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TIRED OF LOOKING GRAY AND BORING ONLINE? A SIMPLE 3-CAMERA TV STUDIO/CLASSROOM FOR LIVELY ONLINE TEACHING.

Glenn Harlan Reynolds
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Many of us are teaching online this semester, and there's an excellent chance that we'll be teaching online next semester, and maybe beyond.¹ I hope that will change by 2021/2022, but I wouldn't bet significant money on it. That being the case, I thought some people might find my experience of setting up a fairly capable online teaching studio useful. Student reports on their experience with this setup are uniformly positive, and I feel much better about it myself. Teaching online last semester felt like work. (When teaching live, I walk out of class feeling energized, better than when I went in. I never felt that way last spring.) With this new setup, I won't say it's as enjoyable as teaching live, but it's close, and much, much better than my experience last time.



I expect that we'll be doing this for a while, and like most law teachers I want to do the best job possible – and, possibly also like many, if not most, law teachers, I want to look good while

¹ Fauci Says Normal Life May Not Be Back Until End of 2021, CNN, Sept. 11, 2020, available at <https://www.newsbreak.com/news/2059065768316/fauci-says-normal-life-may-not-be-back-until-the-end-of-2021?s=oldSite&ss=a1>.

doing it. Our students tolerate a lot in the classroom where it's live, but when they're watching TV, which an online class approximates, they're used to fairly high production values. To quote my colleague Ben Barton, students interpret a bad webcam setup as amateur hour, regardless of the quality of the content being presented.

This semester, I set out to turn lemons into lemonade. Of course, to do that you don't just need lemons, but water and sugar. I had those, metaphorically, in the form of some technical expertise and a fair amount of hardware to experiment with. You may not want to take things as far as I have, but there are numerous off-ramps on the path to a three-camera studio that still take you to a better place than simply lecturing into a webcam. I hope this description of what I've done – and I present some of those cheaper and easier alternatives along the way – will be helpful. I use this studio teaching with Zoom, but I've tested it with Microsoft Teams and it works equally well with that platform, or any similar one.

Getting Started

Like nearly everyone else in law teaching, I was forced to switch to online teaching in the spring of 2020 because of Covid-19 quarantine requirements. I was better situated than most, as I actually have significant video experience on both sides of the camera. I bought a high-end webcam (a Logitech Brio), got a nice lapel microphone, and set up in front of the wall of books in my study, which made a reasonably attractive backdrop.

It worked fine, but I felt unsatisfied. My second online class was recorded and broadcast on C-SPAN,² and it got positive reviews. But in my opinion, it was only just . . . okay. I continued to teach in this format for the rest of the semester with little change, even though there were things I didn't like. In particular, I hated the distorted look created by the wide-angle webcam, and disliked being rooted to one spot, as when teaching live I like to move around the classroom. But with only a month before classes ended for the semester anyway, I didn't think it was worth putting too much time, energy, or expense into improvements, especially when I was busy in my off-hours trying to obtain things like food and toilet paper.

When we first began looking at quarantine preparation in late February/early March of 2020, my associate dean was horrified at my suggestion that we might have to continue our remote learning in the Fall. By summer, however, it was obvious that 2020 (and maybe 2021)³ was

² Free Speech Laws and Court Cases, C-SPAN3, March 26, 2020, available at <https://www.c-span.org/video/?471470-1/free-speech-laws-court-cases>.

³ The prospects for more online time seem high: Nina Agrawal, Cal State Universities Will Stay Online All Year Amid COVID-19 Pandemic, Los Angeles Times, September 10, 2020, available at <https://www.latimes.com/california/story/2020-09-10/cal-state-universities-all-online>; Mikhail Zinshtein, Coronavirus Precautions Likely at UC System Until Fall 2020, CalMatters, September 16, 2020, available at <https://calmatters.org/education/2020/09/uc-coronavirus-precautions-2021/>. (“Zoom classes will need to stick around for at least another year at the University of California, according to the system’s top health official.”) Meanwhile, at my own institution, similar signs: Gregory Raccoules, UT-Knoxville Pushes Back Start of Spring

going to be a year of remote teaching. I wasn't enthused about our "hybrid" teaching plans, and when my colleague Gary Pulsinelli asked at one summer faculty meeting "why do we think this is better than teaching online?" I decided that it probably wasn't. Since my institution gave me the option to skip hybrid teaching and go entirely online, I took it. Instead of attempting what I feared would be a mediocre hybrid teaching experience, I decided to try to provide the best online teaching experience I could manage. That meant multiple cameras – and real cameras, cameras that could shoot video at normal focal lengths, not wide-angle "webcam" video.

