Video Feedback with Composite Cameras

A collection of info and resources for the course: "Intro to Video Feedback with Cameras" on Polyphase Portal. This is a community wiki; if you have a Polyphase login, you can edit or add to these pages if you feel so inspired.

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Links

Course registration page: polyphaseportal.xyz/video-feedback-with-cameras

About the course

In this course, students will learn to create real-time visuals using camera feedback, and create recordings of the patterns they generate. We will each develop our own unique setup for generating video feedback patterns by pointing a video camera at a screen. While this method is simple at heart, it’s also very sensitive to small changes in conditions, and there are many factors that affect the resulting images, such as:

- the position of the camera in relation to the screen
- to the amount of ambient light in the room

- the settings on both the camera and the screen
- the specific model/type of both camera and screen

We will be working specifically with cameras and screens that support **composite video**, an analog video signal requiring just one simple cable (usually with either a **yellow RCA** or **BNC** connector).

Some prior experience in working with analog video signals is recommended for those who take this course, since you will need to provide and operate your own equipment. In an online course, there is a limit to how much tech support we can provide. However, there will be opportunities for troubleshooting guidance and Q&A during each class session.

Due to the nature of this medium, the resulting visual patterns we create will vary. Each student will have a chance to show their own setup and results so that we can all learn from each others' experimentation!

Materials

Students in this course must have their own materials in order to participate fully. A document containing the full details on what you'll need, and where to find it, will be sent out to everyone who registers.

Materials needed:

- A computer with a web browser installed
- A microphone and a webcam so we can hear/see you in the virtual classroom
- At least 1 video camera **with composite output**
- At least 1 television/screen **with composite input** (this can be a CRT or LCD monitor)
- Cables (and converters if needed) so that you can plug your camera into your screen

Optional but helpful:

- Analog video processors, or analog video mixers with effects
- Prisms, crystals, mirrors, or other reflective/refractive surfaces
- An additional video camera, or a smartphone with a decent camera, for rescanning your output
- Tripods and/or other things to position your camera(s), such as magic arms, gimball heads, and other repositionable mounts

About the Teacher

Paloma Kop is a multimedia artist who has been working with video since 2008. They have worked extensively with video feedback in their art practice & live performances, and hosted many in-person workshops through

Phase Space and Phase Shift.

□□ Equipment & Materials

Analog Video Basics

The minimum equipment needed to get started with camera feedback is:

- At least 1 video camera **with composite output**
- At least 1 television/screen **with composite input** (this can be a CRT or LCD monitor)
- Cables (and converters if needed) so that you can plug your camera into your screen

Though you can create a feedback loop with cameras and screens via other types of signals, such as HDMI, we are focusing on composite video in this class. Using an analog composite video signal allows us to incorporate other analog video equipment and tools into our feedback signal chain, and it allows us to use older, (sometimes) less expensive equipment.

Composite video usually uses a yellow RCA connector. Some professional video gear will have a BNC connector.

If your gear setup uses a mixture of RCA and BNC connectors, you can use a passive adapter to connect them together. However, if a device has BNC connectors, make sure they are definitely for composite video, because BNC is sometimes used for other types of signals as well.

If you are new to analog video, you should find out if your region typically uses the PAL or NTSC standard (or less commonly, SECAM). You will need to make sure that all your gear uses the same standard so that it is all compatible (some devices are able to switch between NTSC and PAL, either automatically or as a setting, and some only support one standard).

If you are curious, here is a list of resources where you can learn more about analog video (from the scanlines wiki). It is not a requirement for this class to have a deep technical understanding of analog video signals, so delving into this is optional.

Analog video resources

- LZX Industries Analogue Video Primer 71
- Studio Rebuild #9: Some Analog Video Basics 60
- Lines of Light: How Analog Television Works 19
- How Analog Color TV Works: The Beginnings 17

- Compatible Color: The Ultimate Three-For-One Special 11
- Analog Color TV Wrap-Up–Some extra info 8
- Why is TV 29.97 frames per second? 10

The primary goal here is that you can plug your camera into your screen, and the screen will show the live feed of what the camera is seeing. This basic setup is something you should be able to achieve on your own prior to the class. It is recommended that you have at least some experience working with analog video before this class, or be ready to do some learning on your feet.

If you happen to have access to multiple composite video cameras and screens, all the better. Different equipment can produce very different results, so experimenting to find what works best is a big part of the process.

A note about external links to products

I will try to add some links and models as examples of different equipment that can be used here. However, if you are purchasing equipment it is important to do your own research. Product links can be modified by sellers to show different products, inventory can run out, and prices can change, so we can't make any guarantees or simply point everyone to purchase the same items and rely on them to work. Be patient and know that finding the right equipment for video feedback often involves some trial and error. The up side to this is that since there is no one-size-fits-all solution, each of us will likely be working with different gear, and we will each get our own flavor of feedback as a result.

