
making360

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preface

"THE WELL.
the town may be changed,
but the well cannot be changed.
it neither decreases nor increases
they come and go and draw from the well

structures change, but the life of man with its needs remains
eternally the same—this cannot be changed. life is also inexhaustible.
it grows neither less nor more; it exists for one and for all...
the foundations of human nature are the same in everyone."

we know technology will evolve exponentially, softwares will update, hardware will become smaller, lighter, and more efficient. the chapters we have written thus far could be irrelevant as of yesterday. so please continually constantly self-develop with us.

we want this book to be a town well, a reservoir of resources we can all draw from!

introduction

by Jason Fletcher

Let no one say otherwise, shooting 360 video is difficult and intense! It's a medium that has completely unique challenges. And that is exciting for both the tech folk and the storytellers. But you'll need to understand the many hurdles so that you can soar. Knowing the specific details, inherent limitations, and potential problems will only help to inform how to successfully create immersion. And that is what this book aims to do!

We are going to throw a bunch of information at you. Yet it's really up to you to connect the dots and understand the optimal workflow for your specific camera rig. This isn't your typical DIY book. Really to become adept at 360 video, you will need to perform test shoots and run into problems yourself. The best way to learn and gain valuable experience is to fail! With that said, we will equip you with a comprehensive approach.

Big Picture Workflow

There are many details that we need to discuss. And so we are taking a brute force approach, organized into chapters. But in reality there are distinct steps in a typical 360 video shoot:

- EQUIP: choose your gear
- SETUP: camera settings, memory cards, pair remote
- PLAN: stabilization, safety zones, actor blocking
- SHOOT: recording, synchronization, lighting
- IMPORT: ingestion, file management
- STITCH: dailies quickstitch, color matching, render tiff
- EDIT: rotoscoping, color grading, final render

problems of shooting

equip

setup

plan

shoot

problems of stitching

import

stitch

edit

render

problems of shooting

equip

The Elements

"Welcome, O life! I go to encounter for the millionth time the reality of experience and to forge in the smithy of my soul the uncreated conscience of my race."

- James Joyce, A Portrait of the Artist as a Young Man

Problem:

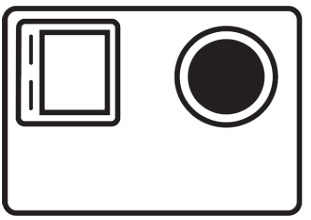
You want to be the next first greatest VR storyteller of all time and space.

You want to create audiovisual immersive experiences. You want to expand cinema, compassion, and consciousness. You want to explore change. You want to create new tools for self awareness. You want to help write a new cinematic language. You want to break open that window of limited views and climb out right into pure experience. You want to bring the world one step closer to putting ourselves in each other's shoes. Hello, astronaut! That's great but what are the first steps to take you closer? What materials do you need to shoot, learn, and grow right here right now today?

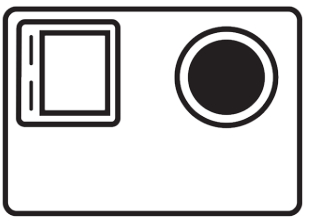
Solution:

Dive deep in. No fear. Take the first step. Then the one after that. Gather all the elements and start experimenting!

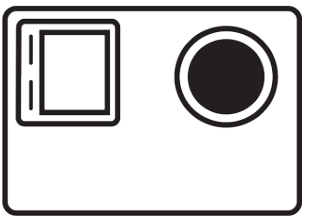
Here's a basic checklist for your journey:



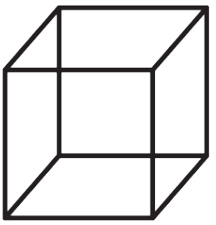
camera



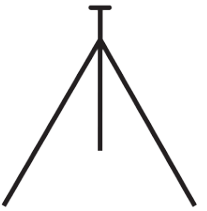
camera



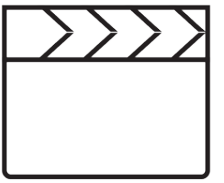
camera



camera rig



tripod



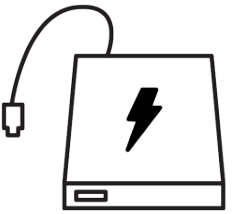
audio slate

microSD cards

batteries

remote

usb hub charger



hard drives

courageous heart

your charming smile

have fun!

