VOODIO:

Proposal for an Online Video Content Creation Tool

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ABSTRACT

Video content is a massive source of entertainment, education, and income for a large population of online users. As more reliance upon this medium enters the field of education, formal and informal, people need tools to enhance their ability to tell stories and engage an audience. A tool that easily adjusts without compromising the interaction, the storytelling, or the visual moment, while also capturing as much information as possible, might be of great benefit to all creators of video content. Allowing tutorial creators the ability to efficiently record multiple views of their content may better aid in presenting concepts while retaining the attention of the viewership. The opportunity to present information effectively may have impacts on fields including education as well as entertainment. This thesis aims to explore possible reasons why content can be made to retain the audience's attention and to create a tool utilizing these facets for far reaching possibilities.

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Introduction

Background and Context

Video content is a massive source of entertainment, education, and income for a large population of online users. As a YouTube user and creator of the Appalachian Bonsai channel, the author has a strong desire to create ever more interesting and engaging content. With the following research, we have explored ways in which video content is created and used in hopes to gain an understanding of how we can better express our individuality to the world. We believe the outcomes will be of benefit to artists and audiences alike.

Problem Statement

I believe that the creation of specialized camera system can increase the production quality of content by providing multiple views with ease. The purpose of this thesis is to design a multi-point desktop camera system for new YouTubers to best display their skills. The 'new YouTubers' are the user group. There is no age requirement because the ability to begin creating video content is not generational. It begins with a person's idea and takes off. Many new videographers start with only one camera, then realize multiple cameras can make creation easier and more interesting - more dynamic. This product aims to be a step up for these newcomers, while keeping their limited videography gear relevant for many years after purchase. No camera, no matter how powerful, will ever make bad content or bad presentations of that content any better. But the ability to quickly and easily set up a camera system removes the barrier of technical know-how and helps new YouTubers put their best foot forward.

Research Question

Can a video recording tool be created that allows a user to more easily create content?

Assumptions to be Discussed

Nearly half of the world's online users watch YouTube at least once a month.[1] There are more than 31 million channels currently on YouTube, having grown by 25% just this past year alone.[2] People want to show off their skills, teach what they know, or even just create for the sake of art. We will assume there is a great desire to create video content.

The topics discussed in videos are as broad as the creators' imaginations. For our purposes, we will be focusing on tutorials, or how-to videos, and assume that videos intending to pass along detailed information will be considered a tutorial, as the aim and purpose of the content is to inform the viewing audience. This will include promotional product reviews, such as unboxing videos. We will not require the content creator themselves to be highly informed of the product they are reviewing as might be expected of a professional teacher. In fact, one of the appeals of an 'unboxing' video is the surprise and discovery associated with unveiling an object with an audience. They, the audience, get to 'share' the experience with the content creator. The methods and solutions created in this thesis will be of great benefit for all video content creators, however we will not discuss aspects of gaming, music videos, or general entertainment. We will also not discuss modes of learning, or why and how people gain knowledge. This topic is too broad for the current scope of this thesis.

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[1] Dean, Brian.; "We Analyzed 1.3 Million YouTube Videos. Here's What We Learned About YouTube SEO." 2017. Backlinko. February 28, 2017. https://backlinko.com/youtube-ranking-factors.

[2] Funk, Matthias.; "How Many YouTube Channels Are There? | Tubics." 2019. Tubics. December 19, 2019. https://www.tubics.com/blog/number-of-youtube-channels/.

There are many video-sharing platforms out there. Periscope, Dailymotion, Vimeo, Twitch, Facebook and Instagram are all powered by video content. YouTube is by far the most popular, beating out its closest competitor, Dailymotion, by more than 300%.[3] We will focus only on YouTube for this thesis.

To create the videos, we must have proper setups. This often comes in the form of piecemeal rigs and assemblies of various origins. Whole websites and businesses are dedicated to providing information and products to aspiring YouTubers. With increased viewership may come an increased desire to increase the value of video production. To do that, we will assume, YouTubers are looking for better video setups.

User needs vary, and without proper research of human subjects, those values are hard to define. Therefore, we will be making generalized assumptions about user needs based upon the author's personal experience as a seasoned YouTuber and professional industrial designer.

Relevance and Importance of the Research

The global camera market is in decline.[4] Smartphones have come to be a major player in the world of cameras. They combine a compact portable form with other innovations and software that fit in the pocket of everyday users, and with every new model comes powerful upgrades. But a smartphone requires accessories to mount and position them, of which a vast trade of gadgets and gizmos has been created. Another downside is the requirement to purchase more than one phone in order to capture multiple angles. This aspect carries over to standard cameras. Either way, an artist who desires to produce engaging videos must find new ways to easily capture content by acquiring more cameras. The creation of a multi-camera system will provide these artists with a versatile tool while helping keep the digital camera relevant.

With the increasing use of online video tutorials as primary and supplemental education, professionals and hobbyists within all fields need an ever-increasing mix of digital tools at their disposal to provide solid video content without losing the meaning that can get lost in remote settings. This is most important for educators in the fields of architecture and industrial design, where three-dimensional concepts constitute a primary means of human connection.

Aspects of human-computer interactions will arise from the findings in this thesis. Specifically, how media is presented to an audience may influence their ability to concentrate and understand concepts. Variations of presentation, such as singular video images displayed in a linear story versus multiple videos simultaneously displayed may have differences in effectiveness for learning. Additionally, handedness displayed from different directions may also impact a viewer's ability to understand the presented information. However, these and other HCI questions we found during initial research will not be further discussed for this thesis. Future research will be required at a later date.

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[3] Wikipedia contributors. 2019a. "Comparison of Video Hosting Services." Wikipedia, The Free Encyclopedia. December 7, 2019. https://en.wikipedia.org/w/index.php?title=Comparison_of_video_hosting_services&oldid=929705170.

[4] IMARC Group; Research, and Markets ltd. n.d. "Digital Camera Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2018-2023." Accessed December 28, 2019. https://www.researchandmarkets.com/reports/4514578/digital-camera-market-global-industry-trends.

Why Multiple Views

How can we create engaging videos? As will be seen below, changing the video's subject matter will keep the audience attentive. The 'change of scenery' per say, allows artists the freedom to explore new subjects without fear of losing a shot, thereby losing the audience.[5] We will begin by showing the evolution of specific fundamental techniques used in filmmaking and discuss why they are important for engaging the audience. Mind you, not all techniques have to be used, and not using does not mean you cannot create something powerful.

Multiple Angles: Historical
Horse in Motion

To begin, let's look at the very first motion picture. We won't go too far into film history, but I think it's important for us to understand a few concepts. In 1878, Eadweard Muybridge set up twelve cameras to capture a horse in motion as it galloped. This study was used to answer the question of whether a horse had all four hooves off the ground when running, which it did. To further prove that the images were not elaborate setups, Muybridge developed a device called the zoopraxiscope. This device placed all twelve images onto a glass disc that could be rotated and projected continuously against the wall. When viewed in sequence, it became clear that the pictures were indeed genuine, thus proving the point. This was the first moving picture. It is extremely important to understand that from the very beginning, moving pictures have and continue to aid education by providing answers to important scientific questions.

Tableaux vivant

As improvements were made and the perforated film strip was developed, more and more people became interested in creating what became known as films. The oldest known film to be created is the "Roundhay Garden Scene", developed in 1888. It is very short, only about four seconds long, and displays pedestrians strolling within a garden. This, and many of the first films that followed were almost always depictions of everyday slices-of-life, or *tableaux vivants*. A single camera was used, as they were bulky, heavy, and very expensive.

Storytelling

However, as the medium expanded, directors moved toward fictional storytelling and employed theatrical elements as if they were stage productions. Stories, like "The Devil's Castle" of 1896 became popular, and borrowed heavily from theater. You can see the stage is set with props and backdrops, the actors are dressed in character, and consequently, the stage is set for new expressions in film. Again, the expense and size of cameras limited these films to a single camera and perspective.

Corbett-Fitzsimmons Fight

The Corbett-Fitzsimmons Fight, May 22, 1897, directed by Enoch J. Rector and produced by William Aloysius Brady may be the first live footage film to show scenes from more than one direction. At the beginning of the film, the camera appears just left of the platform as the boxers move about the ring prior to the fight. The rest of the footage is aimed directly at the ring for the duration of the fight. There is no indication the angle changes was purely for cinematic reasons as the difference is minimal by a few degrees. It appears to be a last minute call. The

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[5] Hamer, Adam. 2018. "Why multicam is possibly the best way to shoot drama." Redsharknews.com March 23, 2018.
https://www.redsharknews.com/production/item/5284-why-multicam-is-possibly-the-best-way-to-shoot-drama

author's speculation is the fight started and the filmmakers realised a better view was had by moving locations. No other footage of the 100 minute film is known to survive, therefore, we cannot know if the director or producer continued to move the camera purposefully or inadvertently because of last minute changes. It appears to be the first use of multiple camera angles to depict a singular event.

The Dreyfus Affair

In 1894, Alfred Dreyfus had been wrongly accused and found guilty of espionage by the French, but evidence was soon discovered about the real spies and how the government covered it up. In 1898, Georges Méliès, the director of "The Devil's Castle" and a supporter of Dreyfus, produced 11 staged films reenacting the events of what became known as The Dreyfus Affair. Each film is only about a minute long each. But, when displaying these films to the public, he glued them together and played it as one long sequence, thereby creating the first effective use of 'cuts,' where a scene ends, the film is cut, and a different scene is shown, and so forth. The film was a sensation and helped countrywide support for, and finally the acquittal of, Albert Dreyfuss.

Grandma's Reading Glass

To add onto these new explorations in cinematography is "Grandma's Reading Glass." It is a short film by pioneer George Albert Smith. It shows a young boy using his grandmother's magnifying glass to look at the newspaper, his pocket watch, a bird, a cat, even his grandmother's eye. Though a rather mundane scene it captures the audience's attention through the use of closeups of each subject. It is the earliest use of this technique, and this is important. Despite the simplistic nature of the content, Smith showed how powerful the change of point-of-view is in keeping the audience attentive and engaged.

Newsreels

Beginning around 1908, Charles Pathe began to stitch together many shots from various *tableaux vivants* and produced what became known as the newsreel. These films provided the public with ongoing current events such as cultural blockbusters, parades, speeches by public figures, or scenes of war. By 1910, the actuality films discussed before had completely fallen out of favor and were replaced with the excitement of this visually interesting media. The actualities alone became ineffective at capturing the attention of the audience. Multiple shots became the norm.

Multiple Angles: Contemporary
Television

Newsreels were supplanted by the introduction of television. News broadcasts displayed much the same information and imagery from newsreels, but made them available to every household that owned a television. People gathered the news from home instead of going to the theatre to watch. Then, as now, television uses varying scenes to keep people glued to their sets.

NFL Replays

Multiple camera angles might have its most visible and important role within the instant replay calls of the NFL. Starting with Art McNally in 1976, the then director of officiating used a stopwatch and video camera from the pressbox to experiment with reviewable plays. After watching the footage, he knew replays could help football. "We asked the camera technicians to

give us different angles," he was quoted as saying.[6] This sparked the beginnings of replay technologies. Today, the Art McNally Gameday Central employs a crew of people tied to multiple touchscreen monitors whose sole job is to provide on-field game officials with the best views of disputed calls. Despite controversies and stops and starts, the instant replay's use of multiple camera angles continues to provide referees with the data they need to make informed choices.

Modern Cinema

Movie theaters are still alive and well. Blockbuster hits like Harry Potter, Star Wars, and Marvel Comics still bring people to the widescreen. The movies are filled with many perspectives and film tricks beyond the simple cut and closeup. Zooms, pans, and single hand cameras keep the audience intrigued and may be utilized to evoke emotion, suspense, and understanding. Though theatres rarely present flashy films, it doesn't mean there isn't a place for single-camera shots. James Benning, who is an independent filmmaker became well known for employing long continuous single-frames. But he does so with intention. His 2012 film 'Nightfall' is a 98-minute long shot of a forest at sundown that ends in complete darkness. It's one shot! but it's made artfully to combine the experiences of a natural landscape with the experience of watching a film. Once you get past the boredom, you can momentarily lose yourself in a slice of visible life.

Social Media

Once again, video has transformed into a new media. Though digital video has been around for many years, sites like Facebook, Twitter, and YouTube allow anyone with an account to produce and share their visions. The door has been opened for new expressions, and we continue to see the use of multiple views in more polished videos. However, amateur videographers often still utilize only a single camera in their work. This may be because of the newness of the platforms or because the embrace of individual expression has revived our acceptance of single perspectives. Whichever way we wish to look at it, digital video media is here to stay, and in order to keep up with the volume of demand, we must continually innovate with the use of new angles and perspectives.[7]

This proves that public interest in visual media is captured by the many uses of cameras and points of view. We as people are storytellers, and a single camera, a single perspective, doesn't always fulfill a narrative the same way many views, or many perspectives can. New uses of single camera perspectives has once again gained prominence through social media site, but as less-trained individuals mature in their skill set, we may see more use of edits like cuts and closeups to better tell our stories.

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[6] NFL; "History of Instant Replay | NFL Football Operations." n.d. Accessed December 7, 2019. https://operations.nfl.com/the-game/history-of-instant-replay/.

[7] Hamer, Adam. 2018. "Why multicam is possibly the best way to shoot drama." Redsharknews.com March 23, 2018. https://www.redsharknews.com/production/item/5284-why-multicam-is-possibly-the-best-way-to-shoot-drama

YouTube

It is hard to describe YouTube without stating the obvious: it's huge. More than 2 billion people actively use YouTube every month.[8] If you consider that there are approximately 4.5 billion people online worldwide,[9] that means YouTube is used by over 44% of all the world's online users. That's a lot of people! More than 1 billion hours of video are watched every day. That's a lot of content!

YouTube has a vast global reach. Mind you, not all content is educational, and not all content is good, but According to Google Insights, the most watched categories of content are *Comedy*, *Music*, *Entertainment*/*Pop Culture*, and *How-To*.[10] It is the *How-To* we will be focusing on.

If we can assume tutorials are guides for learning, then a video documenting steps in a process should feasibly allow the viewer the opportunity to follow the steps and achieve similar results. However, as far as YouTube is concerned, video tutorials are not restricted to the category of Education. How to replace your headlight bulb. How to get the perfect ombre for your nails. How to use Adobe InDesign. Despite not being placed in the Education category.

For instance, YouTube videos labeled as Style may include a large variety of makeup and fashion tutorials. Science & Technology houses a volume of lessons ranging from software tutorials to product unboxings. In-fact, a quick YouTube search with "How-to" brings up videos from the Entertainment, Gaming, and Film & Animation categories before we ever find a video in the How-To or Education categories. This means tutorials and education are not limited to formalized higher learning.

YouTube is the leveling platform: anyone can jump in and create content. Other platforms with video tutorials are often pay-to-play. MasterClass, Udemy, and one of the newest, LinkedIn Learning, have paywalls for access. These websites construct highly polished videos with professional or celebrity instructors, but the higher production costs and talent fees require these sites to charge for their services. That limits the reach to provide content to a global audience. The only thing YouTube requires creators to possess is a camera and a means to upload through a smartphone or computer.

YouTube tutorials are generally asynchronous, meaning, the content is uploaded and published with little if any immediate back & forth with the viewer. Occasionally, live, or synchronous videos will allow for chat, or even paid Super Chat, where questions from the viewership can be seen and addressed at will by the content creators. Some artists opt to Premiere their product, a YouTube option, thereby building hype and a communal audience prior to a scheduled publication. The community can view and chat with the creators, the video is watched, and creators engage with their audience for a specified time. These comments provide valuable feedback for the artists and allows them to make adjustments to the content for the benefit of the viewership.

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[8] YouTube; "Press - YouTube." n.d. Youtube. Accessed December 28, 2019. https://www.youtube.com/about/press/.

