GW:Vis 1 POSTING INSTRUCTIONS: These are fussy, but required!***

### ***9.A Post Image or Video on FlowVis.org***

- **Images:** First, upload your image to the Media Library in Flowvis.org, and set the Media Category to 2023FallGetWet. Keep a version with the highest resolution for archive but make a low res jpg or png (not TIFF) version of the image for posting: no more than 1300 px wide, no more than 900 px tall, but. If your image is portrait orientation, pad the sides with dark gray to make it landscape shaped. Next make a new post **with your name as the title**. In the body put a short sentence describing the flow. **Select your image as the 'featured image'** in the menu bar on the right in the post editor. Also in the right menu, select the 2023FallGetWet category for the post. Unselect the default 'no category'. **Do not select any other categories at this time.** Don't forget to hit the 'publish' button.  
If your post is not ready when you are called on for critique you will be publicly shamed. Sorry, that's what happens. Everybody in class will be searching for your post.
- **Videos:**
  - a) Your video can be up to 2 minutes long. It **must** include a title with author information, or you won't get credit. Do consider adding music; it can really make a video great, but **you can only use music to which you have rights**. A list of volunteer musicians will be

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provided if you'd like to collaborate with a musician on original music for your video. Acquiring rights to other music via stock libraries is easy and inexpensive. You will be expected to **provide documentation of your music rights in your report.**

- b) Upload your video to Vimeo or Youtube. **DO NOT UPLOAD YOUR VIDEO TO FLOWVIS.ORG.** Make yourself a login if you don't have one. CU campus wireless provides awesome upload speeds, so best to do the upload on campus if you can. Choose a good thumbnail frame. Copy the simple link to your video:  
<https://vimeo.com/yournumber>.
- c) Next make a new post at FlowVis.org with your name for the title. Put the Vimeo or Youtube link as the first text in the post; make sure it is plain text, not a functional link. Then add a one-sentence description of the flow. In the menu bar on the right side of the post editor, select Format > Video. Further down the right menu, select the 2022FallGWVis1 category (post category, not media category). **Do not select any other categories.** Do not select a video thumbnail or featured image; these will be added automatically when you publish the post.

### **9.B Post Reports on Flowvis.org, due 9/25:**

**Add** your report to your visual post by the Get Wet: Vis 1 report deadline, Monday 9/26. You can put the text and any additional visuals (sketches etc) right in the post, or you can upload it as a pdf into the Media Library and link to that in your post. Post only .pdf files to Flowvis.org, but you must post .doc on Canvas.

### **9.C Canvas Versions. You have to do these also. Visuals due 9/13, reports 9/25**

Next, please provide the following, in the Get Wet: Vis 1 **Canvas assignments** at <http://cuboulder.instructure.com>.

- a) **High Resolution Final Image:** the best resolution file you have of your final, for future large format prints and presentations. Use the best resolution setting that you can. If your camera only takes jpgs, use the largest file, finest jpg setting. **If you edit the file (and you should at least crop appropriately and set the contrast) DO NOT SAVE AS A JPG.** Save as PNG if possible; consult with me if not.
- b) **Original:** Whatever your original (still) camera file is **STRAIGHT FROM THE CAMERA.** Raw, CR2, NEF, jpg, whatever. Send your straight-from-the-camera file, **NOT** a png version. Only the straight-from-the-camera file has the necessary metadata. You won't get credit if your file is missing the metadata.
- c) **Or Final Video:** Your video **MUST** include a title with your name as author. Submit a high-resolution copy of your final edited video to Canvas. Links to youtube or vimeo are not acceptable. This can be slow, so be sure to use a location with a fast upload speed, such as on campus. Do not submit raw video unless your video processing includes color shifts or distortions. If you have trouble uploading, bring the file on a thumb drive to class.
- d) A **Word document** of your report, in the Canvas Vis 1 Report assignment. Please use Word. If you don't use Word, convert your file to .doc however you can. Do not post pdfs to Canvas. However, if your report is done as text and images in your image post, just put the link to the post with a note in Canvas. Reports must be submitted **BOTH** in the appropriate Canvas Assignment and to Flowvis.org (in your GW post, see above) by

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the deadline on 9/25. Word doc in Canvas, PDF at Flowvis.org. **See the Report Guidelines** document at Flowvis.org>Course Info for what content to write about.

