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Preparing an Online Lecture That We Wouldn't Hate to Attend

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■ **IN MARCH THIS** year, we all realized that the next term would be different. We, and lecturers around the globe, would not be in a lecture hall anytime soon. Luckily, in Germany, the term starts in April and we still had time to prepare. Thus, on March 20, we started to call each other to ask what the others were planning. We realized that we know very little about creating online lectures or video recording, we will all teach introduction to human–computer interaction for up to 120 students in one month, and we will have to deliver our courses online.

We started to look at lectures available online for inspiration and found three typical approaches. The first is the notorious tiny

person in the corner of a video with slides, just like those one might use in an in-person class consisting of numerous bullet points. You can hardly see the lecturer, and it remains unclear why the video of the lecturer is even there because it is so small and hardly visible. The second approach is a recording from a lecture hall. The audio quality is often poor, there are conversations with an invisible and silenced audience one cannot follow, and the lecturer constantly walks out of the video. The third approach is from instructors creating highly professional, engaging, and pleasantly looking videos for a living. The problem is that these instructors can only produce one video per week, even with a team and a studio. We neither had a studio nor a team—and only one month to go. What followed was an iterative process of testing and improvisation to prepare a lecture that we would not hate to attend.

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Figure 1. Speaker recorded with four different cameras showing differences in quality: Built-in 13" MacBook Pro webcam (top left), Logitech StreamCam (top right), Pixel 3a smartphone camera (bottom left), Canon EOS M50 (bottom right).

AUDIO

One of the first tasks we had to focus on was the audio quality. While we can easily listen to some audiobooks and videos for 90 min straight, many online lectures are exhausting to attend. You quickly tune out of the lecture. We believe that the most important reason is the effort you have to invest to understand what the person in the video is saying due to poor-quality audio. Even if it is intelligible, poor audio quality can significantly increase a user's mental load.²

We tested different microphones: those in our notebook computers, webcams, smartphones, and semiprofessional DSLRs, as well as external microphones. Examples that we bought and discarded after the first tests include a 70€ USB condenser microphone and a 250€ shotgun microphone. Both are probably great microphones, but we had problems bringing them close enough to the speaker to produce great quality. Valentin jumped in and provided test recordings using an 18€ lavalier microphone. While the quality certainly still provides room for further improvement, it easily beats everything else we tested. While a dedicated cardioid microphone might further improve the audio quality, we now all believe that one would have to invest some hundreds of EUR to beat our 18€ lavalier microphone.

CAMERAS AND LIGHT

The next thing we investigated was image quality. We wanted to keep a connection with students even if there are over a hundred in our class. Thus, we considered being with the students important, and being with the students meant being in a video.

Figure 1 shows a comparison of some of the cameras we tested. Clearly, the quality provided by our notebook's integrated camera leaves a lot of space for improvement. Dedicated webcams are a step up, but even the best one we tested, a Logitech StreamCam, is easily trumped by our smartphone's camera. Paired with enough light, the camera of the Pixel 3a, for example, is almost on par with the Canon M50—a mirrorless camera used and recommended by many semiprofessional social media broadcasters.

No matter which camera we would like to use, adequate light is necessary to get good video quality. The easiest solution would have been sunlight. With a good setup at the right time, the Sun can provide plenty of soft light that is perfect for video recording. Unfortunately, setting up a studio in the middle of our sunny living room was not an acceptable option for at least some of our housemates, and being able to record at night was a necessity for others. One or two simple floor lamps were a



Figure 2. One of our initial green-screen setups with two softboxes. The green screen is still poorly lit as the speaker would cause massive shadows.

major improvement, but we all bought additional light sources. Our typical setup consists of up to four “softboxes” (see Figure 2) that can provide soft and even light.

POSITION AND CONTENT

There was not much discussion about what we would do while recording. We are all used to delivering lectures in large lecture halls while standing. Thus, we decided that standing while recording the video is important because we found it much more engaging for us and, therefore, hopefully also for our students. Our lectures depend on the combination of different media. In a professional setting, one would probably combine a video of the lecturer with multimedia content in postprocessing. This is, however,

time-consuming, and recording the video itself takes only a fraction of the time of such complex editing. We did not have that time, and so we needed a more efficient process. Thus, we tested different, simple approaches for combining our live recordings with PowerPoint slides.

Figure 3 shows two of the approaches we tested. Our favorites were adding slides on top of our video and removing the slides’ background and adding us on top of the slides and removing our background. While we realized that chroma-keying, the process of removing a specific color from a video and replacing it with other elements, is not a completely solved problem, we still decided to buy green screens in the hope that they would enable this type of editing. At this point, most of us bought an “Influencer Set” offered by a supermarket chain (online obviously) that includes a green screen, a light, a tripod with a smartphone mount, and a lavalier microphone.

We realized early that we would have to split up our lectures—typically 90 minutes long—into smaller chunks to make them digestible in the noisy environments our students might face. Not surprisingly, the move to shorter videos is also supported by research showing that making videos shorter increases the probability that students will watch them.¹ Once we chunked our content in this way, it made our lives much easier, because it is exhausting to record videos. It seems virtually impossible to record 90 min of high-quality content in a single go. While preparing the content we, however, often realized how



Figure 3. Two different compositions we tested. The recording on the left is shot in front of a white wall, a slide with a white background is added on top, and the white in the slide is made transparent. The recording on the right is shot in front of a green screen, the green screen is made transparent, and then added on top of the slide.