[9] Clement, J.; "Global Digital Population 2019 | Statista." n.d. Statista. Accessed December 28, 2019. https://www.statista.com/statistics/617136/digital-population-worldwide/.

[10] Google Insights; "The Latest YouTube Stats on When, Where, and What People Watch." n.d. Think with Google. Accessed December 15, 2019. https://www.thinkwithgoogle.com/data-collections/youtube-stats-video-consumption-trends/.

Research Design and Methods

Aims and Objectives

In order to understand the system, we must first establish basic requirements for common video tutorials. Specifically, we hope to create a set of criteria by which to design and evaluate concepts. Conceptual artifacts will be rated according to the set parameters and weighed against each other to discover the best solution that meets the most requirements. That concept will then be further refined to shore up criteria where it may falter. We will review existing examples and costs to better understand the economic value of the tool in the digital camera market. Finally, we will discuss the importance and implications of such a tool and possibilities for future research.

Practicalities and Potential Obstacles

One might generalize tutorials to be of purely educational value. After all, 'tutoring,' or the act of guiding through personal instruction dates back as far as Ancient Greece. Sources differ as to what constitutes an online tutorial. According to the University of South Queensland, traditional tutorials are "smaller classes which allow discussion of lecture content and assignments. You can ask questions and clarify what you have studied."[11] TechSmith, "the global leader in screen recording and screen capture software," lists video tutorials as a form of instructional video, going so far as to call them the go-to method for teaching a process or step-by-step walkthroughs . Even formal online tutorials have sets of rules guiding how a lesson plan should be conducted.[12] How does this relate to YouTube, where the content is rarely live, and creators broadcast to a worldwide audience, not just to a small classroom?

> *"Online interaction is essentially verbal, so that nonverbal cues, often considered essential to the tutoring process, are not present. For example, in a text transferred back and forth online (asynchronous paper review), facial expressions, body movements and eye contact are not present. Both the tutor and the learner may need experience with the medium to get used to this. However, face-to-face meetings are not actually essential, since, with training, online tutors can exploit features of the online environment to communicate in new ways, such as by sketching on whiteboards or using a shared online calculator. The learner may be invited to reflect on the discussion or consult specific resources."[13]*

For our purposes, we will assume that videos intending to pass along detailed information will be considered a tutorial, as the aim and purpose of the content is to inform the viewing audience. This will include promotional product reviews, such as unboxing videos. We will not require the content creator themselves to be highly informed of the product they are reviewing. In fact, one of the appeals of an 'unboxing' video is the surprise and discovery associated with unveiling with your audience. They, the audience, get to 'share' the experience with the content creator.

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[11] "What's the Difference between a Lecture, a Tutorial and a Workshop?: Ask USQ Current Students." n.d. Accessed November 21, 2019. https://usqassist.custhelp.com/app/answers/detail/a_id/4759/~/whats-the-difference-between-a-lecture%2C-a-tutorial-and-a-workshop%3F.

[12] Turrentine, P., and L. (2006) MacDonald. May, 12, 2006. "Tutoring Online: Increasing Effectiveness with Best Practices." http://lacmsig.pbworks.com/f/tutoring%20online.pdf. May, 12, 2006. http://lacmsig.pbworks.com/f/tutoring%20online.pdf.

[13] Wikipedia contributors. 2019c. "Online Tutoring." Wikipedia, The Free Encyclopedia. December 19, 2019. https://en.wikipedia.org/w/index.php?title=Online_tutoring&oldid=931516278.

Video Setup

The setup of cameras for a common tutorial will be further discussed in User Needs, however, other aspects should be pointed out prior to that review. Backgrounds must be managed, for they are part of the overall *mise-en-scène*. These may interfere with the attention of the viewer, causing them to lose focus and miss key elements of the tutorial. To remove any distractions from the surroundings, plain white fill panels will be added to the frames. This eliminates a great need to keep the area around the filming platform clear of distractions. A creator has the option of removing the panels for their own purposes as they explore how they wish to display content.

As an example of a clean video layout, consider the setup used by the popular YouTube channel Unbox Therapy. With 15.7 million subscribers, it has found an incredibly effective means of finding and keeping an audience. With their simple, almost sterile background, plain table top, and minimal camera angles, they effortlessly showcase the products they review without averting from the content. This elimination of clutter and distraction pulls the viewer completely into the video.

High quality image and multiple viewpoints are not the only aspects of good video craft. After all, a terrible lesson recorded in 4K resolution is still a terrible lesson. Without pushing beyond the scope of this thesis, we will briefly state a few seemingly obvious points on good content. Other aspects of the experience should include knowing your audience, what they want or need to see, video preparation, presenting, and editing.[14] These together contribute to the overall level of quality and make the final content better. Dive deeper into understanding the YouTube algorithms, and chances are a popular, possibly viral video can be produced.

Lastly, the presenter, the artist, the talent - the person in front of the camera - provides a large portion of the video content. They are the human aspect of a video and make it relatable, as will be reviewed in depth in the next section under subheading *Primary View*. A poor presenter, unless fantastically so, can make the content dull and less engaging.

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[14] Perssico, Ashley. 2016. "10 Things You Need to Do When Getting Started on YouTube | Constant Contact." Constant Contact. August 1, 2016. https://blogs.constantcontact.com/getting-started-on-youtube/.

User Needs

Videography begins with a camera setup. Whether it is a high quality DSLR or a simple camera phone, the filming begins with the push of a button. The camera, regardless of the make or model, must be placed in a position directed at the subject. That subject can be anything: the person making the film, an object of interest, a landscape. To achieve the best frame, the artist must set up the camera on a tripod, a special camera mount, or even a stack of books to gain the right angle. For overhead views, custom rigs must be constructed to gain height over the subject without getting in the way.

All options will at some point lead to monetary costs. How much a person is willing to spend largely depends upon financial budgets, but desire for a particular product or sometimes local availability can be the difference between a good purchase and a great purchase. The choice becomes an investment to be used over and over again. Creative endeavors ultimately change and new means to express this may require more equipment, but the original purchases should be of enough value to carry the artist through their beginnings.

As a beginner, the author used an iPhone camera to take detail shots, but soon realized that more was needed for his desired output. He was gifted a GoPro within two months which increased his ability to tell a story. After purchasing some simple mounts for the GoPro and, in conjunction with a propped up phone, was able to create more intriguing content.

One great benefit of having multiple cameras is the ability to tell a story with fewer lines. By this, it is to mean decreasing the amount of time and takes to achieve the end result. If the user only has one camera and desires to add various shots, they must tell their story, pause, move the camera into another position, and retell the story, all the while hoping for continuity between cuts. Three or four perspectives multiplies the required setups and repeats. With forethought, a script can be written, and read multiple times, but the authenticity of a moment might be lost. In comparison, if two or more cameras are rolling, a person can capture a single moment from many perspectives without having to readjust and repeat.

For this thesis, we will assume three main views, much like Unbox Therapy uses, to be ideal. These shots will be the primary, secondary, and tertiary, or detail views. Combining aspects from these three core views into a single linear narrative allows the artist to best present themselves and their subject to an audience.

Primary View
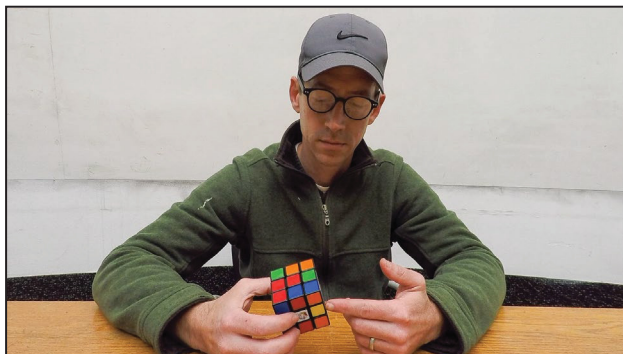
Fig. 1. Primary View, Front

A camera placed in front of the talent will give the artist an opportunity to address viewers directly, and the audience will conversely come to know the talent. This is important. We are human, and we are evolved to seek human faces.[15] We see faces in ordinary objects, a phenomenon called pareidolia. We gather social cues, like reactions of disgust and surprise, that

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[15] Quiroga, R. Quian, L. Reddy, G. Kreiman, C. Koch, and I. Fried. 2005. "Invariant Visual Representation by Single Neurons in the Human Brain." *Nature* 435 (7045): 1102–7. https://doi.org/10.1038/nature03687.

we can then understand and use in our everyday lives. Even from a video, we can register these cues much as we can in person. As we continue to watch, trust is built through the familiarity principle,[16] and we allow ourselves to become immersed in the content. The artist can utilize this to best effect by placing a camera towards themselves, thereby connecting with the audience. I consider the front view to be primary, as it involves the human in all of us.

Secondary View
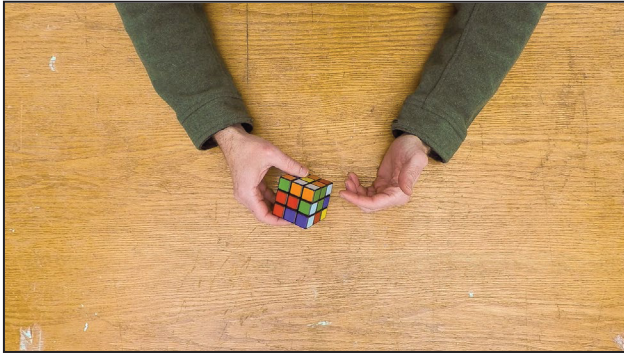
Fig. 2. Secondary View, Overhead

If the artist themselves is the main focus of video, then one camera may be all that is needed, such as is the case with NikkieTutorials. However, if a subject other than the artist is to be reviewed, then a secondary view should be used to capture and describe it. In the case of software items, a screenshot can be utilized, but for this thesis, it is assumed a physical object will be the subject. Capturing this can take the form of an overhead camera or from the side. The artist presents the object for the view to see and review with them. Overheads, or birds-eye views, can display the tabletop in much the same way the artists see it. This gives can give us a frame of reference between the artist and the object, and it is important for the audience to be able to relate. In a similar way, side views simulate a person's ability to stand or watch near the action. We have often stood in front of a teacher or mentor as they demonstrate, and therefore we can relate to the video's form of instruction through this view.

Tertiary View
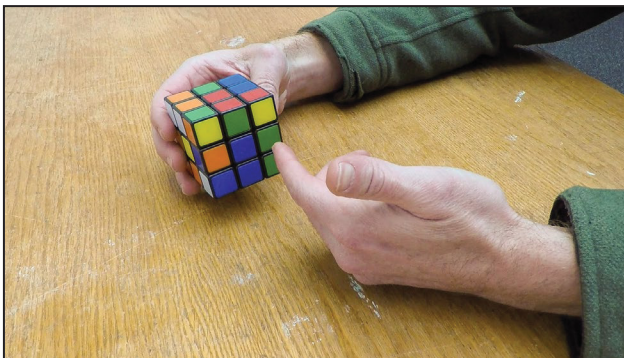
Fig. 3. Tertiary View, Side Closeup

Much as the primary and secondary views can deliver information, the audience cannot zoom in or out of a video to get a closer look. Closeup shots, or detail views, can bring to light careful particulars of the subject. The artist can examine the object in front of them by bringing it close to the eye. To simulate this, the artist can also move the subject towards the camera or vice versa to point out the information they themselves see to the audience. Smith's use of the closeup shot in "Grandma's Reading Glass' taps into the curiosity we all hold by using a magnifying glass as the mechanism to transition from a front view to a closeup view.

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[16] Wikipedia contributors. 2019b. "Mere-Exposure Effect." Wikipedia, The Free Encyclopedia. December 18, 2019. https://en.wikipedia.org/w/index.php?title=Mere-exposure_effect&oldid=931297893.

Case Studies

Bon Appétit

Bon Appétit, owned by Condé Nast, is one of the world's most respected food magazines, having showcased fine foods since 1956. To increase their online presence, BA crafted an incredible video powerhouse through YouTube. A recent episode of Hot Ones, the show with hot questions and even hotter wings, interviewed Brad Leone, one of BA's editors and onscreen personalities. In the conversation, they discussed the evolution of Bon Appétit's YouTube content. Originally, the company showed 'hands & pans' overhead shots typical of many popular how-to cooking videos. In 2016, Creative Director Alex Grossman conceived a more casual approach to videos: showcase the staff in their natural environment. The first "It's Alive with Brad" video followed the eccentric chef through the BA Test Kitchen as he explained his process of making kombucha. Smash hit. It has millions of views. The success of the show and others that followed completely changed the way Condé Nast produces their video content. Bon Appétit has garnished almost 5 million subscribers and nearly a billion views.

Images Credit: Bon Appétit / Condé Nast Entertainment.

Fig. 4. Primary View, Front, Artist, Amiel Stanek [17]

Fig. 5. Secondary View, Overhead, Subject, Salmon [18]

Fig. 6. Tertiary View, Closeup, Salmon [19]

[17] ...y to Cook Salmon (43 Methods) | Bon Appétit." YouTube. October 21, 2019. https://www.youtube.com/watch?v=AbxbOd_mtn8

[18] Ibid.

[19] Ibid.

Bob Ross, Inc.

From the very beginning, *The Joy of Painting* television series on PBS was a hit. Following the footsteps of its predecessor, *The Magic of Oil Painting* with Bill Alexander, the stars of the video, Bob Ross, along with his voice, his encouragement, and his luscious canvas landscapes were masterfully captured with only two camera angles. The front medium shot displayed both Ross and easel, while the side rear shot took closeup details of either canvas or palette. The tutorials were filmed in real time and cut between the man with his art and various close-ups while he worked. Interestingly, the subject, the canvas, is a two-dimensional object. It reads similarly from most directions and may not need additionally cameras. However, due to the additions of the multiple separate shots, we connect with the artist and better understand the mechanics of how he created. Nearly 25 years after his final show, Bob Ross' videos maintain their relevance today. The Bob Ross Inc. has uploaded every video he created to the YouTube platform, sparking a renewed interest of 3.4 million YouTube subscribers and nearly 300 million views. *The Joy of Painting* lives on.

Images Credit: Bob Ross, Inc.

Fig. 7. Primary View, Front, Artist, Bob Ross [20]

Fig. 8. Secondary View, Side, Subject, Canvas [21]

Fig. 9. Tertiary View, Closeup, Palette [22]

[20] Bob Ross, Inc. 2016. "Bob Ross - Island in the Wilderness (Season 29 Episode 1)." Youtube. November 28, 2016. https://www.youtube.com/watch?v=lLWEXRAnQd0&t=636s.
[21] Ibid.
[22] Ibid.

UnboxTherapy

Arguably one of the most popular channels on YouTube, Lewis Hilsenteger's *UnboxTherapy* reigns king of the unboxing video world, where showcasing and reviewing new gear directly out of the box is the focus. With almost 16 million subscribers, Lew and his team have set a standard for high quality videos, yet, possibly surprisingly, only three cameras are utilized on set. The main camera is a front wide shot, the side camera gives dynamic details, and the overhead gives the overall table view. This is a far cry from his first videos that only had a single overhead shot, beginning in late 2010. It was not until mid-2013 he began to employ more head-on views as additions, not stand-alones, to his videos. In MKBHD's behind-the-scenes video of the UnboxTherapy set, Lew comments "when you're starting on YouTube, you're experimenting a lot. You're just like, maybe this will work. Maybe that will work."[23] It goes to show that trial and error can lead to success.

Images Credit: Marques Brownlee/MKBHD

Fig. 10. Primary View, Front, Artist [24]

Fig. 11. Secondary View, Overhead, Subject [25]

Fig. 12. Tertiary View, Closeup, Subject [26]

[23] Brownlee, Marques. 2019a. "Behind the Scenes of the UnboxTherapy Studio!" Youtube. January 26, 2019. https://www.youtube.com/watch?v=9ZjlFZ3_b9E&t=443s.
[24] Ibid.
[25] Ibid.
[26] Ibid.