千里之行，始於足下

"When we say expanded cinema we actually mean expanded consciousness. Expanded cinema does not mean computer films, video phosphors, atomic light, or spherical projections. Expanded cinema isn't a movie at all: like life it's a process of becoming, man's ongoing historical drive to manifest his consciousness outside of his mind, in front of his eyes."

- Gene Youngblood, Expanded Cinema

Platonic Rigs

"There is geometry in the humming of the strings, there is music in the spacing of the spheres."

- Pythagoras

Problem:

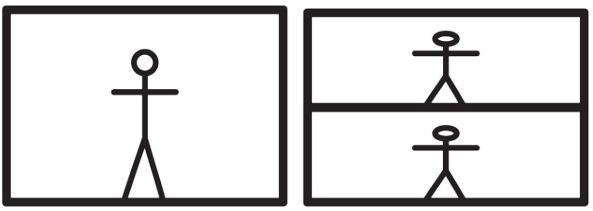
You need to choose a 360 camera rig from all the options and configurations available.

The popular 6 camera cube? 7 camera cylindrical layout? 10 camera layout? Or perhaps 3 cameras with modified fisheye lenses? Mono or stereo? What about spherical or cylindrical? One size does not fit all. Don't worry, we'll find the perfect fit. Selecting a rig depends on the type of content you are shooting, environment, distance, moving shots and of course money in the piggy bank.

Solution:

Prioritize your needs.

MONO vs STEREO



First decide between using a monoscopic or stereoscopic 360 video rig.

With a mono 360 rig, all of the cameras will together capture a single 360 video. No illusion of depth can be achieved. This is the simplier approach in every way.

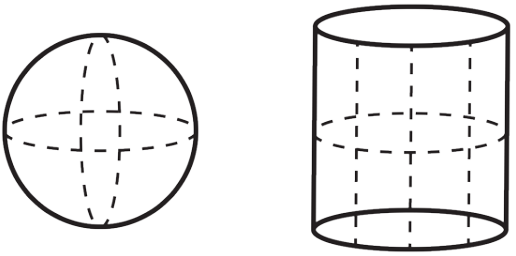
But a stereo 360 rig is specially designed to have cameras for the left and right eyes. Hence the need for double the amount of cameras. In this way 360 video can be achieved in 3D. But there are a few caveats...

In the end, it all comes down to overall cost. Stereo will give depth to the subjects and objects, enhancing the quality of experience but the costs will be significantly greater in both hardware and post production. If you have the budget and manpower, then stereo for the win! The difference is astounding and makes the experience more vivid and real.

If you are shooting on a tight budget look at the type of content you are shooting. Will the subjects and objects be close? If they are at farther distances or if you are shooting landscapes without close subjects, the stereo effect won't be as noticeable. You should save your money for a different aspect of the production. Another factor to keep in mind is how much control you have over the environment. If you are shooting a live event like a concert or sports then it will be difficult to control variables like subjects moving between seams of the cameras. The parallax and flaws between cameras is even more apparent especially for differences between stereo pairs. The errors will exponentially compound and cause viewing discomfort, eyestrain, and nausea. Shooting on set where you can control variables and block movement will be best for stereo. If you are sending a stereo rig into the field, be prepared for potentially heavy post production since environment variables will be out of your control.

With monoscopic videos you will be able to get higher resolution. To playback stereoscopic videos the left and right eye videos are stacked over/under and combined into one file resulting in half the resolution. If you don't have the budget for stereo, don't be too bummed as you can capture more detail over stereo with a 4K, 8K, and even 12K resolution out of your mono videos!

SPHERICAL vs CYLINDRICAL



If you have decided to stay mono, there are quite a range of options for you to choose from that offer high resolution. Again, pick the rig based on the style and type of content you are shooting. If you are shooting landscape with minimal subjects, then a cylindrical rig with more cameras around will offer extra high resolution. There will be more camera coverage around the horizon. However, because of the limited vertical FOV (field of view), there will be a hole at the nadir (floor) or zenith (sky). In other words, there will a zone where footage is not captured, but this may be okay because the viewer will not be looking at the sky or floor most of the time. So if you are shooting for a dome, the nadir hole won't be a problem since the camera rig will be on a tripod and won't be rendered into the fisheye shot.

The sky and floor can also be shot with an extra camera. You can even use a still camera, such as a Nikon or Canon. Then during the stitching process fix the missing zone and patch in the nadir hole or replace the tripod.

But a cylindrical rig is not ideal if you have multiple subjects moving around between cameras. More money, more problems. More cameras, more seams!