Luckily, real estate in Knoxville is cheap, and I had the ideal space already at home: a largely unused "pool house" (read: shed) in the backyard. It's not huge – about 12 x 15 feet – but it's big enough, and my wife and I weren't using it for much. Constructed by a previous owner as a writing/yoga retreat, it's heated, air-conditioned, and the natural lighting is excellent, though the acoustics were a bit echoey.

Having identified a space for my virtual classroom, I contacted our excellent UT Law IT guy, Chris Bombardo, and told him what I wanted: a box that would look like a camera to my computer and Zoom, but that would actually let me switch among at least three cameras. I wasn't sure such a thing existed, but happily it did. He recommended, and purchased for me, the Atem Mini switcher from BlackMagic Designs. It supports switching among up to four different cameras via easy to use pushbuttons. It also offers some other features – audio management and some special effects – that I don't use, but that are kind of neat.

I chose a 3-camera setup because it's been a standard in TV production almost since the beginning. Though Desi Arnaz is wrongly credited with inventing three-camera production, it did find its first really big niche with *I Love Lucy* and it has been a standard in TV production ever since.⁴ The three cameras from varying angles give a sense of space that a single camera lacks, and switching between them brings a feeling of dynamism, where a single-camera setup feels static.

I already owned several video cameras and started experimenting. My first choice for the main "lectern" camera was my Nikon D500 DSLR, which shoots really excellent 4K video, overkill for Zoom. It looked great, but like DSLRs generally it had a hard limit of 29 minutes and 59 seconds of video, after which it would shut off. Research indicated that there were firmware tweaks to fix this, but at the risk of bricking the camera. I also had a couple of elderly (10 years old) Sony

Semester, Announces Cancellation of Spring Break, Wate.com, September 17, 2020, available at <https://www.wate.com/news/education/ut-knoxville-pushes-back-start-of-spring-semester-announces-cancellation-of-spring-break/>.

⁴ Jon Krampner, Myths and Mysteries Surround Pioneering of 3-Camera TV : Broadcasting: A popular belief is that Desi Arnaz created the technique for 'I Love Lucy' in 1951, but evidence of the system dates to 1947, Los Angeles Times, July 21, 1991, available at <https://www.latimes.com/archives/la-xpm-1991-07-29-ca-176-story.html>.

video cameras. They worked but weren't designed for streaming and provided occasional glitches.

I finally cracked and bought three Canon Vixia HF R80 cameras at \$249 each. They got high reviews as streaming cameras and work perfectly. Connected via HDMI cable to the Atem Mini switch box, they provide sharp, clear video without glitches, once you set the setup menus properly for streaming, which is very easy.⁵ I have them mounted on tripods, with one focused on me as a lectern camera, providing basically a head-and-shoulders view, one as a wide camera showing me, my laptop, and a whiteboard, and one that's focused on the whiteboard (it's actually a flip pad on an easel), but zoomed just wide enough room for me to lean in and talk to the camera while writing. The little LCD monitors on the cameras swivel to face forward, so that I can look straight at the camera while checking that I'm in the frame properly, which is especially useful for the whiteboard camera.

I also got a pretty high-quality USB-C lapel microphone, a pair of (cheap) soft-box studio lights, and a black cloth background, for that TED-talk ambiance. I used my Macbook Pro as my computer, with a laptop stand that lifts it above the desk. It sits on a small round "pub" table that I've had for years, and the laptop stand's chief function is to lift the laptop high enough that if I spill my coffee or water it's safe.