Buying older gear used is a great option, but we obviously can't provide links to specific listings since they are usually put up in small quantities. We encourage you to search on eBay, other used marketplaces, and/or at your local thrift/charity shop. Saving old gear from getting thrown away is often more sustainable than buying new equipment, and can sometimes be a much better value.

Cameras

Below are some of the types of cameras that can be found with live composite video output.

Security cameras

Many CCTV cameras have a composite video output. These can be great because they usually output a clean video feed. Some may be small and come in a dome-like enclosure; these will usually have a fixed wide-angle lens, and sometimes an infrared LED array for night vision. Others are larger and rectangular; these usually have a c-mount for attaching any compatible c-mount lens.

- Pros: this type of camera is meant to be run 24/7 and powered from a wall, so will not have any automatic shut-off function.

Examples:

- Vanxse CCD camera (Amazon) (Side note: people will write "HD" on anything! This is fairly common; if it's a composite video signal, it is *not* HD)
- The older, rectangular metal box-style CCD security cameras can often be found used on eBay.
  - If you get one without a lens, look for a compatible c-mount lens with around a 5mm focal length. Ideally it will have separate rings for manual control of the zoom, focus, and aperture. We have had good results with the Tamron 3.5mm-8mm F1.8 C Mount Zoom Lens.
- A lower end security camera (Amazon)

Older consumer camcorders

Many camcorders from the 80s and 90s have a composite video output, though some require a specialized cable to access it. Some of these types of cameras have text or icon overlays on the video output, but it is sometimes possible to turn this off and get a clean output. Some even have digital effects.

- Pros: camcorders usually have manual zoom controls and other settings that can be fun to experiment with
- Cons: usually need to be sourced used, so price and inventory can vary widely

Examples:

- A variety of Sony Handycam models (such as the HDR-HC1)

Mini cameras

there are a number of tiny cameras out there with composite outputs, which are sometimes used as backup cameras for cars, or other uses where they are built into some other device. These can be found brand new online for very cheap, but they usually have a lens that you can't change (often quite wide-angle) and no control over any of the settings (focus, exposure, etc.)

- Pros: very cheap
- Cons: no controls, often need to source power supply separately

Examples:

- Vehicle Backup Camera (Amazon) (Again, this says HD in the title but that is absolutely not the case)

Screens

CRT TVs

CRT screens are beloved for their retro aesthetic, and due to the technology behind them, they are extremely low-latency, which means your feedback patterns will often move and change very fast. Whether you are using them with a camera for feedback or for rescanning, it is helpful to use a camera that allows manual shutter speed so that you can set it to 1/60 for NTSC or 1/50 for PAL to prevent weird sync issues. But, some cameras without manual controls will still play nicely with CRTs; you will need to test them to find out.

Some CRTs don't take composite input and can only be used with an RF modulator.

They are also very heavy, take up a lot of space, and should be handled somewhat carefully due to the glass tubes.

LCD TVs

LCD screens can yield very good results when used for feedback. Their higher latency can actually make them a bit easier to work with. They can be found in small sizes made as backup screens for cars (often without an included power supply). TV models in the 15-20 inch size range with a variety of inputs can also be found used or in the trash.

Examples:

- 5-inch Vehicle Backup Screen (Amazon)

Tripods & Camera Supports

It's important to be able to control and stabilize the position and angle of your camera relative to the screen. On a budget, it is possible to create DIY camera supports out of a variety of household objects, such as small tables, books, etc. However, it can be very helpful to gather some specialized equipment to give you a finer grain of control. Here are some examples:

- A **basic tripod** is a good place to start. Here is an example (Amazon)
- A **gimball head** can give you the ability to rotate the camera in many ways. Here is an example (Aliexpress)
  - Note: if your camera is short enough to fit "sideways" on the gimball head, you can use this to rotate the camera while keeping it centered on the screen, which can yield excellent effects. See optical manipulation for more on camera rotation.
- A more **heavy duty tripod** can be helpful for additional stability, especially if your camera is heavy or liable to be bumped. There are many heavier tripods made for

shooting video that have "fluid heads" to provide smoother motion, which is also helpful.

Here is an example (Amazon)

- For a more customized mounting solution, you can also use a **magic arm**, also known as an articulating arm. These can be on the pricier side, especially for good quality ones, but when paired with modular attachments such as clamps and brackets, you can use them to attach a camera to pretty much anything. These are especially useful if you want to point your camera straight downward, which can be tricky with a regular tripod. With the right adapters, you can also mount an LCD screen on these instead of using it for the camera.