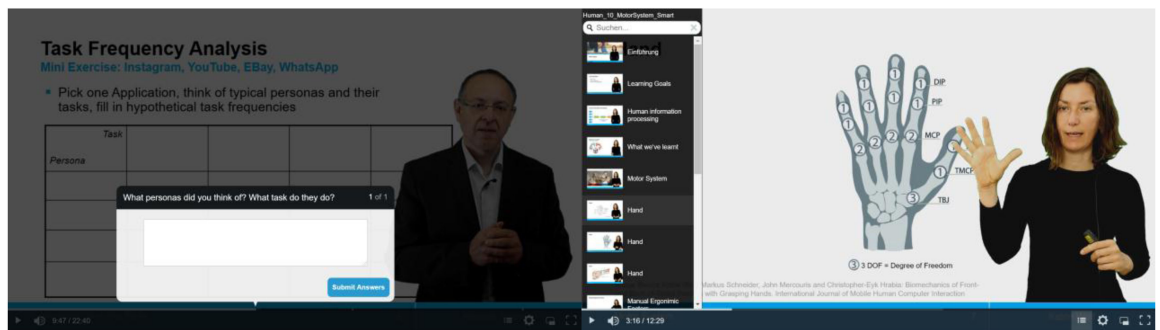


Figure 4. Simple quiz integrated into the video is shown on the left and the outline with thumbnails and the title of the slides is shown on the right.

challenging it is to video snippets which to not exceed 15 min and ended up with many longer ones. While the average is around 15 min, the longest one on Shneiderman's eight golden rules of interface design ended up to be 27 min.

Often the slides we use in class have two purposes: we use them during our lecture, and we provide them to our students who use them as a coursebook. In contrast to the ephemeral lectures in class, students can rewatch the recordings on demand (probably on fast-forward). Therefore, we expected that the slides would become less important. Thus, we reworked our slides by removing a lot of content and focusing more on images, videos, and charts that make sense to have on slides supporting a speaker.

We had repeated, lengthy discussions about the framing of the content and how the videos would be perceived when used in practice. For example, we deliberately have only a short video intro of around 5 s, with no greeting and no introduction of ourselves. After the first video, students will know who we are, and they will likely watch multiple videos in a row. We expect that learning our names and getting a hello every 15 min might be rather annoying.

SOFTWARE AND DISTRIBUTION

We considered different tools for video editing; there are some great options. DaVinci Resolve, for example, which has been used for multiple Hollywood productions, is a professional solution that is free to use. Unfortunately, most tools require abilities most of us did not have and were unwilling to learn in the short amount of time we had. Even if one knows how

to use professional tools, cutting videos can still take significantly more time than recording the video footage, especially when using the notebook computers we typically use for work, which are not optimized for video editing.

After exploring different tools, we finally decided to use Camtasia, which is a rather basic nonlinear video editor. While Camtasia is far from being the most advanced video editor (chroma-keying, for example, could certainly be improved), it provides some nice features. It comes with a PowerPoint plugin that captures slides, audio, and the video from a webcam but can also combined with video and audio recorded through an additional camera, such as the mirrorless camera one of us started to use. We use Camtasia to integrate quizzes into the videos, which generate brief interruptions of the videos to provide some interactivity. Quizzes are only provided when exporting videos using the "smartplayer," or as a Shareable Content Object Reference Model (SCORM) package; these exports provide a menu that enables jumping directly to slides, which we assumed will come in handy for students (see Figure 4).

We upload our final videos to the respective learning management systems and a dedicated website.* Students, however, might not have the best internet connection. To make our content more accessible, we also created a YouTube channel** for our course as this enables students to select the video quality their internet connection permits. In addition, slides are available on our website as PDF and as PowerPoint files.

*<https://hci-lecture.org>

**https://www.youtube.com/channel/UC8WcYxVY3hBzWsm3_rTtISyw/

Unfortunately, quizzes are only added in postprocessing using Camtasia that is why we did not find a good way to share them with other lecturers. We, however, provide reusable exercise sheets with tasks for students for the content blocks.

As all our content is now world-readable, we had to revise slides to ensure that we have the right to use all content in our slides. Ultimately, we realized that using an open license (we are CC-BY-SA 4.0) makes our lives much easier as we can use content already under a creative commons license ourselves. In particular, using a creative commons license enabled us to reuse content from Wikipedia in addition to our own content and from websites providing images and videos under a public domain license. While it is still necessary to check the license, one can search for creative commons content using, for example, Flickr or Google image search.

CONCLUSION

In conclusion, we have learned quite a lot about microphones, lighting, cameras, and video editing during the last weeks. While it might seem obvious, iterating and testing devices and setups is important. Probably most fundamentally, however, we were reminded how important it is to team up with others, especially in challenging times. By lecturing together, not only did we share the workload, but we also shared our excitement about teaching and the topic itself. We could have also prepared lectures individually, but doing it together turned out to be almost as fun as standing in class.

We are still iterating. The latest purchases include cameras, microphones, and even more lamps. We, however, also started adding content that became easier to acquire due to the recent circumstances. We did a first interview with Alan Dix accompanying our lecture on Alan's principles to support usability, with more interviews soon to follow. We also started to think about courses on other topics, such as on pervasive

computing,³ where students work on novel devices. For example, we are eagerly awaiting the outcomes of a maker's lab course currently taught by Susanne Boll and her colleagues at the University of Oldenburg. Students in this course received hardware kits for tinkering and crafting, and they can use these kits while they all practice social distancing.

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