Numerous test runs over the summer Zooming with my cheerfully-helpful daughter (who worked for a TV production company in high school) showed that everything performed well, but that eye contact was a problem. It's very difficult to avoid looking down at the laptop screen while talking with someone, and that breaks eye contact with the camera. And breaking eye contact with the camera breaks emotional contact with the person you're talking with. That was unacceptable to me. Students are isolated enough in remote teaching without that.

I tried mounting an old monitor that I had lying around just below the camera, but it didn't work. The sight angles were all wrong.

My solution was a teleprompter. Those are available relatively cheap – mine was \$164.99 – though I had to buy a high-brightness monitor to make it work. A teleprompter is an angled half-silvered mirror that reflects what's on a monitor lying horizontally below it, while the camera shoots through the mirror. Thus, you can look at the camera and see what's on the monitor, whether it's text to read, or an image of the person you're talking to. A regular small flat monitor sort of worked, but looked pretty ghostly. I wound up buying a 7" high-brightness monitor made for daylight use for \$259, which works fine. (I'd rather it were bigger, but the price escalates sharply with size.; an 11 inch high-brightness monitor specifically made for a

⁵ Basically, you want to disable "power save," and you want to turn off the screensaver-like "demo" that will otherwise pop up if you go long enough with hitting the Record button. Also, you can set the zoom lens to stay in its last position on waking, instead of automatically going full wide angle each time. That means that once you've framed the shots for your camera, they stay framed every time.

teleprompter was nearly \$800.) Now when I talk to students, I can look straight into the camera while still seeing them. The effect is substantially more intimate.

The teleprompter:



Probably unnecessarily, I cleaned up the acoustics in the space by placing four sound absorbent panels from ReadyAcoustics – I had had a bunch of these in my old home studio years ago, and gave them away to a friend when I moved; he still had some extras in his garage unused. They drastically improved the sound in the space, but the lapel microphone doesn't really pick up the room tone, so they were probably unnecessary.⁶ I also hung a cheap (\$11.99) clock on the wall behind the cameras so I could see the time without looking at my watch.

In video, amateurs talk about cameras, but professionals talk about lighting. The natural light in my space is quite good, though as the sun's angle has shifted since I tested things in midsummer, I've had to add a cheesecloth diffuser – I just ordered some cheesecloth from

⁶ If you want to clean up acoustics in your space, a cheaper solution is to hang up a couple of mover's blankets (available cheap from U-Haul), ideally on hooks that space them an inch or so out from the walls. Do not use egg cartons, which are overrated, and a fire hazard.

Amazon and taped it over the skylight – to keep sharp beams of sunlight from shining on my face distractingly. The two cheap softbox lights I ordered work fine but are unnecessary during daylight. I swapped out the 100-watt-equivalent CFL bulbs that came with them for brighter 250-watt-equivalent LED bulbs to give them a bit more oomph in case I need to do Zoom appearances after dark. Because the Canon cameras tend to render things a bit reddish under indoor lighting (2800K color temperature), I chose bulbs with a 5500K “daylight” color temperature.

I also tried, but failed, to add a fourth input, an iPad, to the Atem Mini switcher for PowerPoint. My thought was that I could put PowerPoint (or Apple Keynote) slides on the iPad, and then I could just hit the button on the switcher and swipe through them on the iPad, producing an experience that would be smoother and more seamless than doing screen-sharing on Zoom. Getting the switcher and Zoom to see the iPad as a camera was easy once I bought a 30-pin to HDMI adapter but then I discovered that my iPad was so old (hence the 30-pin plug) that it wouldn’t run PowerPoint or even Keynote. I tried to get around this by saving my PowerPoint slides in jpeg format, then opening them in Apple Photos on the iPad, which worked, but periodically produced “this app is not supported” messages on the iPad for some reason. At this point, since I hate PowerPoint anyway, I gave up on that. Those with newer iPads, or more affection for PowerPoint, may have better results. I prefer to write on the board anyway, as I think it adds a touch of dynamism that PowerPoint slides lack, even though my artistic skills are subpar.