Marques Brownlee | MKBHD

Similar to *UnboxTherapy* for his reviews of brand-new technologies, YouTuber and influencer Marques Brownlee's sets himself apart by also interviewing many of the world's most powerful people in technology, including Bill Gates and Elon Musk. His channel MKBHD garnishes over 10 million subscribers with large format 8K video. Though he uses many different views, his three go-tos are the same camera angles already described: *Primary*, *Secondary*, and *Tertiary*.

Images Credit: Marques Brownlee/MKBHD

Fig. 13. Primary View, Front, Artist [27]

Fig. 14. Secondary View, Overhead, Subject[28]

Fig. 15. Tertiary View, Closeup, Detail [29]

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[27] Brownlee, Marques. 2019b. "The Most Expensive iPhone in the World!" Youtube. December 26, 2019. https://www.youtube.com/watch?v=gl62BSjp7Vo.
[28] Ibid.
[29] Ibid.

Ingleton Pottery

In contrast to the previous cases, YouTuber Dan Unsworth of the popular *Ingleton Pottery* channel has amassed 383,000 subscribers by generating content from only one camera angle. Most often, his potter's wheel is framed with a front shot. However, from time to time, he will change angles. His first known adjustment came about in December of 2017 with his "*Making a Pottery Bowl: Side on view*." "A lot of people have been asking me about different angles," *he begins. "So I'm trying it from this side for the first time."* In one of his most recent uploads, "*Making some Small Pottery Bowls on the Wheel: Overhead View*," Dan provided a shot from above the workspace. "I just thought I'd try a bit of a different view. I've got the camera up above me. Don't know if you'll get a different angle, but we'll see." The comments that followed applauded the latest change, with some requesting multiple views. It is unclear why Mr. Unsworth uses only one camera and not multiples, but his willingness to try new ideas harkens back to Lew of Unbox Therapy's comment about trial and error. It could be Mr. Unsworth stays with his simplified format, or that multiple views will become an avenue he wishes to explore in the future.

Images Credit: Dan Unsworth/Ingleton Pottery

Fig. 16. Primary View, Front, Artist [30]

Fig. 17. Secondary View 1, Side, Subject [31]

Fig. 18. Secondary View 2, Overhead, Subject [32]

[30] Unsworth, Dan. 2019a. "Making a Clay Pottery Moon Jar on the Wheel." Youtube. July 3, 2019. https://www.youtube.com/watch?v=rTTLDTb5eLM&t=516s.

[31] Unsworth, Dan. 2017. "Making a Pottery Bowl : Side on View." Youtube. December 18, 2017. https://www.youtube.com/watch?v=JDyRSsdLVJk&t=237s.

[32] Unsworth, Dan. 2019b. "Making Some Small Pottery Bowls on the Wheel : Overhead View." Youtube. November 2, 2019. https://www.youtube.com/watch?v=ofWl5LtOvhU&t=40s.

Special Cases

Mark Crilley

Mark Crilley is an illustrator, author and YouTube star with 3.3 million subscribers. The subjects of his videos are drawings, of course, primarily pencil. You never see his face, pencil box, or other tools he might use off-camera. You only see the drawing. This is a two-dimensional object. There really are no additional facets available for us that we need to understand. If Mark Crilley wanted to showcase his personality more, much like Bob Ross did in *The Joy of Painting*, he could set up a front camera and talk directly to his audience, or if we needed to know how a pencil is sharpened, then a detail shot might be useful. However, for his current purposes, one camera is enough. We will briefly review capturing two-dimensional objects in the next section under subheading *Perfect Sphere*.

Images Credit: Mark Crilley
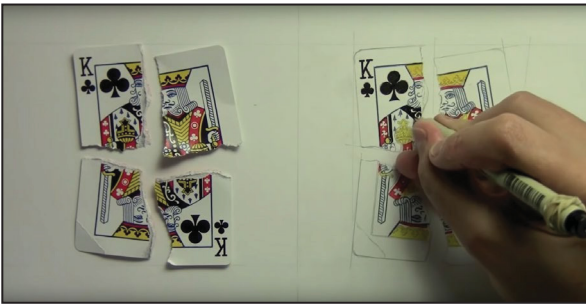
Fig. 19. Primary View, Overhead, Subject [33]
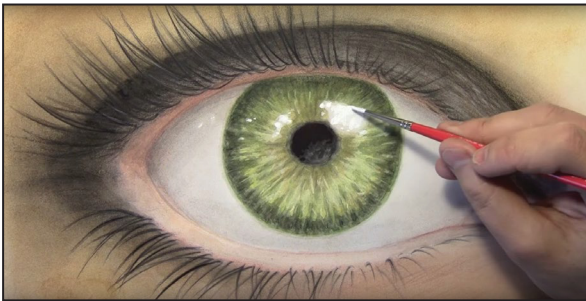
Fig. 20. Primary View, Overhead, Subject [34]
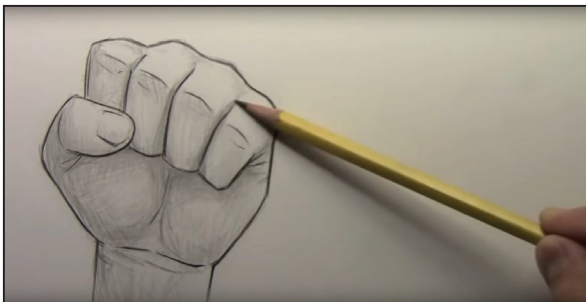
Fig. 21. Primary View, Overhead, Subject [35]

[33] Crilley, Mark. 2012. "Realism Challenge #3: Playing Card." Youtube. August 24, 2012. https://www.youtube.com/watch?v=XuMuGYCW63w.

[34] Crilley, Mark. 2011a. "How to Paint a Realistic Eye [Coloring Tutorial]." Youtube. November 18, 2011. https://www.youtube.com/watch?v=iybQwiJWToM&t=233s.

[35] Crilley, Mark. 2011b. "How to Draw Hands, 2 Different Ways [HTD Video #3]." Youtube. June 10, 2011. https://www.youtube.com/watch?v=CHZLop6fd3o&t=340s.

NikkieTutorials

Dutch makeup artist Nikkie de Jager has made a name for herself on YouTube by providing high quality and entertaining tutorials. For more than a decade, she has given her audience the opportunity to understand how she applies makeup in various ways to produce various effects. Celebrities such as Snoop Dogg,Drew Barrymore, Kim Kardashian, and Lady Gaga have appeared on her show, and it is as popular as ever. Surprisingly, *NikkieTutorials* only uses a single camera for tutorials, which is a front shot. We believe, like the drawing tutorials, that this is a unique situation that only requires the single shot. Even though the subject of the video is three-dimensional, i.e. the front of the person - the face, there is no need to show the side or top of the head, nor the back of it. She blends colors, textures and powder directly on her face and does not need to display any additional information happening off camera. Her face is personality, the palette and the canvas. Nikkie puts her best face forward, and that's all she needs.

Images Credit: Nikkie de Jager/NikkieTutorials

Fig. 22. Primary View, Front, Artist, Subject, Palette [36]

Fig. 23. Primary View, Front, Artist, Subject, Palette [37]
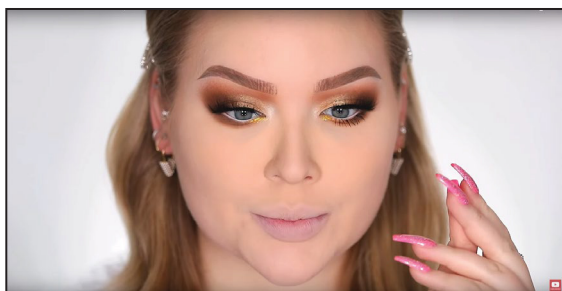
Fig. 24. Primary View, Front, Artist, Subject, Palette [38]

[36] NikkieTutorials. 2019c. "HOW TO FAKE FULL FLUFFY BROWS!! OMG! | NikkieTutorials." Youtube. November 10, 2019. https://www.youtube.com/watch?v=unLNOxFVASw&t=794s.

[37] NikkieTutorials. 2019b. "SHANE DAWSON X JEFFREE STAR Conspiracy Palette... THE TRUTH!!! | NikkieTutorials." Youtube. November 1, 2019. https://www.youtube.com/watch?v=EUb2dvsJmAI&t=861s.

[38] NikkieTutorials. 2019a. "SPEAKING DUTCH ONLY Makeup Tutorial! | NikkieTutorials." Youtube. July 18, 2019. https://www.youtube.com/watch?v=jL0qadiKDlQ&t=530s.

Multi-Cam Prototype

To gain a better understanding of how to incorporate multiple views into a product, we constructed a physical framework, mounted multiple cameras, and recorded three tutorials. The frame itself was constructed from PVC pipe and fittings. The six cameras used were Dragon Touch Vision 3s. These cameras are of similar size and capabilities as GoPro cameras. The three tutorials showcased practical design concepts. The demonstrations helped gauge the weaknesses of this prototype and establish parameters by which to gauge future concepts.

Through these exercises, we learned some limitations, specifically that, as constructed, the framework was not conducive for various height adjustments as needed by the user. This could be in the form of stationary cameras that required considerable effort to reposition, as well as working height for users who wished to stand or were of tall stature. A less limiting, more adjustable system was needed.

The camera placement also indicated other limitations. For instance, the right-handed users often blocked the view of the subject when manipulating their objects as seen from the audience-right camera position. This negated the potential usefulness of these right-camera views. The audience-left camera was found to not be as useful for the same reasons. This opens the possibility to review proper left/right orientations for camera positions in the future depending on subject matter and handedness.

Lastly, the Dragon Touch cameras each come with a remote control. However, it was found that one remote could operate all six cameras simultaneously. This was of great value to the operator, who was able to start and stop all cameras without having to interact with each one individually. Nevertheless, the remote did not turn on and off cameras, therefore the operator had to interact with each with great frustration. The findings of this preliminary work will be further explored in future research *Appendix B*.
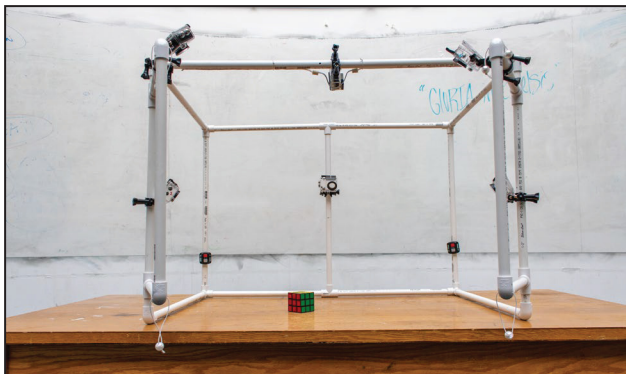
Fig. 25. Multi-cam Setup, Frame, Front

C1: Camera 1. Front View
C2: Camera 2. Audience-Right Side View
C3: Camera 3. Audience-Left Side View
C4: Camera 4. Overhead
C5: Camera 5. Over-the-Shoulder, User Left
C6: Camera 6. Over-the-Shoulder, User Right
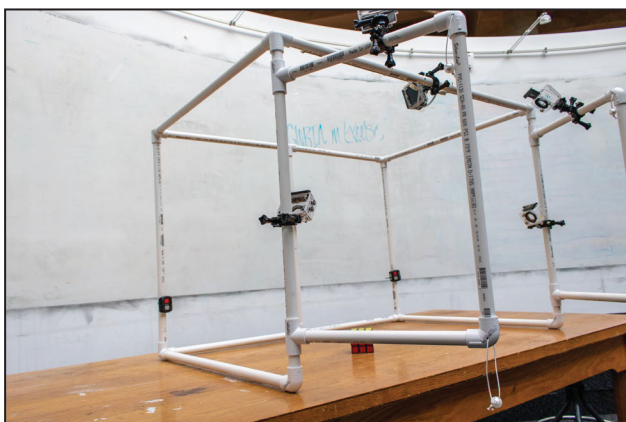
Fig. 26. Multi-cam Setup, Frame, Perspective
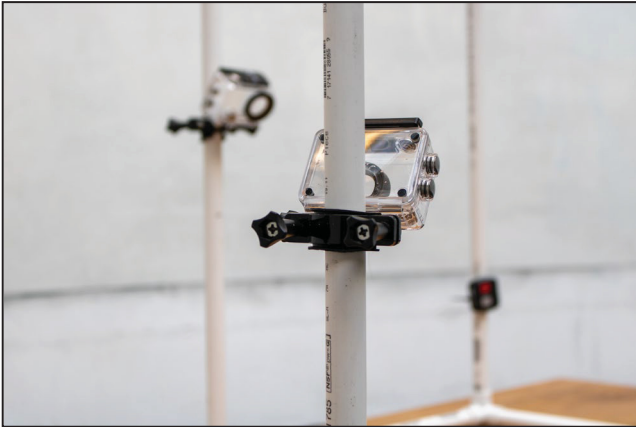
Fig. 27. Multi-cam Setup, Camera Detail 1

Camera pipe mounts held the cameras into place. A remote to operate all cameras simultaneously can be seen at the far corner.
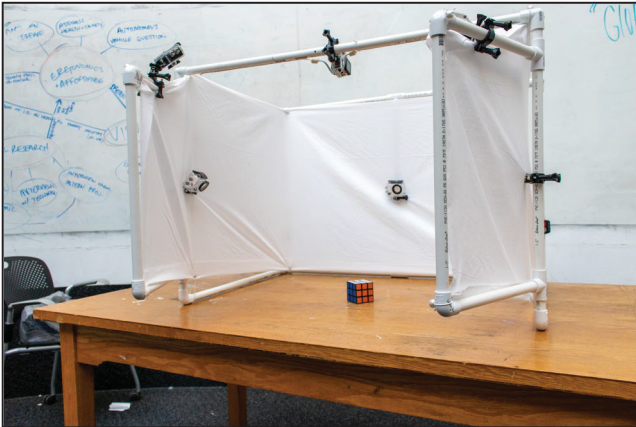
Fig. 28. Multi-cam Setup, Shrouded

A shroud was added to the frame to prevent distraction of the *mise-en-scène*.

Fig. 29. Multi-cam, Camera Detail 2

The camera mounts were situated through holes cut in the shroud fabric. Camera 2 (**C2**) is visible in Fig. 5.

Fig. 30. Multi-cam, Pinch Pot

Pinch Pot

Our first tutorial, *"How to Make a Pinch Pot,"* allowed us to discover several things:

First: We recognized the height limitations. Although the instructor was mindful of the camera, it was found that the position was not conducive for a standing height. This system had not
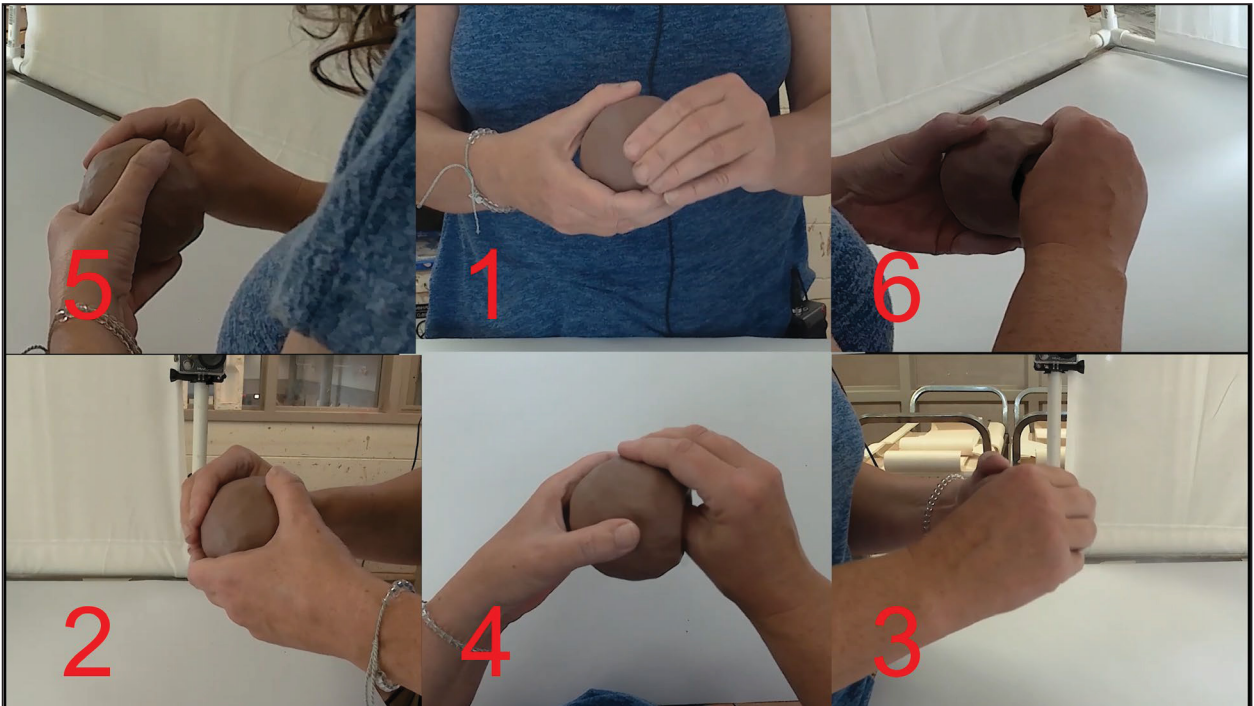
ability to adjust to correct for this.