- e) **SAF:** A completed visual Self-Assessment Form (SAF) in the Canvas report assignment, on the same date that your report is turned in. The SAF form is available under Course Info at Flowvis.org. The SAF form is to help you make sure you've included the required information. Metacognition is good for you.

**10. In Depth Reviews:** You will be assigned to do reviews of two classmates for each report, in Canvas. There will be a detailed rubric, similar to the SAF. Look in the upper right hand corner, in the Get Wet Report assignment, after you have submitted your report to see you the reports you've been assigned. The 'GW Review' assignment is to record after you've done the reviews but you won't find the reports to read there. They will be found in the assignment where you submitted your report. The reviews will be due Monday October 2.

### Hints for Get Wet Vis 1:

- Using the built in flash on your camera usually results in ugly visuals. Use something like white cardboard, foil, or tissue to 1) *bounce* the light so it comes from a different direction and 2) *diffuse* the light to soften the shadows, or use sunlight or open shade. A variety of strobes, lights, backdrops, and light tents are available for checkout. We'll go over lighting later in class.
- Avoid distracting backgrounds, such as woodgrain surfaces. Tabletop photo tents and seamless backdrops are available for checkout. Plain bedsheets or tablecloths work fine too.
- If you image a drinking glass or bottle, make sure **no** distracting text or logos are visible on the glass.
- If you use a fish tank or other glass enclosure, be careful about where the flash reflects off the glass (to become a distracting white hole in your photo).
- Automatic focus systems often have trouble with fluid visuals, which have no sharp lines to lock on to. If your camera has a 'focus lock' feature (try pressing the shutter button halfway), lock onto a ruler or other sharp-edged object held in the desired focus plane before you make the visual, or use manual focus.
- Almost any deficiency in color balance, contrast, etc., can be adjusted in darktable or Gimp, but this requires a working familiarity and access to the program. There are instructional videos available in Youtube. Some instruction will be given in class.
- Video editing can be done using a free program, Minitool Moviemaker. More instruction will be given later in the semester.
- You'll find lots of ideas in the Galleries on Flowvis.org, and in the Best of Web assignments. Please don't default to food coloring in water unless you have something new to say about it visually.

**Safety considerations:** If you want to work with **flames**, you must follow the combustion guidelines posted on the website. When working with household materials, you are pretty safe if you stick to personal hygiene (i.e. soaps and shampoos) and food products. If you are working

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with cleaning or medical products, or lab chemicals, you must discuss them with me first, and you may be required to submit a safety proposal.

**Due Friday October 20, 4 pm.**

**11. The Photography of Clouds.**

There will be two Cloud assignments, with Clouds First due **Friday October 20**, and Clouds Second due Friday December 8 (last class is Weds Dec 13). This is to give plenty of opportunity to observe a variety of atmospheric conditions. *Visuals for Clouds First must be made between August 28 2023 and October 20, Visuals for Clouds Second must be made between October 21 and December 8.* Exceptional visuals outside these dates **cannot be submitted for credit in this course**, but I encourage you to share them on the web, such as in the Flow Vis Facebook Group. The goal is to get you to experience clouds every day this semester.