It took me about 4-5 weeks of experimentation to set things up the way I wanted. I had something roughly functional almost immediately, but refining things took quite a while. Some of that was trying to make the old cameras work. Some of it was the – regular – discovery that I needed a cable that, unaccountably, I didn’t have in my cable drawer, or something similar, and had to order it from Amazon. The teleprompter monitor was glitchy at first. I set all the options on both the monitor and my laptop so that it would mirror my display, but it stubbornly (and unaccountably) insisted on always showing my camera output. Then, when I powered everything down and unplugged it all at once to hook it up to a small UPS (so that I wouldn’t lose video in a power outage)⁷ everything worked perfectly when I plugged it back in and turned it on. Gremlins banished.

The signal from my home WIFI in the pool house was okay, but not great. I dug out an old Apple Airport Extreme router,⁸ and positioned it as close to the poolhouse as I could get it, connecting it to the cable modem with a long ethernet cord. That worked perfectly.

As a final note, with many TV networks doing interviews by Zoom now, a setup like this also makes it easier to provide a high-quality interview for them, something I’ve since done. Law faculty who do a lot of TV appearances, or aspire to, may find something like this – or even a

⁷ My home router/wifi point is already connected to an uninterruptible power supply (basically a battery backup), so that the signal won’t drop out if the power goes off.

⁸ As you may have inferred, I tend to hang onto old hardware, as it often comes in handy.

single-camera setup using a real video camera as opposed to a webcam – worth the trouble for that purpose alone. My own law school is setting up a studio much like mine for both remote teaching and media appearances.

Here's a summary of the equipment and how it's connected.

3 Canon Vixia HF R80 cameras, connected by HDMI cables (mini-HDMI to HDMI) to an Atem Mini switch box, which connects by USB-C cable to a Macbook Pro, which connects by USB-C to a USB lapel microphone, and to a high-brightness teleprompter monitor. The teleprompter mounts on the tripod for the lectern camera. Two softbox lights, and a large easy-to-read clock.

Cost: Canon Cameras: \$249 x 3 = \$747.

Atem Mini Switcher: Provided by law school, but currently \$299 on Amazon. Has been as low as \$249 recently.

Boya USB-C Lapel Microphone: \$39.99

Ultra Bright 7" Feelworld monitor, \$259.

Boyata Laptop Stand, \$49.99.

Caddie Buddy TelePrompter, \$164.99

Tripods: I already had them, but available for \$39.99 from Amazon.

Lincostore Photo Studio Light Kit with Backdrops: \$179.99. (This includes two softbox lights, a green-screen backdrop if you want Zoom virtual backgrounds, and both black and white backdrops. I chose basic black.)

Amazon Basics HDMI cables: 4 x \$9.31.

Clock: \$11.99

All told, this comes in between \$1700 and \$1800 dollars. That's relatively inexpensive for what you get, and I could have economized by using my existing cameras and tolerating the occasional glitch – the Sony Cameras want to go into "demo mode" from time to time when they're not actually recording and lack a control to turn that off, and one of them shared some viewfinder information (zoom position and focus mode) in its output that I would rather have left off – but they worked. The teleprompter setup was basically there because I'm a bit of a tech perfectionist.⁹ And the lights and background may be optional – I could have used the white wall that was already there, but that much white space seemed to suck the life out of things. I also considered painting that wall with dry-erase paint, which lets you use the wall as a whiteboard, but I think writing on a white pad on an easel (which I got from the law school supply closet at no cost) is more visually interesting.

So this is cheap for what it does, but not that cheap. Some of that is learning curve, but most of it is me indulging my tech-perfectionism, and finding something interesting to do during a pandemic.

⁹ A less expensive alternative would be a small LCD monitor, available for under \$100, clamped to the tripod next to the lectern camera.