Fig. 31. Multi-cam, Pinch Pot, Multi-view

Second: After reviewing the footage, it was found that C2, the audience-right view, did not allow much information to be passed along due to the instructor holding the subject matter, the pinch pot, in her hand. C3, audience-left view, also limited visibility of the subject matter.

Third: When combining the six videos into one single video frame, it was found that certain placements may cause confusion or disorientation. For instance, if the right hand of the instructor moved to her right, we would visually see it go left on the screen. Conversely, if the same hand moved right in C4, we would also see it go right on the screen. If combined, they move in opposite directions, even though the instructor's movements are the same. To correct this, C1 was reversed, like a mirror, as can be seen in Fig. 6. This form of mirroring is also used by applications like Apple's Facetime.

Fourth: The over-the-shoulder cameras needed to be placed above the side cameras, as having them below an image they are visibly above makes less sense to the viewer. It might be compared to having an aerial view placed below a ground-level view.

Fifth: Right-handed views like C3 & C6 were placed on the right, and left-handed views like C2 & C5 were placed upon the left. The orientation of camera angle corresponds with our own body movements. This mirroring prevents us from being confused. Further understanding to be reviewed in future research.

Foam Block
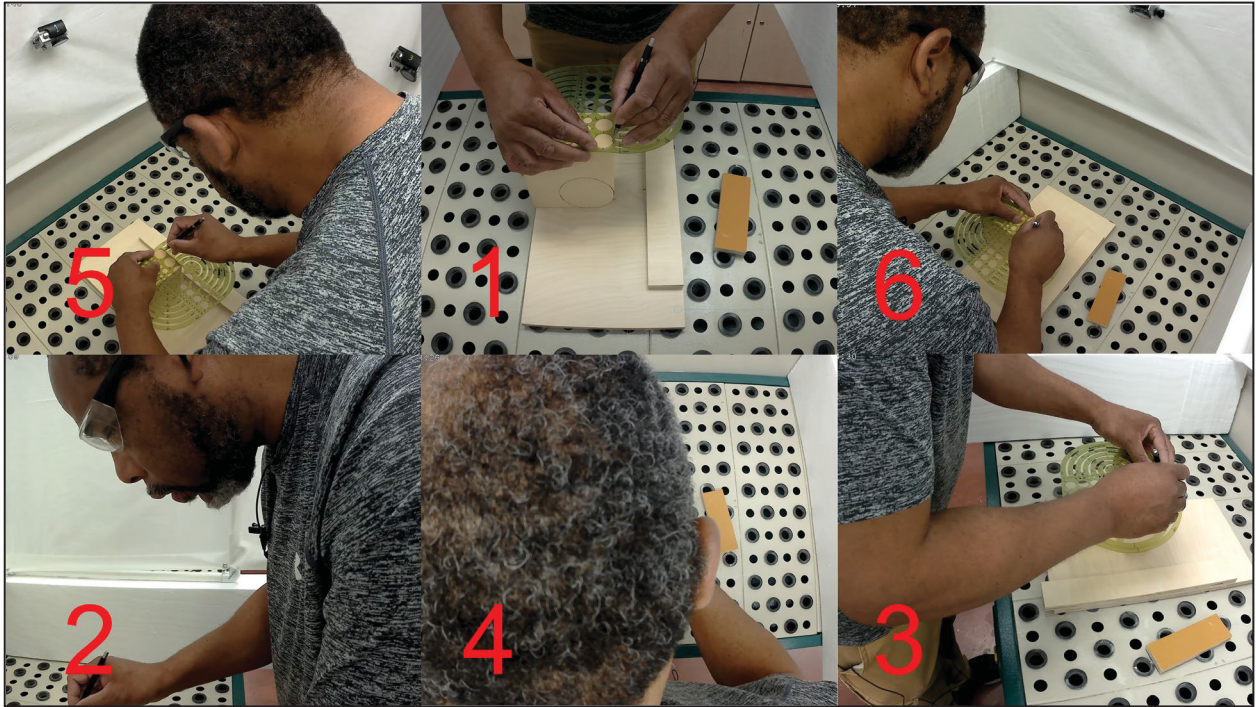
Fig. 32. Multi-cam, Foam Block, Multi-view

Our second tutorial, *"Shaping a Radius on a Foam Block"* the instructor defines a specific radius around a curve, then shapes the radius through a series of steps. This video gave us more information about the multi-cam rig.

First: It further proved that the height of the overhead camera C4 needed addressing. Even with supports under the multi-cam frame (Fig. 8. C6), the instructor bumped into the C4 camera multiple times and was often blocked its field of view.

Second: We found that the inability to see the monitor of the cameras resulted in poor framing, as can be seen in Fig. 8. C2.

Third: Information is still lost due to handedness in certain views. In Fig. 8, we can clearly see the demonstration in C5, but we cannot understand what is happening in either C3 or C6. Fourth: The orientation of the overhead cameras (C5, C6) had to change to accommodate the stature and build of the instructor, who varied from the first instructor. The camera mounts needed to be made more adjustable.

Perfect Sphere
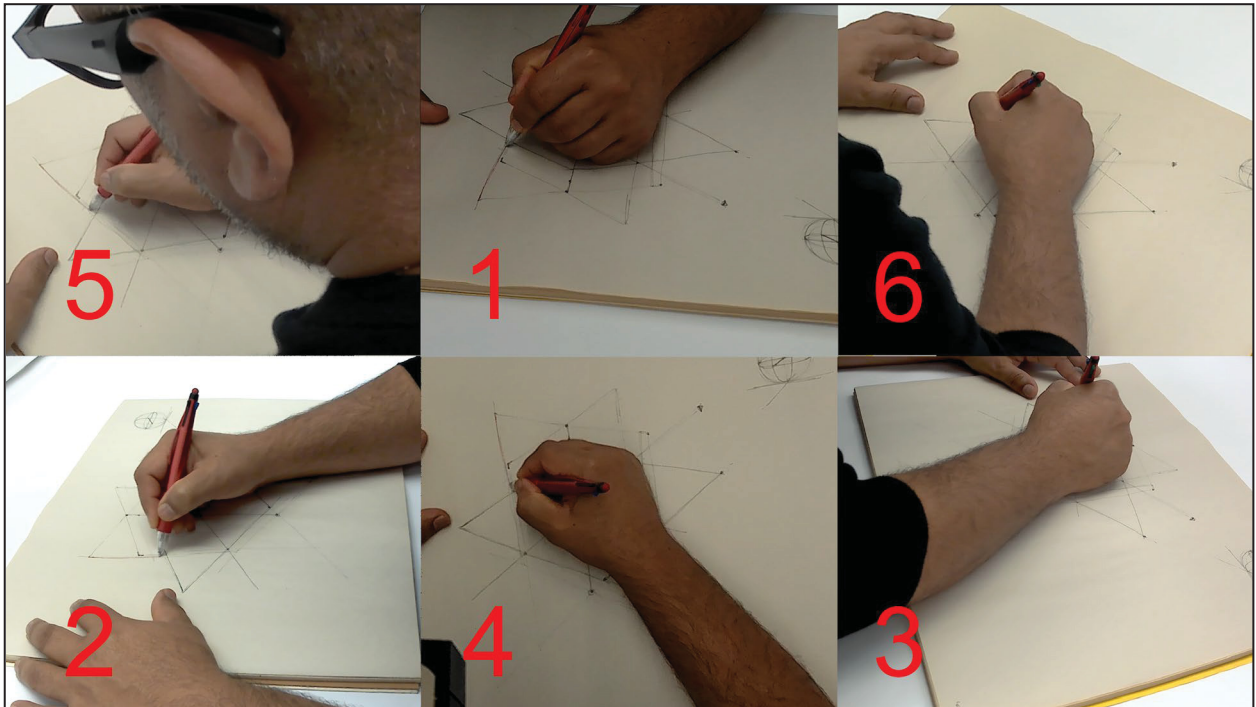
Fig. 33. Multi-cam, Perfect Sphere, Multi-view

For the third tutorial, "Drawing a Perfect Sphere," we had the instructor in a seated position. This removed interference of the C4 camera. However, despite the adjustments to position and adjustments to the overhead cameras, we still have the similar problems as before, such as mirroring of the C1 front camera, loss of information due to handedness as in C3 & C6 and blocking of views in C5.

With this particular tutorial, the instructor is working on a two-dimensional subject. Multiple points of view may not be needed, and the viewer may find they only need the C2 or the C4 view to understand the demonstration. Why is this? Do we subconsciously understand the differences of a two-dimensional subject versus three-dimensional, even if viewed on a two-dimension display like a television monitor? There are studies by Shepard & Metzler[39] and others that discuss these concepts in further depth, however, effectiveness of this will not be continually explored in this thesis. Future research will allow us to better understand how we might better design an effective tool with HCI and other fields (see *Appendix B*). However, as previously mentioned, other artists, including Mark Crilley and Nikkie de Jager use singular views to great effect and garnish billions of views (see *Case Studies*).

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[39] Shepard, Shenna; Metzler, Douglas. 1988. "Mental Rotation: Effects of Dimensionality of Objects and Type of Task" Journal of Experimental Psychology: Human Perception and Performance 1588, Vol. 14, No.1, pp 3-11.
http://nmr.mgh.harvard.edu/mkozhevnlab/wp-content/uploads/pdfs/courses/literature/Types%20of%20spatial%20transformations/SHEPARD_METZLER_1988.pdf

Concept Design Parameters

Without gathering input from human subjects, the author created a set of guidelines by which to gauge the value of the designs. They are guided by the author's experiences as a videography and professional industrial designer. In his video work, he often finds himself making camera adjustments to follow the changes in presentation of material. This may be moving a camera to the side to show a full view of his bonsai trees or close in to get detail shots. The author cannot lose himself in the work without neglecting cameras, and he cannot continually adjust cameras without sacrificing the creative moment. A balance must be made. Additionally, having experience as the primary estimator and designer for custom light fixtures allows the author to make certain assumptions for costs and user needs. Once the ability to gather information from human subjects is given, we can poll other users to gauge their own needs and desires and budgets for a camera product.

Beginning with the Number 1 as worst-case scenario and Number 5 as best-case scenario, we can look at how aspects of Manufacturing, Adjustability, Camera Angles, Portability, Repair & Upgrade, User Interface, and Aesthetics can be used to examine the quality of a product. Weights have not been given to the value of each Parameter. In future research, a value hierarchy will be produced through user surveys.

Manufacturing

The highest costs for a product come from manufacturing. Uses of materials will factor into manufacturing, such as injection molding for plastics and stampings for metal. With the assumption that the structural components of the concepts will be of metal, manufacturing costs may be considerable. Tooling, or the machinery involved in forming processes, increases with complexity. Molds for plastic injections or metal castings might have a high upfront cost, but they allow for high-volume high-quality components. Machining removes material from extruded metal components through a subtractive process, drills and taps holes in integral bosses, and can add value for their high precision. Labor, as the human side of manufacturing, can be decreased through the use of high-volume processes and parts. The more complex a product becomes the higher the labor costs during assembly. Additionally, the delicate work of human hands for custom details adds value for their craftsmanship but increases the costs.

Manufacturing Parameters:

1. **Bespoke**

    A very labor-intensive process, human hands touch and manufacture nearly every component of the unit. Careful details and techniques render raw materials into beautiful one-of-a-kind products. The result can be admired as the culmination of thought and ingenuity. A custom rifle with engraved filigree and knurled walnut stock pairs with gold and mother-of-pearl inlay speaks of luxury and attention to detail. You will not find this available in any store.

    1. Fully custom components.

    2. Handmade.

3. Specialized tools

4. Complex assembly

2. Technical

Well-engineered products may find aspects of their manufacture very expensive. Intricate machining and multiple components add to the complexity of the build. A custom tool may be required to fit special components together. The casing of a MacBook is made through the machining of a single aluminum billet. But the subtle curves leave no right angles which allows light to wash over in a subtle gradient.

1. Multiple components

2. Specialized systems.

3. Some complex machining

4. Detailed assembly

3. Streamlined

As production volume increases, so does the opportunity to decrease labor and specialized tooling. In some cases, extrusions make sense. If engineered well, they can simplify the assembly by lowering the quantity of processes necessary for manufacture. Assembly lines make specialized tasks routine and increase throughput. Some tasks can be automated for accuracy, further eliminating human error. GoPro cameras have stamped and injected molded parts that accurately fit together. Micro componentry like circuit boards and soldered connections are automated.

1. Extrusions

2. Basic machining

3. Assembly lines

4. Fewer parts

4. Mass Production

A simplified design lends itself well to mass-production. Lower quality and quantity of components make assembly easy, and with automation, almost put an end to human input. Expensive, but well-made tooling has initial up-front costs, but lowers overall end cost to consumers through volume. Many cheap goods can be purchased through discount dealers and large box stores.

1. High-volume

2. Injection molding

3. Die-case

4. Minimal parts

5. **Off the Shelf**

    Sometimes a homemade solution works better than a bought version. Customization comes with the artist's vision, but may accrue sweat equity, time, and money. Local hardware stores provide PVC pipe, barstock, lumber and hardware for simple processes. The end product is definitely do-it-yourself, but if it gets the job done, then it may be the right solution for the user.

        1. Easily sourced materials

        2. Piecemeal

        3. DIY

        4. Cheap

Adjustability

No one particular setup works for everyone. Customization allows users the option to cherry pick their camera views. The more adjustability the setup has, the more flexible it can be for any situation. As seen in the Multi-Cam Prototype, the inability to adjust the framework can lead to lost opportunities to showcase concepts as well as interfere with the instructor's or artist's ability to perform their demonstrations. To see a selection of different views, please review the selections in *Case Studies* (pp. 20-26), *Multi-Cam Prototype* (pp. 27-31), and *VOODIO: FOV* (pp. 59-61)

Adjustability Parameters:

1. **One & Done**

    Whether mounted to a stationary object or created without joints, an immobile stand offers no adjustments.

        1. No adjustments after setup

2. **Monkey Wrench**

    Without careful consideration, even something as simple as TV wall mount may require the need for a screwdriver, wrench, or hammer. Repeated adjustments come at cost to the users time and energy. This reduces time spent creating the video.

        1. Requires tools

3. **Limited Use**

    A product that moves in only one linear direction offers little adjustment for necessary tasks. Think of a standard camera tripod. The legs adjust, but without a gimbaled top, it only allows a camera to move up and down or side to side. It cannot pivot to accommodate desired angles or perspectives. This option might

have some knobs to twist or latches to loosen, but they are integral to the design and do not require tools.