  Here's an example (B&H)

Projectors

You can also use a projector to create a video feedback loop. This can open up a lot of possibilities: projecting on different objects and surfaces, placing items or people in the path of the projector, and if you have more than one projector you can even layer their images together. Many consumer-grade projectors, even newer ones, come with an RCA input for composite video. However, they can also be expensive and delicate devices. Though we will be mainly focusing on using screens to create feedback, bear in mind that using a projector for feedback is also a great option, and try it out if you have one available to you.

□□ Getting Started

Once you have your equipment, you are ready to get started creating some video feedback!

1. Connect your camera and screen together so that the screen is showing what the camera sees, then point the camera at the screen.
2. Try to align the edges of the camera's view with the edges of the screen, so they are lined up as closely as possible. You will likely have to zoom or adjust the distance between the camera and screen, as well as ensuring that the camera is level with the center of the screen, and pointing straight at the screen.
3. Spend some time with your camera and screen, and identify what settings you can change that will affect the image (see below).

Settings to look for identify & experiment with on your camera and screen:

- Focus and zoom (camera/lens only)
    - Does it have auto and manual focus modes?
- Brightness, exposure, or aperture
    - For cameras: does it have auto exposure and manual exposure modes?
- Color / chroma / saturation
- Tint, hue, and white balance

These controls may be available in the form of a knob, a lens ring, or an option inside a menu. For some security cameras, it may even be a small plastic screw called a "trim pot." Not all cameras and screens have all of these settings, but the more of them you can find, the more control you'll be able to have over your feedback.

Start by trying to align the camera and the screen as best you can, get the screen in focus, and try to get as close to neutral color & brightness as you can. From there, you can start to change individual settings and see if it affects the resulting feedback. Feedback can be delicate, so start with small changes.

It can be helpful to work in a darkened room as any ambient light can affect the results.

□□ Optical Manipulation

What is optical manipulation?

Transformations & Geometry

rotation

tripods

magic arms

gimball heads

Physical materials

putting the tv flat on the table

Prisms and lenses

dichroic

random glass

Mirrors and reflective materials

Filters

Polarizing film

Masking and silhouettes

Hands

Random objects from the kitchen or around the house, cool-shaped pieces of metal, toys

Movement - rotation, turntables

Images drawn on transparency film

to-do:

- finish "transformation/geometry" section and draw/add diagrams
- flesh out list of types of optical materials
- 2 way mirrors
- add notes about adding light - flashlight, candle, laser pointer
- add some links to order some of the items

⚡ Signal Manipulation

what is signal manipulation?

[note: add diagrams]

Video Processors

x

enhancers

Video Mixers

x

luma key

Advanced signal chains

figure 8 feedback

Capturing & Rescanning

Now that you have a beautiful video in the analog realm, how do you get it into a digital file?

Since this topic is relevant to anyone working with analog video signals, it has been made into its own wiki.

→Capturing & Rescanning Analog Video

□□ Inspiring Works & References

Videos

https://www.youtube-nocookie.com/embed/WS8v6jKPP68?si=nuf2B6LHKMekSP_l

https://www.youtube-nocookie.com/embed/flKVGyEpWKI?si=N_tQAma36gEHrG6i

https://www.youtube-nocookie.com/embed/VuaqWvYvdm4?si=o61dHgUevO4RopFG

https://www.youtube-nocookie.com/embed/tbfjdEEIFTQ?si=R8NsIHieTQOc4PWg

https://www.youtube-nocookie.com/embed/3uzxcl_d8uk?si=aWlJm7ZCLiDfh5IN

https://player.vimeo.com/video/536042431?h=e660437bed

https://player.vimeo.com/video/220073615?h=049a269a09

^an article about this piece

https://www.youtube-nocookie.com/embed/il5s8VbhyRM?si=okZK8euAAmEx7OLX

https://www.youtube-nocookie.com/embed/502YvYZI7bk?si=lhup35YtpNk3iDan

https://www.youtube-nocookie.com/embed/dUCXZV96l9A?si=T1KoCbThLPujNsqm

Readings

- Space-Time Dynamics of Video Feedback - James P. Crutchfield (1984) - PDF & Accompanying Video
  - A paper addressing Video Feedback and the phenomena from the perspective of physics
- Physics:Video feedback on HandWiki
  - Contains an explanation as well as some history & context
- Getting Started with Video Feedback by Andrei Jay
- I am a Strange Loop by Douglas Hofstadter (Goodreads)
  - A review of this book in Scientific American summarizing the topic of video feedback as a model for understanding human consciousness

History

- Illuminatin' Sweeney - documentary on video feedback artist Skip Sweeney, 1975
  - Skip Sweeney Bio (Exploratorium)
- Doctor Who: An Unearthly Child opening sequence, 1963
- Earth, Wind & Fire: September music video, 1978
- Amii Stewart - Knock On Wood music video, 1979
- Steina and Woody Vasulka (Monoskop)
- Eigenwelt der Apparatewelt / Pioneers of Electronic Art, Ars Electronica 1992