You could certainly get by with a single video camera (which you probably already own) plugged into your computer, and it would still look a lot better than a webcam, whether the kind built into computers or the fancier ones you can gooseneck-clamp to your desk. (And pretty much everyone should be using a lapel microphone for remote teaching.) That said, it looks as if remote teaching is likely to be, if not the norm, at least a norm, for semesters to come. In my case, I just spent money I would have spent on my (sadly canceled) summer dive trip to Grand Cayman; some schools may have budgets for this sort of thing. I won't say I got as much fun from fiddling with this setup as I would have from 10 days of scuba diving, but it was a pleasant hobby for the summer.¹⁰

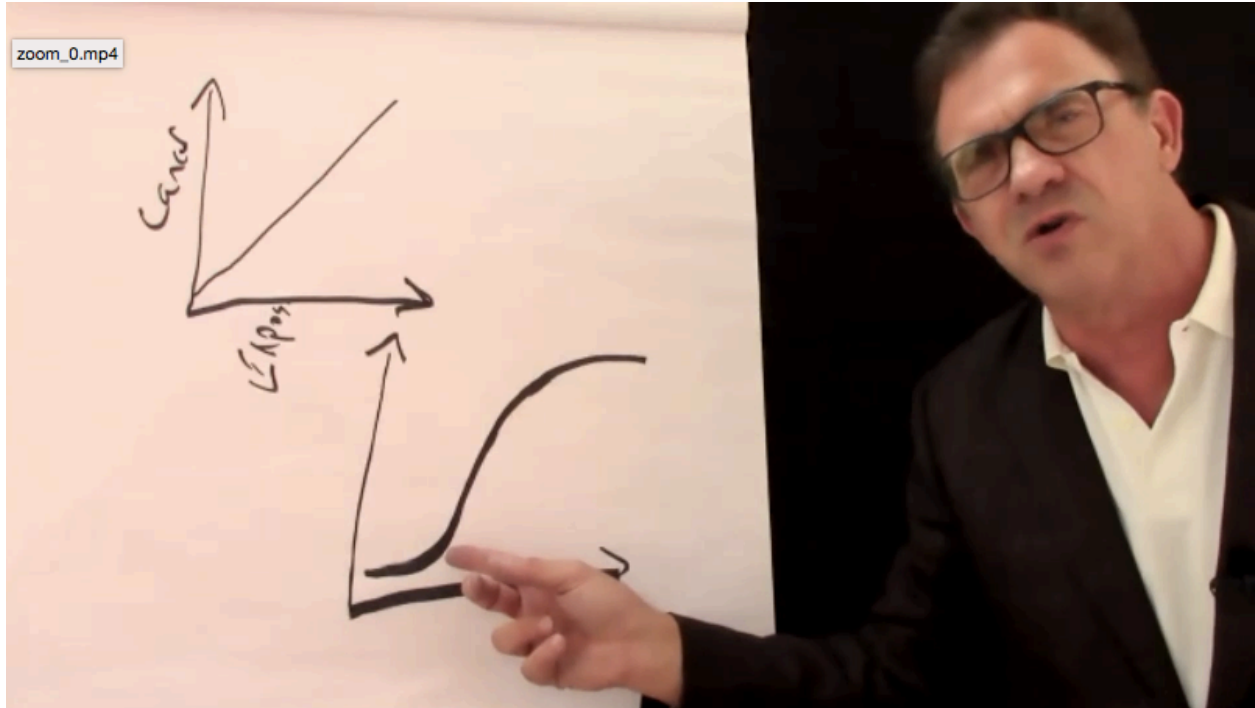
I'd still rather be teaching in the classroom, but I find this platform surprisingly satisfactory. I hope that some others find my experience useful. Meanwhile, I've been living the great irony of 2020: When I imagined teaching online, I saw it as a way to teach remotely from some exotic tropical location. Instead, when I finally wound up doing it, it was at a time when I couldn't go anywhere. But it has occurred to me that I could fit everything into a single foam-lined case for the cameras, etc., and a duffel bag for the tripods and the rest. Maybe next year!

Below: Actual screengrabs, teaching The Benzene Case¹¹ in Administrative Law.



¹⁰ I'm an endowed full professor, of course, so I have more money to spend on such "hobby" activities than, say, an adjunct in another discipline. (Adjuncts in legal teaching are usually practicing lawyers who don't depend on adjunct pay for their livelihood). That said, used video cameras are pretty readily available, and at low prices. And many schools have budgets or grants to aid in remote teaching.

¹¹ Industrial Union Dept, AFL-CIO v. American Petroleum Institute, 448 U.S. 607 (1980).



And what things look like from my perspective:



I hope people find this helpful!