> 1. No tools required

4. **Two-Hands Rule**

> Some tools work great, but may require the use of both hands. This is not desirable if the subject of the video also requires at least one hand. If it is a messy subject, such as clay or Jello, then the user must lay down the product, clean hands, and make adjustments. The tripod may also fall in this category, as it often uses one hand to steady the camera while the other adjusts the tripod head. GoPro camera mounts can sometimes be adjusted through force against friction, but are manufactured to hold their positions through the toughest of actions. Their long-handled adjustment knobs require one hand while the camera is adjusted and held with the other.

> 1. Highly adjustable, but with two hands

5. **Fully Adjustable**

> Friction-held joints can allow a user to move a camera or mount with one hand while the other maintains its hold on the subject. Spring-loaded latches or tight tolerances can simplify the processes need to move perspectives. GorillaPods can create a tripod that bends and moves with one hand, while the camera swivels near effortlessly by the user. Software driven items also lend themselves to being fully adjustable. Automatic camera gimbals stabilize a shot and can sense the focus of the frame, keep them in frame, and move only when the user moves too far out of frame. Tracking cameras, like the OSBOT automatically move with the user.

> 1. Near limitless with one hand only

Camera Angles

Adjustments are not the only aspect of the usefulness of a setup rig in regards to the cameras. For multiple views you must have multiple cameras. Versatility of camera views creates better stories by offering new perspectives.

Camera Angle Parameters:

1. **Single Use Only**

> This is the standard for nearly all cameras: a single unit. Changing perspectives requires moving the camera from place to place, so a portable solution or highly adjustable system needs to be installed. More cameras must be purchased to gather simultaneous recording of a scene. Hidden cameras, often used for surveillance, are generally stationary with only one perspective. An example of a single view with flexible use is a handheld camera or a drone. Though the user

only has one unit, their mobility allows them to gather many perspectives that can be cut in edit or shown as one long shot.

1. Only one camera. Requires many units

2. **Extras Needed.**

It can be hard to find a one-size-fits-all solution, so while certain cases may allow some flexibility, they may still require the purchase of multiple units. Even the mobile filmmaker may wish to add new views. In a card came like Texas Holdem, camera crews install stationary cameras into the rails to provide hidden views of players' hands while an overhead shows the table and dealer. Sometimes a handheld is used to give moving shots of the players, chips and other interesting details.

1. Limited views – multiple units

3. **Gets the Job Done**

As you find your feet as a creator, you may also find that your first purchases no longer fit your needs. A solution that gets the job done means you have most bases covered for now and the near future. There may not be a reason to add more, but if a different perspective is desired that the product cannot provide without moving, a new purchase may be in order. I would consider this a common setup for many users. Several cameras are mounted in place, with another more mobile camera for flavorful shots.

1. All-in One with Limited views.

4. **Multiple options**

What else could a person want? Everything is contained in one cohesive assembly and all the shots needed are provided. It would take a large change in subject or creator focus to require more cameras or options. Ideally, the user can showcase a moment or detail on the fly with the full understanding a camera has captured it well.

1. A set quantity of versatile cameras

5. **Limitless**

This can go overboard, but knowing the option to add on anytime you need may be of comfort to some people. Not all views may be needed, but if you want to change it up for whatever reason, you can have the chance. This parameter may be extreme for the majority of users. Possible uses would include volumetric videography, where the more information from more views provides a clear picture of the object. The images could be processed to form three-dimensional data for virtual viewing.

1. Modular assembly with vast configurations

Portability

A change of scenery is nice. Sometimes that means moving locations, and for a camera rig, it must be portable. Many tripods are collapsible. Attachments can be thrown into a bag and sorted through later. Wires and cables and battery packs and spring clamps are often crammed together, creating a headache. For larger rigs, like jibs, the size is prohibitive to quick location changes. A desktop rig needs to be able to pack away easily and quickly if moving is a necessity.

Portability Parameters:

1. **Fixed**

   Much the same as adjustability, a camera setup that requires installation will not allow the user few, if any options. A wall or pillar-mounted TV screen is not going anywhere anytime soon. CCTV, or closed circuit television security cameras fit within this category. They may have wide angle lenses, and some pivot at the direction of a user's joystick, but mobility to & from various locations does not exist.

   1. Fully mounted. Hardware required

2. **Cumbersome**

   Furniture is generally mobile, but requires a laborious process. Armchairs are bulky, awkward, they often do not come apart, and might require wheeled equipment or multiple people to move. The user should not have to enlist the help of friends to move a camera system unless the juice is worth the squeeze. Large television and movie production cameras house massive systems and are usually mounted to an industrial dolly or wheeled cart.

   1. Some mobility. Requires two or more people

3. **Tools required**

   A large camera rig might have mechanical joints that require some assembly. Imagine a large fair tent with poles, corner joints, and central posts that break down into a bag, but must be pieced together. Similarly, a DIY overhead camera setup might have a few screws to remove in order for the walls to lay flat together. The system could be moved by one person, but some steps are in order first. An Erector set epitomizes this. Useful, but requires some elbow grease to break down. Panoramic camera rigs also utilize connected parts like rails, belts, gears, and motors. They are highly useful, but tools are required.

   1. Some disassembly/reassembly required

4. **Modular**

   Some camera systems have accessories that clip on with a squeeze clamp or a simple knob attachment. Think Tinker Toys, but for cameras. These can be easily removed for putting away. Many lighting rigs feature a tripod-style base with a removable lamp head and umbrella diffuser attachment. You can find most any solution for any surface with GoPro's versatile camera accessories. From spring

clamps to dog harnesses, they have you covered. The drawback is the expense and storage of so many possibilities.

    1. Easily breaks down

5. **Grab & Go**

Few, if any all-in-one camera systems exist. Some combinations can be found, however. The GorillaPod can be paired to a camera, and both can be put into a bag while still attached to each other. GoPro, as well, is compact and can remain within a protective polycarbonate housing attached to a selfie stick or mini tripod for portability. The ideal would be a small setup with integral cameras.

    1. Packable

Repair & Upgrades

Camera equipment is expensive. A videographer should expect their investment to last through years of continuous use. To me, a quality piece of equipment is durable, but things still break. Having the option to purchase a new component or accessory versus a complete new unit allows users the comfort of knowing the manufacturer has them, as the customer, in their best interests. As more technology becomes software driven, right-to-repair legislation has been fought against by companies such as Deere & Co. who claim their intellectual property must be protected, even at the cost of consumers.[40] However, companies such as GoPro, and even Apple, offer free software upgrades to fix operational bugs or add new features, but still limit the ability for a home user to physically repair. For this research, it is assumed all concepts have software upgrades available to them. Only physical repairs and upgrades are considered.

Repair & Upgrade Parameters:

1. **New Model Necessary**

Many companies want absolute control of their products and caution or fully prohibit customers and repair shops from modifying units. This speaks highly of a company's wish to provide the absolute pinnacle of a quality product and user experience, but disenfranchises the customer base when a repair is needed. The greatest example would be Apple and their iPhone. They have been notoriously protective of their product, disallowing private owners and techshops from modifying or repairing without compromising service. If you want an upgraded iPhone, you have to buy a new one.

    1. No ability to repair. Requires purchase of new unit

2. **Call in the Experts**

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[40] Deleon, Nicholas. 2018. "Right-to-Repair Laws Could Make It Easier to Get a Phone or Laptop Fixed." Consumer Reports. Accessed December 22, 2019. https://www.consumerreports.org/consumer-protection/right-to-repair-laws-could-make-it-easier-to-get-a-phone-or-laptop-fixed/.

Cameras house precision components such as optics and mirrors. There are dedicated companies who have the right to repair products and guarantee the workmanship, even if they are not authorized dealers. This is a great option for users who may not have the know-how or courage to disassemble their expensive equipment. Nationwide electronics dealer BestBuy has a dedicated repair service called the Geek Squad, which specializes in tech support and product servicing.

    1. Requires complex disassembly and special tools

3. **DIY**

Despite some companies holding their secrets tight, many enthusiasts and do-it-yourselfers offer online tutorials that describe where to purchase upgradable materials from sites like Alibaba, and how to make repairs from home. There is a vast trade in off-brand and aftermarket components for the hobbyist to buy, including specialty tools and detailed instructions for installation. Websites like IFIXIT and RepairClinic are dedicated to helping customers fix or upgrade their equipment by themselves. And if all else fails, take it to the repairman.

    1. Simple enough construction to allow general repairs.

    2. May include some complexity without being too technical.

4. **Instructions Included**

There are some companies that understand the importance of longevity when it comes to their products. If environmental impacts and public concerns are addressed by a company, then it's value may increase. Addressing public concerns and environmental impacts through extended life service and offerings for upgrades add value to a user experience. Giving a customer easy options and instructions to repair at home empowers the user to make choices on their own. Dell provides warrantied parts to repair, upgrade, and extend the life of their computer products. Some Sears stores even offer parts their customers can use themselves along with full repair services. A product that is designed well may be composed of simple joints and components that a home buyer can easily repair with common tools.

    1. Easy adjustments with common tools

5. **Plug & Play**

An intuitively designed product may simplify a repair or upgrade by making connection points easily accessed without requiring tools or sacrificing the integrity of the product. KitchenAid stand mixers, specifically the Model K, has cross-generational compatibility for all of its hub attachments, meaning, add-ons for the latest model will work with the oldest model, even the original 1937 model and vice-versa. This allows the consumer to reuse their favorite pasta maker attachment with their new mixer if their old appliance was beyond repair. The product commands a high price, but reliability and interchangeable parts keep this product on the market.

1. No wires. No hardware. Quick-change

User Interface

A camera should be easy to operate without having to refer to user manuals in the middle of filming. It should also be easily accessible to the user for quick adjustments to the framing, recording, and settings. As a solo videographer, the author finds inability to operate most cameras from the set a common problem. He finds himself removing himself from the frame, stopping and starting recording, and trying to get back into frame without losing continuity, that is, the consistency of each image from one cut to another in regards to placement of objects, including the talent.

User Interface Parameters:

1. **One at a time**

   Turning a camera on and off is part of the game. Having to turn multiple cameras on and off can become a chore. If each individual camera requires input, time is ultimately lost. Imagine having to get up to turn on the camera, adjust the frame, adjust the settings, to hit record, to stop record, turn off camera, and remove the SD card for download. That's seven steps for a simple shot that may only last a few seconds in the final cut. Multiply that for every camera in use, regardless of make. GoPro is a prime example, as the UI for the camera is on the back side away from the subject.

   1. UI at each camera.

   2. Requires user to leave set

2. **At Arm's Length**

   Some cameras have an LCD screen that flips open and rotates around for the human subject to visibly see the shot while still in frame. Touch screens allow the user to make inputs without having to leave the scene. This is common for Canon DSLRs like the T6i. Interacting with the camera will ultimately compromise the shot as the user reaches into frame to touch the controls. If unstabilized, the camera may shake. This will require some editing. As the user becomes more comfortable with their off-screen activities being captured by the rolling camera or if they take care to stabilize the camera properly, this may not be of great concern.

   1. UI controls per unit

   2. Requires reach

3. **Remote Control**

   Some cameras come with a remote control, like Dragon Touch, a GoPro knockoff. Whether in the form of a physical device provided with the camera or a mobile app you download to your phone remote control access can be very

user-friendly. A physical device may still require you to review the shot from the camera's UI, but a mobile app often lets you review the footage remotely. In either case, one remote per camera requires the user to provide individual inputs with multiple remotes. For this instance, each remote must be labeled and remembered by the user in the form of numbers, colors, or whatever scheme the user provides. Little thought is given in this regard by manufacturers, and the consumer finds themselves 'hacking' solutions with marker and tape. The benefits would be the ability to prepare a shot and begin recording at your leisure without having to leave the scene.

1. UI accessible remotely but for single cameras

4. Proximity

This solution would allow the user to remain within frame and operate each camera of the unit with inputs integral with the unit. This also requires the unit be of a large enough size so as to allow reach by the user without compromising the shot. It's a specialized case that applies to only a few concepts, but allows the user freedom.

1. UI integral without compromising the shot

5. In the Mix

Mixers, made by companies like Atomos, are often employed by professional videographers who can afford them. They require wired or wireless input from each camera, but allow the consumer to operate each unit from a single source wherever they may be. This includes review of the frame, the settings, on & off, and record. They are highly versatile pieces of equipment, but are not cost effective for most home users.

1. UI for all cameras
2. Remote access

Aesthetics

Much can be said about the design of a product, but there are gray areas that cannot be ultimately defined. In a parallel way, art captures a moment of an artist's life. Whether painting a portrait, a landscape or an abstraction of a dream, the artist's movements come to life and remain behind as an artifact of their expression. Picasso drew inspirations from his life, and occasionally would bring props in to be surrounded by physical media that he could attach memories to. All of it informed his art, and it can therefore be said to have been embedded into his paintings. The artifact is the culmination of him, his memories, and his surroundings.

The stylings of VOODIO come from many influences. Though not explicit in nature, childhood memories of military airshows and the author's father's love of classic automobiles have always had an effect on his design work. Exposure to these elements inform the hand as a curve is drawn. The arm, hand, fingers and pen move downward in a smooth arc creating a gentle curve. Another follows. Then another. The form begins to take shape. It is not random or haphazard.

Visions of Raymond Loewy's bullet trains and mid-20th Century aircraft design, which also informed the automobile industry in their aerodynamics, fins, and stylings, take shape in the mind's eye and move through the pen. The body's spine and the arm pillar have ovular cross sections, as a nod to the shapes of airplane wings and propeller. The arm pillar itself began at a 25 degree angle, much like an airplane prop, however, the relationship could not be made strongly with the pillar's short length and single nature. It was therefore rotated to be in plane with the front hub's central axis. Comparisons can be made to Egmont Arens' Model K stand mixer, designed for KitchenAid in 1937, which can also be compared to Loewy's S1 locomotive, made in 1939. The 'head' of the camera and curved spine follow similar profiles to the appliance and terminate in a flared base.

Brightly colored enamel paint was an option

The author borrowed heavily from the automotive industry and will use examples in his thinking. In the end, to each their own. Surveys from user groups will allow a larger opinion of what is attractive to consumers outside the author's personal opinions.

Aesthetics Parameters:

1. **Back to the Drawing Board**

    DIY home setups are often piecemealed together to make a functional rig. Due to time and expenses, little consideration may be given to the aesthetics. "The Homer" designed by Homer Simpson's is a mish-mash of desired ideas, including double bubble domes, crammed into one unit. Vehicles stripped down to their essential working and safety components may also fall into this category. A product designed with little form will appear to be a conglomeration of various components that do not pair well together. It might work for videography needs, but you would likely never find anything like this on display by itself. An Arduino board with a camera attachment would likely fall within this parameter. The Ariel Atom, a stripped down road-ready race car, may be attractive to certain buyers.

    1. Clunky.

    2. Little consideration for form

2. **Utilitarian**

    Highly engineered products can have a great aesthetic on their own. The Volkswagen Thing, for instance, has an almost loveable charm, and it may be because of the quirkiness. It is basically a Beetle combined with a corrugated sheet metal box built around it. The attractive curves of 'the people's car' have been lost for durability and ease of manufacture. Tesla's Cybertruck is, arguable, a sleek design that removes all curves for complete utility. In the camera world, GoPro's original Hero line has a very clean box housing with few detractors, but its minimalist structure leaves little to the imagination.

    1. Well engineered. Maybe too well

3. **Run of the Mill**

Some forms become tiresome. Single-lens reflex camera housings have followed similar contours for years. Little sets them apart from each other, and at first glance, you might not know the difference between brands like Canon, Nikon, and Sony. This is possibly due to a design language that has been carried over with cameras for decades. Modern vehicles like the Honda CRV, the Mazda CX-5, and the Ford Escape rarely turn heads anymore, and the same could be said of modern smartphones. The revolution of the iPhone destroyed many fanciful and intriguing designs of years prior to its introduction.[41] Undoubtedly, the change was welcomed for its user-friendly interface and sleek design. However, the market has become visually stale and relies almost exclusively on features like cameras and security. A conceptual design in this category will have little to offer in the way of excitement. It better be feature heavy.