A spherical hemicube rig is an option if you have a smaller budget and less cameras on hand. There will be equal coverage between the cameras including the zenith and nadir.

FISHEYE vs WIDE-ANGLE

Another option for rigs is to modify the camera with a fisheye lens. You can achieve a greater FOV than wide angle lens and have more coverage per camera. In effect you will need less cameras for the rig, which allows the cameras to be closer together and have less parallax. An advantage of this rig is allowing subjects to get up close to the camera because there are less cameras and seam lines to break. It also allows for more footage overlap and can really help to hide any seams during the stitching process.

RECOMMENDED MODELS

MONO

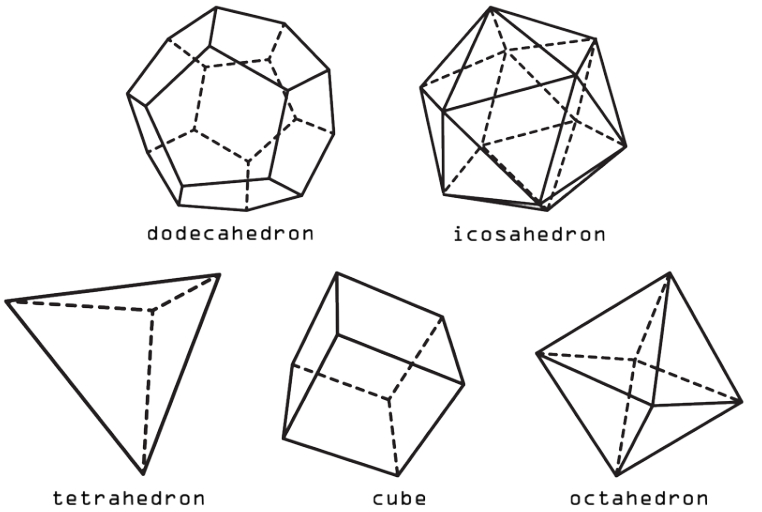
- 6 hemicube camera rig
- 10 camera rig
- 3 camera modified fisheye rig
- 4 camera modified fisheye rig

STEREO

- 12 camera rig
- 14 camera rig
- 6 camera modified fisheye rig
- 8 camera modified fisheye rig

For a comprehensive list of existing available solutions, see Jason Fletcher's collection of 360 video rigs on **The Fulldome Blog**.

MODELS OF THE UNIVERSE



Find the balance between the FACTORS
TIME...is money
MONEY...is power
DISTANCE...is time apart
DEPTH...is love
CONTROL. . . is an illusion
RESOLUTION...is a state of mind

Play Your Cards Right

Problem:

Which brand and size of microSD cards should you purchase?

Nike vs Adidas. FujiFilm vs Kodak. SanDisk vs Lexar.

Solution:

Sell out and go with the name brand GoPro endorsed and recommended cards.

Use the same make of memory cards for all the cameras. You want all the cameras as identical as possible so the microSD cards matter as well. Get the cards with the fastest read/write speeds. The cards with fastest write speed will perform better in the cameras. Also having the fastest read speed will minimize file transfer time. Spend more money on the higher class cards since they will last longer as well.

The SanDisk Extreme PLUS 64 GB or Lexar 633x 64 GB is recommended.

You need the cards with the fastest read/write speeds because when you shoot with a high resolution video mode on the GoPro cameras, then you are obviously dumping alot of data onto the memory card! So if you buy a knockoff memory card and the write speeds aren't up to snuff, then the camera buffer will fill up and will stop recording prematurely.

setup

Formatting Cards

"N.Z: I suppose your explorations of new media are like swimming in an endless ocean.

N.J.Paik: A tabula rasa, you know a white paper. Video is a white paper, a tabula rasa."

Problem:

How do you keep track of all the cameras and tiny microSD cards?

Be organized! Number your cards as well as cameras. Color code your cameras if you have multiple rigs. This will prevent headaches and confusion during textbfIngestion and post production. There are all the normal problems of shooting times x amount of cameras so proceed with extra care.

Solution:

Blank canvas and tweezers.

Before every shoot, format all your cards or file management will get really messy. Keep the same microSD card per camera so it is easier to troubleshoot. For example, if one card has corrupted files, footage that is out of focus, over exposure, or other problems you can track it down to the exact camera. Of course, always double check that your footage has been backed up before formatting.

Formatting the cards through the camera is best instead of on the computer so the original file structure and partitions are restored.