Cloud visuals submission is similar to the Get Wet Vis 1 submission, with a few important differences:

### **Changes for Posting Cloud Assignments:**

- a) Post on flowvis.com of your edited visual (video requirements are the same as for the GW assignment) as the Featured Image. **Edit the publish date of your post to match the date and time that your visual was taken.** This will determine the order of critique, and must match your visual metadata.
- b) In your post, include the appropriate Skew-T diagram (will be covered in lecture) and your original (unedited) visual. You'll find these helpful when discussing your visual in class.
- c) In the post write short statement of cloud type and whether the atmosphere was stable or unstable. Not a document, just a short note, to be used as your post title. **You will be expected to discuss this in class during your critique.** We'll cover how to determine stability in class before the assignment is due.
- d) In Canvas, submit your edited visual and your original (unedited) image on October 20.
- e) Reports on your Clouds First visual will be due Monday October 30, both to Flowvis.org and Canvas, along with an assessment (SAF) form, same as for all the other images/vids. Your report should also include the appropriate Skew-T diagram. See the Report Guidelines document at Flowvis.org>Course Info for details. Other submission details are the same as for the Get Wet report. Edit your post to include your report.

Photograph a cloud. In fact, photograph clouds as often as possible, and start as soon as possible. You will soon discover that it is not easy to do but that it is a very pleasant diversion from everything else that you do. Phone cameras are generally OK for cloud photos, and you always have them with you, but they may or may not give satisfying results.

Do keep track of where, when, and how the visual was made, including what direction you were facing, and what was going on elsewhere in the sky (take some extra photos), and what happened before and after, if possible. **Your report must include atmospheric sounding data** (e.g. a Skew-T diagram; we'll cover how to download the data in class from <http://weather.uwyo.edu/upperair/sounding.html>) and discuss the physics revealed. There will be a series of lectures on cloud physics to help you interpret your visuals and the Skew-T diagram. The most common problem is selecting the wrong date/time for the sounding data. The morning data is taken with a 12Z time, with the correct date. Evening data will have a 00Z timestamp *for the next day*. The Report Guidelines document includes information for your cloud reports.

You can get the altitude of Boulder clouds from the ceilometer at <https://skywatch.colorado.edu/>. There is a nice app, Windy, that gives predicted altitudes, but not actual measurements.

The most famous "cloud" photographs were made in black and white by the legendary early twentieth century New York art dealer, photographer, and husband of Georgia O'Keefe, Alfred Steiglitz. He called them "equivalents" and considered them to be music.

Sunrise and sunset are sometimes quite colorful or even extraordinary, but may be difficult to capture in a satisfying way. Do capture them when you are inspired, but don't limit yourself to them. During the day, individual clouds can be extremely interesting. In the course of this assignment you will discover what the English writer and amateur photographer George Bernard Shaw once said about the photographer: "The photographer is

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like the cod (fish) who lays a million eggs so that one may hatch." So, keep looking up and keep pressing the button. And, if you have access to an extreme wide angle lens as well as a telephoto lens, use them as needed and as often as possible. Also consider making a short time lapse video instead of, or in addition to a single visual. Most camera phones can automate this process. Also try photographing clouds at night. Many new cameras are sensitive enough to accomplish this now, depending on the phase of the moon, but a tripod will be needed (these are available for checkout).

Clouds require that you think outside the box.

**Additional hints:**

- Perhaps you have seen the absolute black skies of Ansel Adams' black and white landscape photos, with brilliant picturesque white clouds. If not, do look him up; all photographers should know about him. The black sky trick is accomplished using a red or orange filter with black and white settings. A circular polarizing filter can be used to heighten contrast in color visuals, but they are pricey and may cause color shifts. This can also be simulated in postprocessing afterwards, at least to some extent.
- Good cloud visuals can be acquired from airplanes. Be sure your window is clean, and sit in front of the wing if possible, on the side towards the sun.
- Again, many cameras have difficulty focusing on clouds. A manual setting for infinite focus distance is best. You might be able to do a focus lock on a distant hilltop.
- Avoid foreground objects like trees, light poles or buildings unless you specifically want them for a visual statement. Parking lots and balconies often have good sky views, but streetlight poles can be a problem.