1. I'd accept the gift, but might not buy personally

4. Attractive

Some designs command attention, even if it's not the right one for me. Jeep Wranglers are created to be utilitarian, but still have attractive qualities that no other competitor can match. Mazda's MX-5 Miata has cult status. Even despite the drawbacks, consumer Hummers and FJ Cruisers draw few comparisons with other vehicles. Red Digital Cinema is a manufacturer who has bucked the norm for high-end digital cameras. They have boxy frames, but unlike GoPro, their addition of sharp bevels, contrasting materials & textures, splashes of color, and knurled details set them far apart from the rest. They have a rugged, almost no-fuss feeling without coming off as too utilitarian. The features Red designed into the product are absolutely purposeful.

1. You have my attention. Tell me more

5. Enviable

The author is a sucker for curves as long as they are just the right amount. That would be a Volkswagen Karmann Ghia or Porsche 911. He would take a 1950's Studebaker, or even a Corvette Stingray as long as they were baby blue. 'Whoa man, my head is turning!' Unlike, say a 1930's Bugatti Atlantic or even the Plymouth Prowler, the curves are smooth and not overly exaggerated to the point of being garish. We have not yet found a camera that fits this profile. Outside of vehicles,

1. Whoa! Where'd you get that?!

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[41] Brownlee, John, Luke Dormehl, Killian Bell, Cult of Mac Deals, David Snow, and Charlie Sorrel. 2012. "What Phones Looked Like Before And After The iPhone Transformed The Industry [Image] | Cult of Mac." Cult of Mac. February 8, 2012. https://www.cultofmac.com/145083/what-phones-looked-like-before-and-after-the-iphone-transformed-the-industry-image/.

Conceptual Design

Concepts were created using information gathered from YouTube *Case Studies*, our initial research with the *Multi-Cam Prototype*, and according the *Design Parameters*. Designs were created using a mix of ballpoint pen, marker, and graphite & colored pencils on 8.5x11 white printer paper. Many concepts follow similar forms and functions. To help distinguish them, three main categories were formed: Mounted, Modular, Mobile. The colors associated with them are for quick recognition when reviewing data.

Mounted

Some solutions may provide many views, but they must be stabilized through hardware. In other areas, concepts are so large that they are meant to be placed and not moved again. These will be also considered mounted. (9) Total Concepts

Modular

The concepts within this category give the option of purchasing a few units at a time or allow for additions and accessories. (9) Total Concepts

Mobile

These are absolutely portable, but because of their small size, often warrant the purchase of many units. (8) Total Concepts
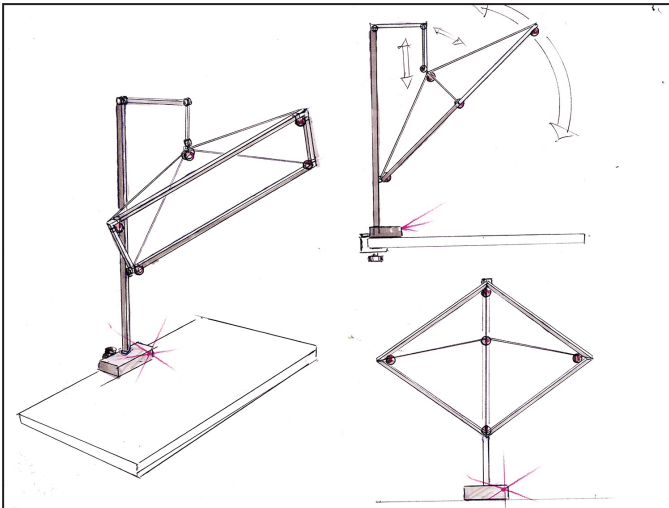
Concept Sketches
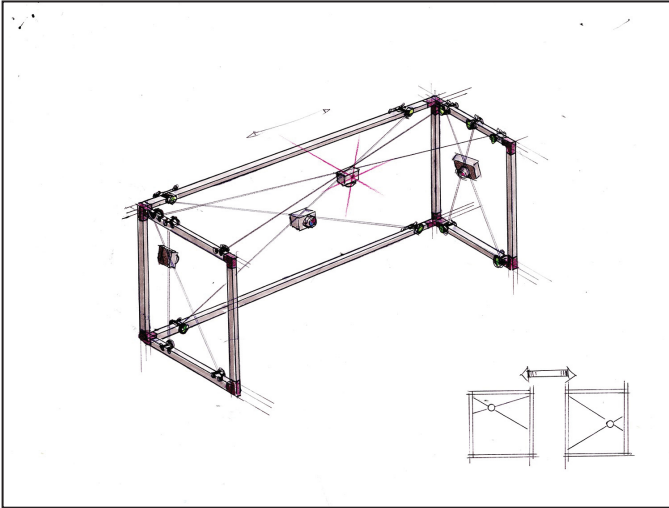
Fig. 34. Concept 1

Concept 1
Modular | 51.4%

Manufacturing: 4
Adjustability: 4
Camera Angles: 4
Portability: 2
Repair & Upgrades: 3
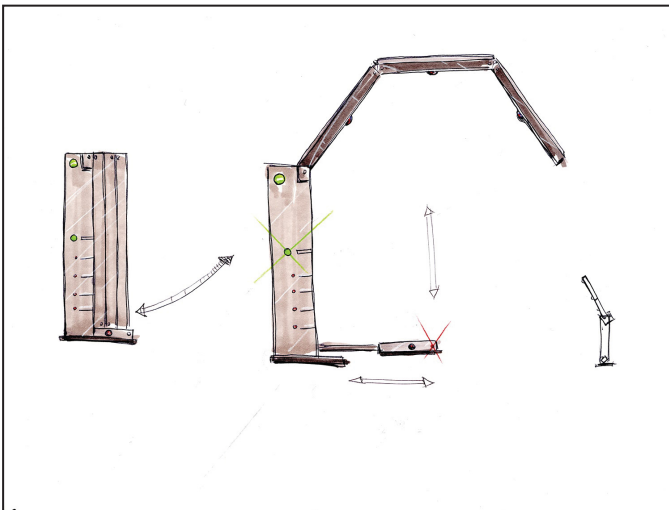User Interface: 1
Aesthetics: 2

Fig. 34. Concept 1

Concept 2
Mounted | 51.4%

Manufacturing: 4
Adjustability: 3
Camera Angles: 3
Portability: 1
Repair & Upgrades: 3
User Interface: 2
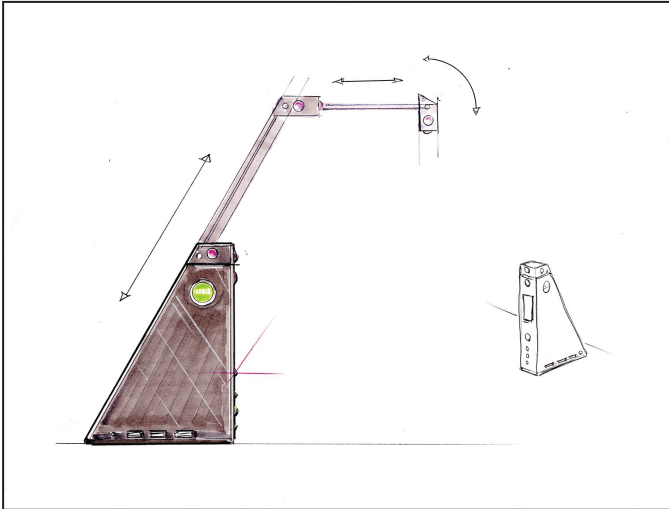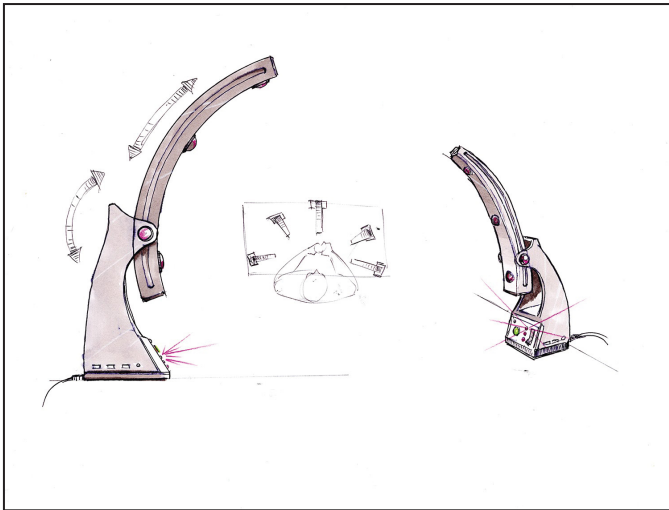Aesthetics: 2

Fig. 35. Concept 2

Concept 3
Mobile | 51.4%

Manufacturing: 2
Adjustability: 3
Camera Angles: 2
Portability: 5
Repair & Upgrades: 1
User Interface: 2
Aesthetics: 3

Fig. 36. Concept 3

Concept 4
Mobile | 54.3%

Manufacturing: 1
Adjustability: 3
Camera Angles: 2
Portability: 5
Repair & Upgrades: 1
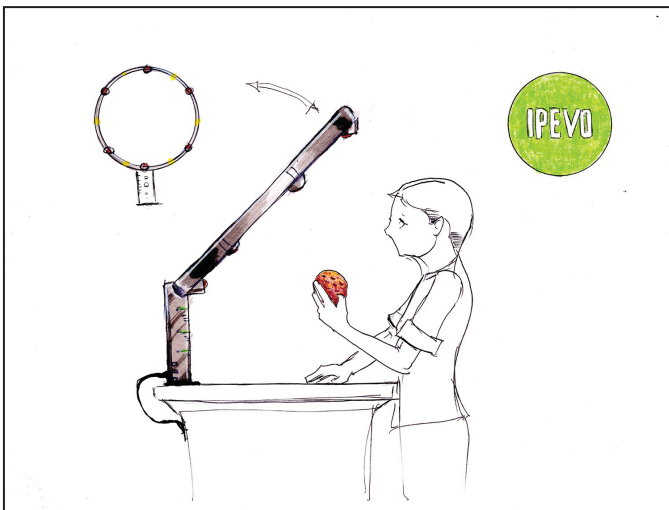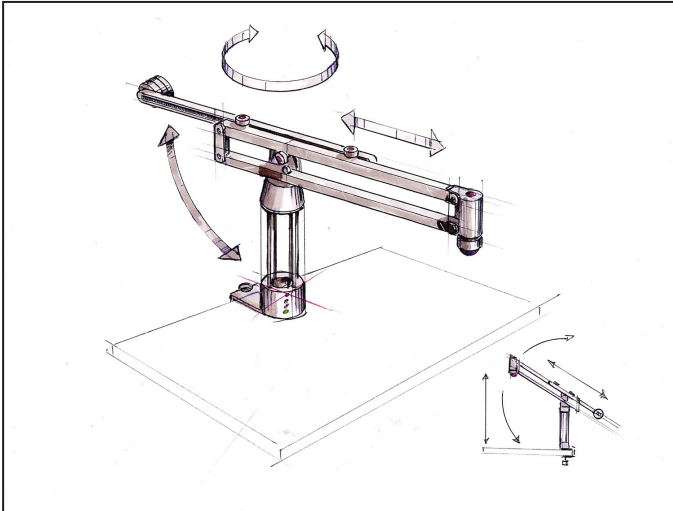User Interface: 4
Aesthetics: 3

Fig. 37. Concept 4

Concept 5
Mobile | 60.0%

Manufacturing: 2
Adjustability: 3
Camera Angles: 2
Portability: 5
Repair & Upgrades: 1
User Interface: 4
Aesthetics: 4

Fig. 38. Concept 5

Concept 6
Mounted | 45.7%

Manufacturing: 2
Adjustability: 3
Camera Angles: 3
Portability: 1
Repair & Upgrades: 2
User Interface: 2
Aesthetics: 3

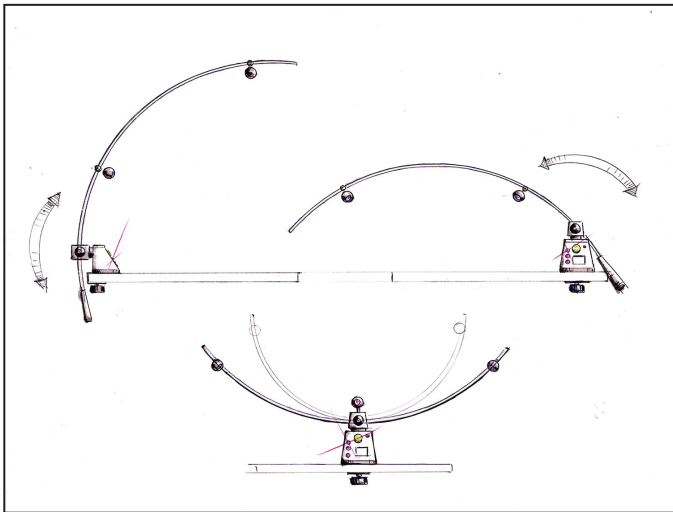**Fig. 39. Concept 6**

Concept 7
Modular | 60.0%

Manufacturing: 3
Adjustability: 5
Camera Angles: 3
Portability: 3
Repair & Upgrades: 2
User Interface: 1
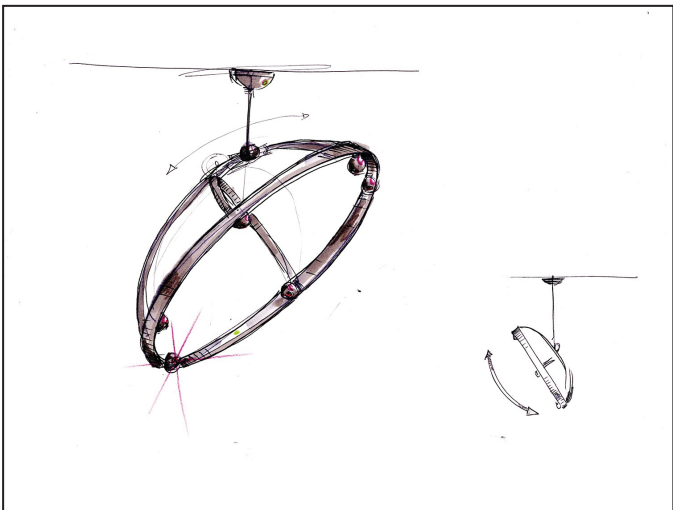Aesthetics: 4

Fig. 40. Concept 7

Concept 8
Modular | 54.3%

Manufacturing: 2
Adjustability: 3
Camera Angles: 2
Portability: 3
Repair & Upgrades: 4
User Interface: 2
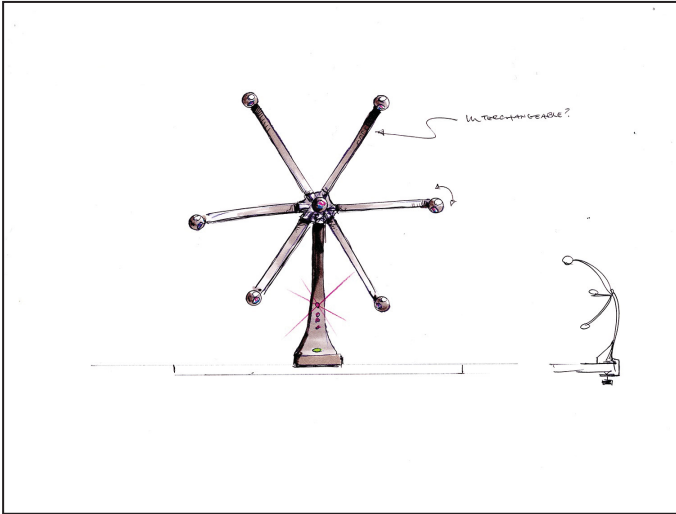Aesthetics: 3

Fig. 41. Concept 8

Concept 9
Mounted | 51.4%

Manufacturing: 2
Adjustability: 2
Camera Angles: 3
Portability: 1
Repair & Upgrades: 2
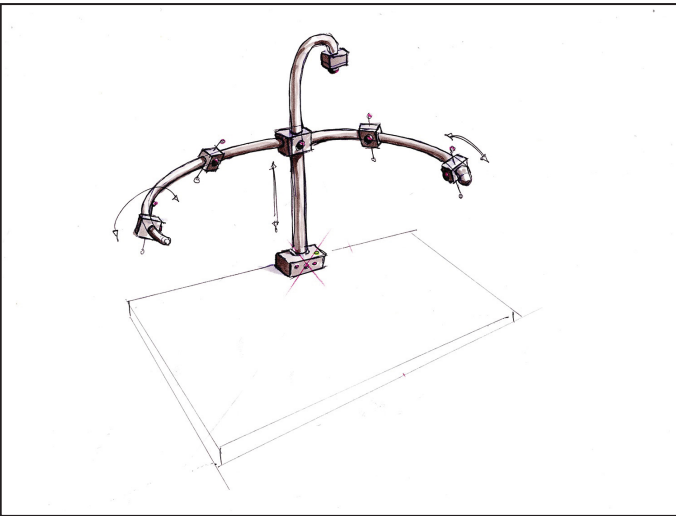User Interface: 5
Aesthetics: 3

Fig. 42. Concept 9

Fig. 43. Concept 10

Concept 10
Mounted | 51.4%

Manufacturing: 2
Adjustability: 1
Camera Angles: 3
Portability: 2
Repair & Upgrades: 4
User Interface: 2
Aesthetics: 4
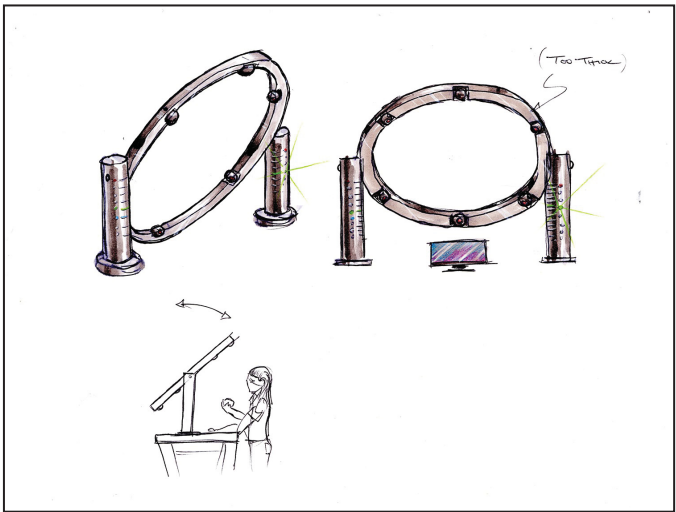
Fig. 43. Concept 10

Concept 11
Modular | 45.7%

Manufacturing: 2
Adjustability: 3
Camera Angles: 3
Portability: 1
Repair & Upgrades: 3
User Interface: 2
Aesthetics: 2

Fig. 44. Concept 11

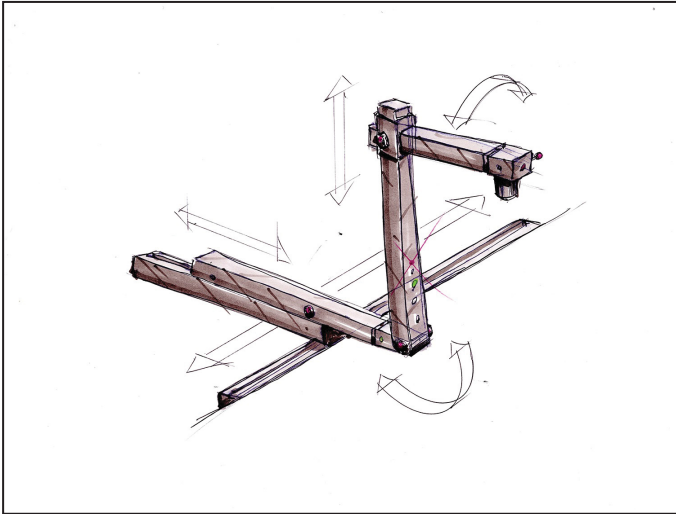*Concept 12*
Mounted | 51.4%

Manufacturing: 2
Adjustability: 3
Camera Angles: 3
Portability: 2
Repair & Upgrades: 2
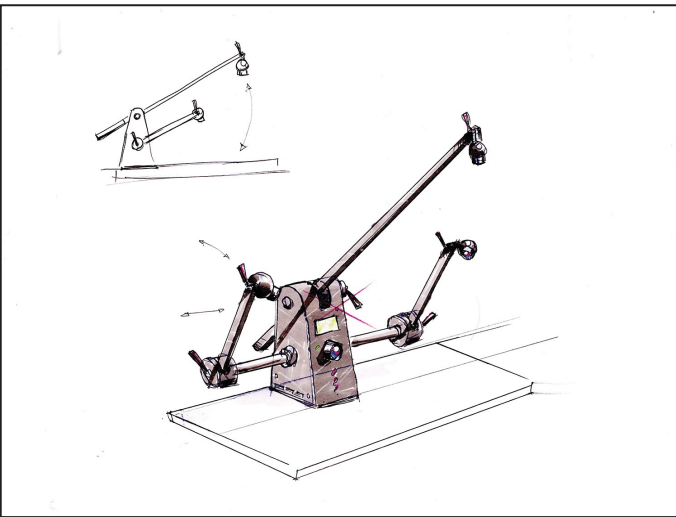User Interface: 2
Aesthetics: 4

Fig. 45. Concept 12

Concept 13
Mounted | 48.6%

Manufacturing: 3
Adjustability: 4
Camera Angles: 3
Portability: 1
Repair & Upgrades: 1
User Interface: 1
Aesthetics: 4

Fig. 46. Concept 13

Concept 14
Mounted | 51.4%

Manufacturing: 2
Adjustability: 4
Camera Angles: 3
Portability: 2
Repair & Upgrades: 3
User Interface: 2
Aesthetics: 2

Fig. 47. Concept 14

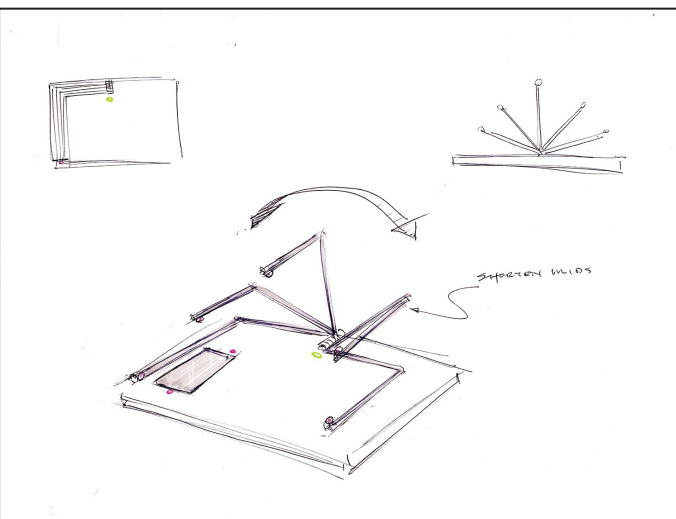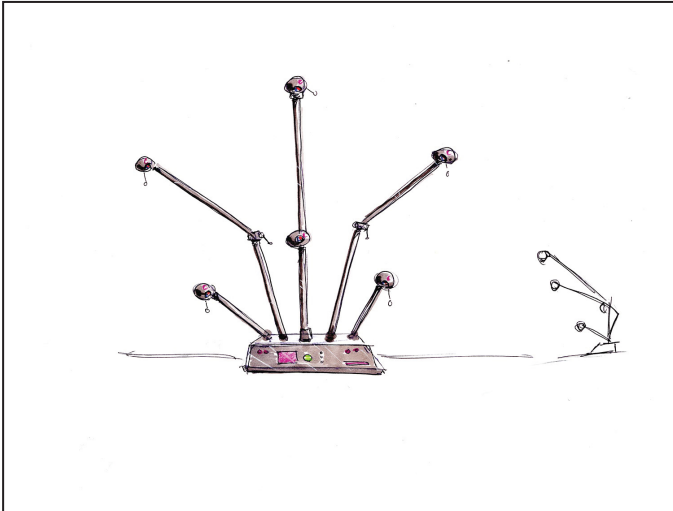### Concept 15
Mounted | 51.4%

Manufacturing: 4
Adjustability: 1
Camera Angles: 3
Portability: 2
Repair & Upgrades: 1
User Interface: 5
Aesthetics: 2

Fig. 48. Concept 15

Concept 16
Mobile | 62.9%

Manufacturing: 2
Adjustability: 5
Camera Angles: 5
Portability: 5
Repair & Upgrades: 2
User Interface: 2
Aesthetics: 1

Fig. 49. Concept 16

Concept 17
Mounted | 42.9%

Manufacturing: 2
Adjustability: 4
Camera Angles: 2
Portability: 1
Repair & Upgrades: 3
User Interface: 1
Aesthetics: 2

Fig. 50. Concept 17

Concept 18
Modular | 68.6%

Manufacturing: 4
Adjustability: 1
Camera Angles: 4
Portability: 2
Repair & Upgrades: 3
User Interface: 5
Aesthetics: 5

Fig. 51. Concept 18

Concept 19
Modular | 68.6%

Manufacturing: 2
Adjustability: 3
Camera Angles: 4
Portability: 2
Repair & Upgrades: 3
User Interface: 5
Aesthetics: 5

Fig. 52. Concept 19

Concept 20
Modular | 57.1%

Manufacturing: 4
Adjustability: 4
Camera Angles: 3
Portability: 4
Repair & Upgrades: 4
User Interface: 1
Aesthetics: 2

Fig. 53. Concept 20
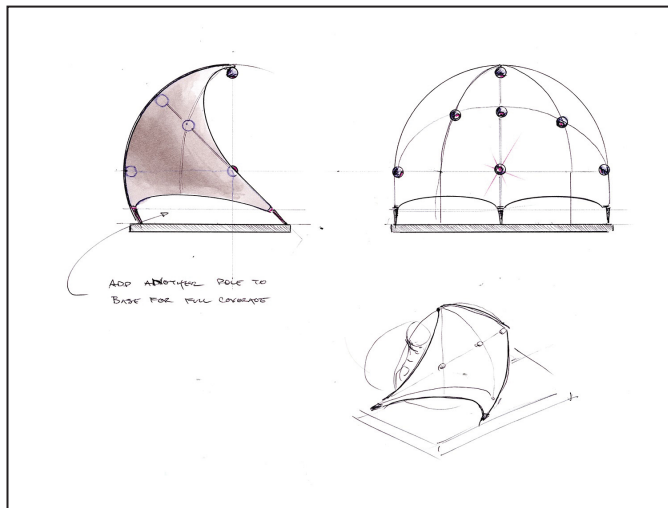
Concept 21
Modular | 57.1%

Manufacturing: 4
Adjustability: 1
Camera Angles: 3
Portability: 3
Repair & Upgrades: 4
User Interface: 1
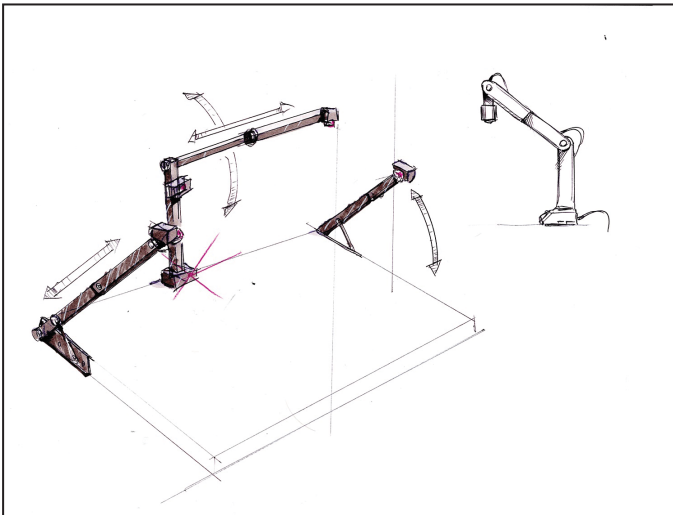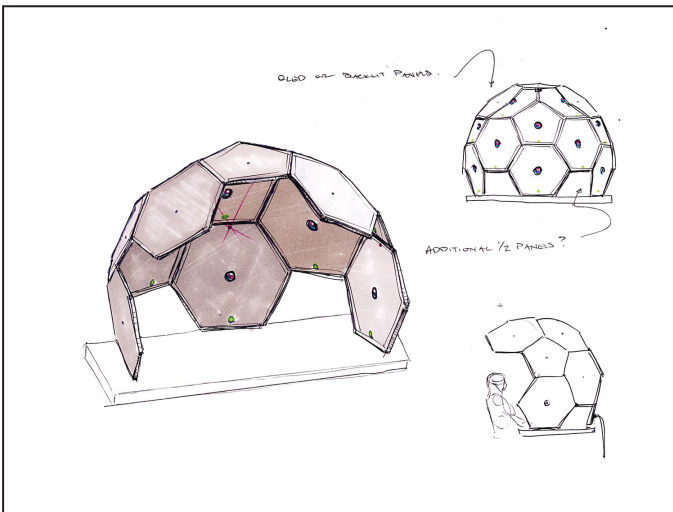Aesthetics: 4

Fig. 54. Concept 21
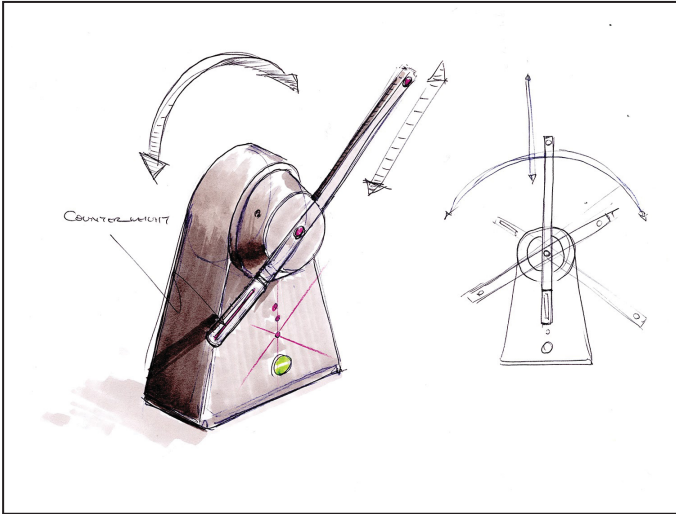
Concept 22
Mobile | 48.6%

Manufacturing: 3
Adjustability: 3
Camera Angles: 2
Portability: 5
Repair & Upgrades: 1
User Interface: 2
Aesthetics: 3

Fig. 55. Concept 22
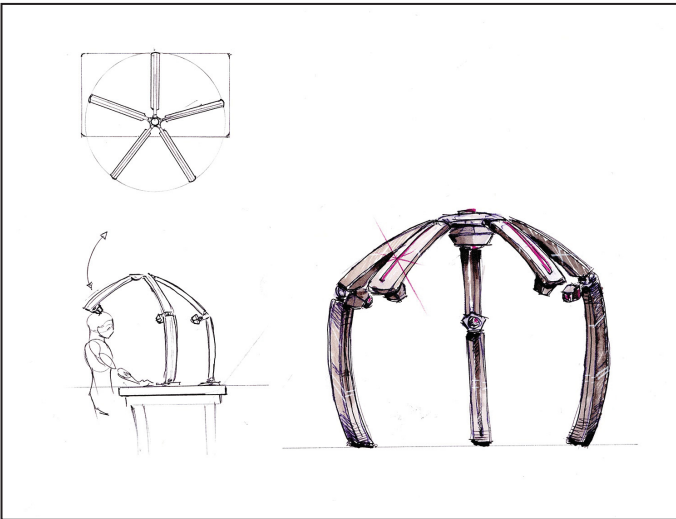
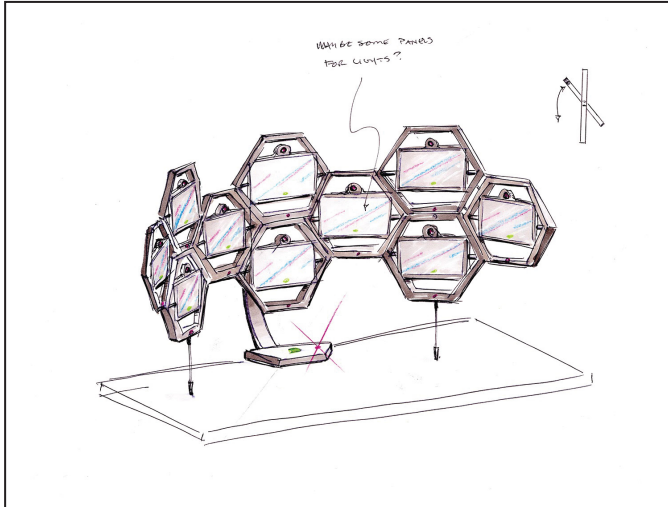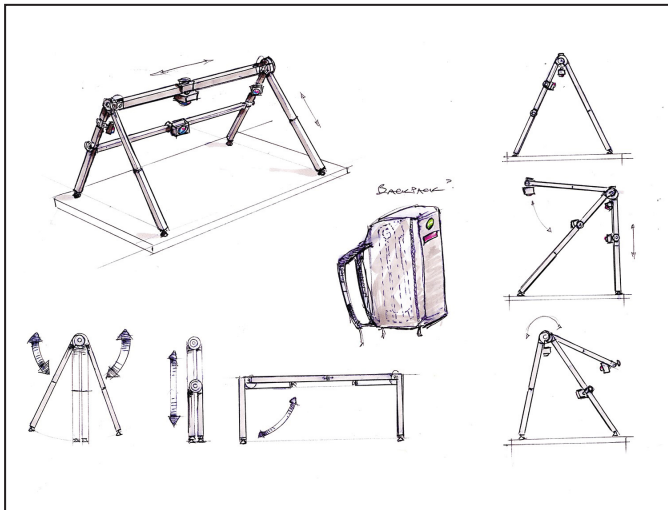### Concept 23
Modular | 71.4%

Manufacturing: 2
Adjustability: 3
Camera Angles: 3
Portability: 4
Repair & Upgrades: 3
User Interface: 5
Aesthetics: 5

Fig. 56. Concept 23
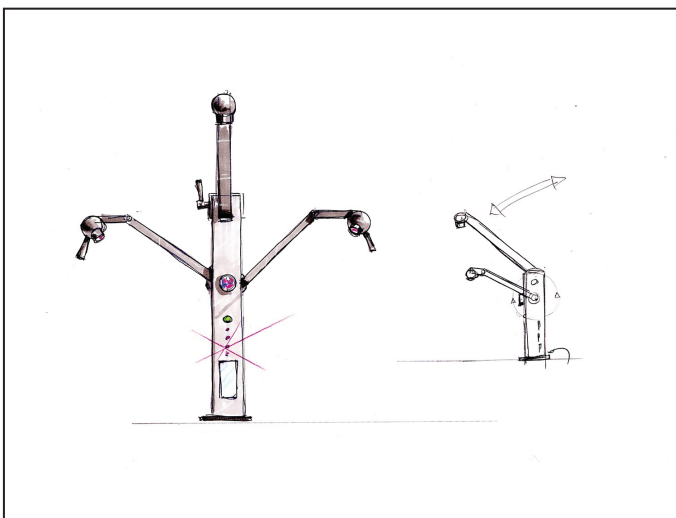
Concept 24
Mobile | 57.1%

Manufacturing: 2
Adjustability: 3
Camera Angles: 2
Portability: 4
Repair & Upgrades: 2
User Interface: 4
Aesthetics: 3

Fig. 57. Concept 24

Concept 25
Mobile | 74.3%

Manufacturing: 3
Adjustability: 5
Camera Angles: 1
Portability: 5
Repair & Upgrades: 3
User Interface: 4
Aesthetics: 5

Fig. 58. Concept 25

Concept 26
Mobile | 62.9%

Manufacturing: 2
Adjustability: 5
Camera Angles: 2
Portability: 5
Repair & Upgrades: 2
User Interface: 2
Aesthetics: 4

Fig. 59. Concept 26
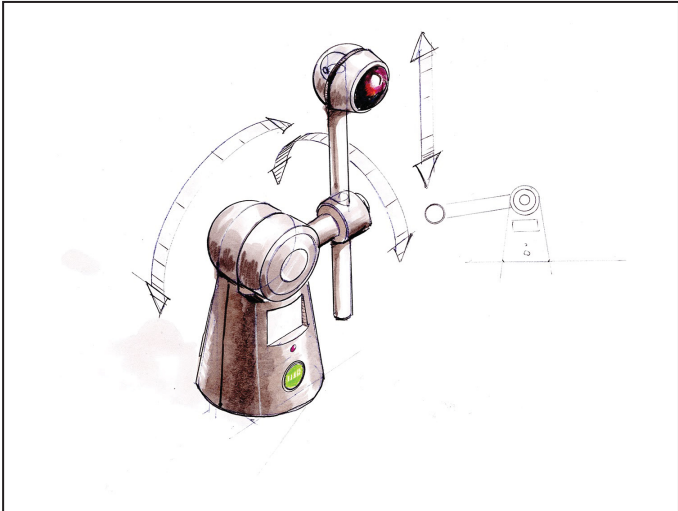

Design Parameters
Overall Totals
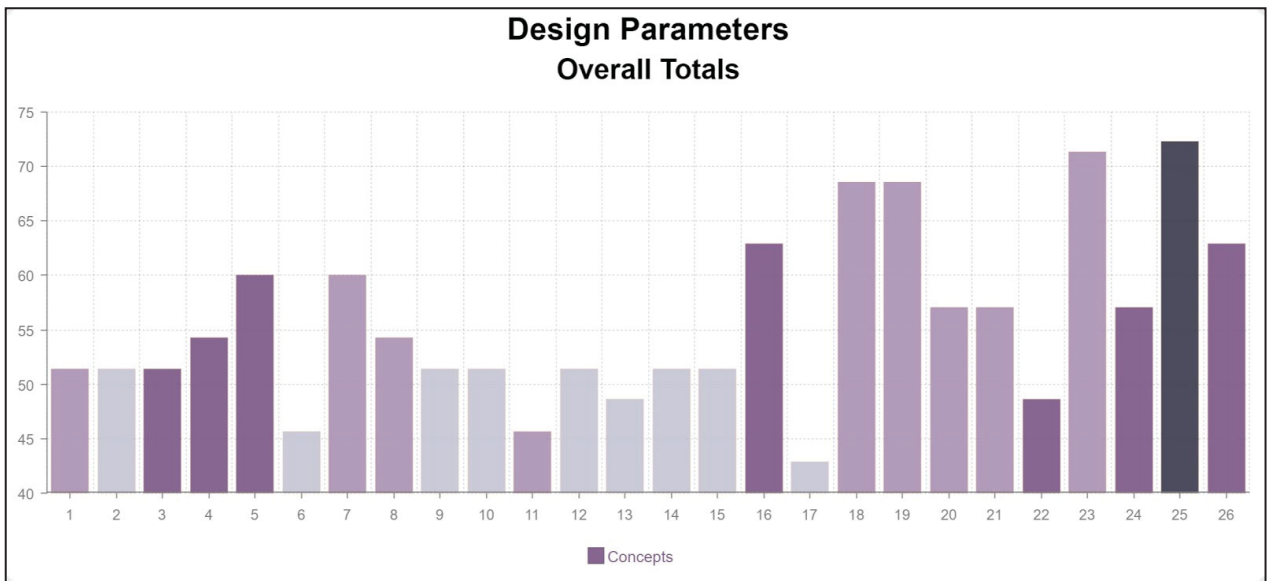
Concepts

Fig. 60. Grand Totals of All Concepts

VOODIO: Concept 25
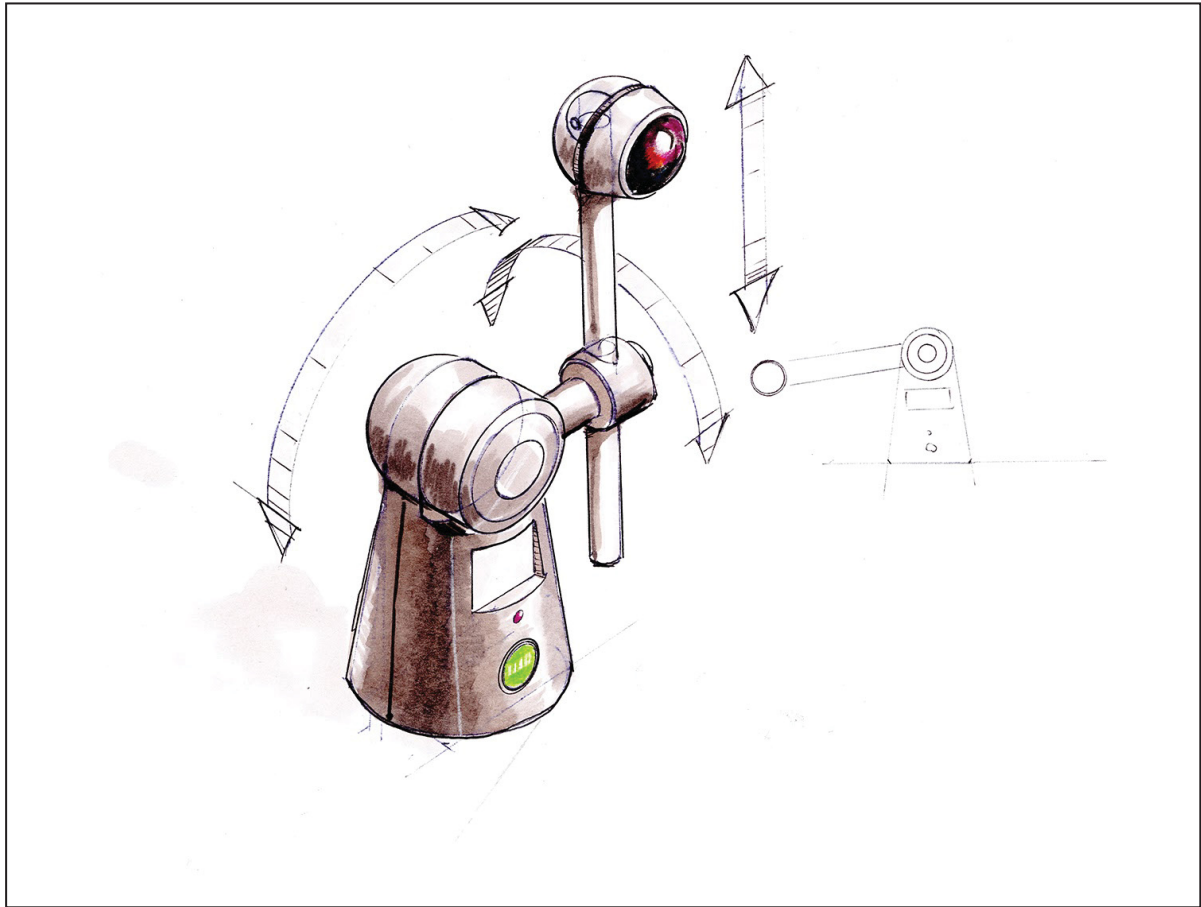
Fig. 61. Concept 25 Detail (Top)

Fig. 62. Concept 25 Design Parameters (Left)
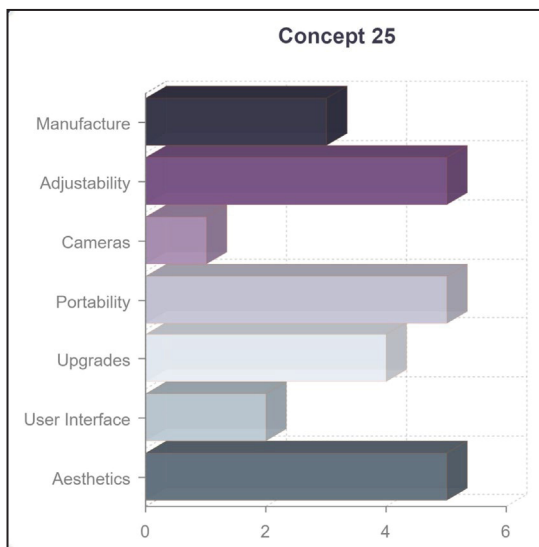
Outcompeting all other concepts was Concept 25. It has been named VOODIO, a contraction of Voodoo and Video. The concept was by no means perfect. Even though its **Adjustability** is very high, it only has a single **Camera Angle**. The author admires the simplicity, though desired more movement to the **Aesthetic** to keep from being too monolithic. The body's **Manufacture** is made up of a clamshell of either die cast or stamped metal. Its small compact form makes it very **Portable**. The **User Interface** requires the user to reach across the table to interact with it. There were improvements to be made in how the user might scroll through the menus and make selections better. As drawn, the arm camera should allow for easy removal, **Repair and Upgrade**. Through prototyping and modeling, a new iteration was created for the next sections.

VOODIO: *Prototyping*

Fig. 63. Prototype Front View

In order to better understand Concept 25, a prototype was created. PVC pipe and fittings were used to construct a simple model to demonstrate size and function.
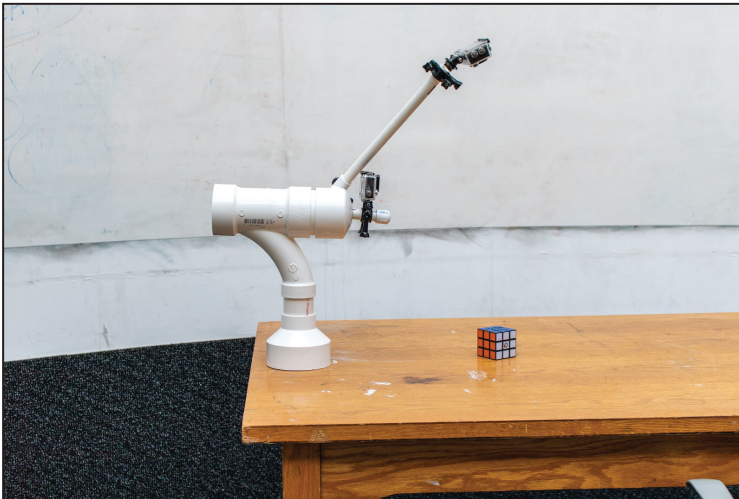
Fig. 64. Prototype Side View

At left, the arm is positioned in an overhead view. Cameras used were a GoPro Hero4 for the Front and a Dragon Touch Vision 3 for the Arm. However, for video purposes, only the Hero4 camera was used in all instances as quality was higher. Images from this prototype can be found in *VOODIO: Camera Angles*. The front camera was added in increase the available cameras.

Fig. 65. Prototype Detail View 1

Threaded knobs provide secure connection points, and allowed the operator to loosen, adjust, and tighten the various camera angles.

Fig. 66. Prototype Detail View 2

At left, the arm is positioned in an overhead view. Camera displayed in the Primary view is a GoPro Hero4.

Fig. 67. Prototype Detail View 3

The Dragon Touch Vision 3 on the Arm was used for demonstration only. For video purposes, this camera was swapped with the Hero4 as quality was higher. Images from this prototype can be found in *VOODIO: Camera Angles*.
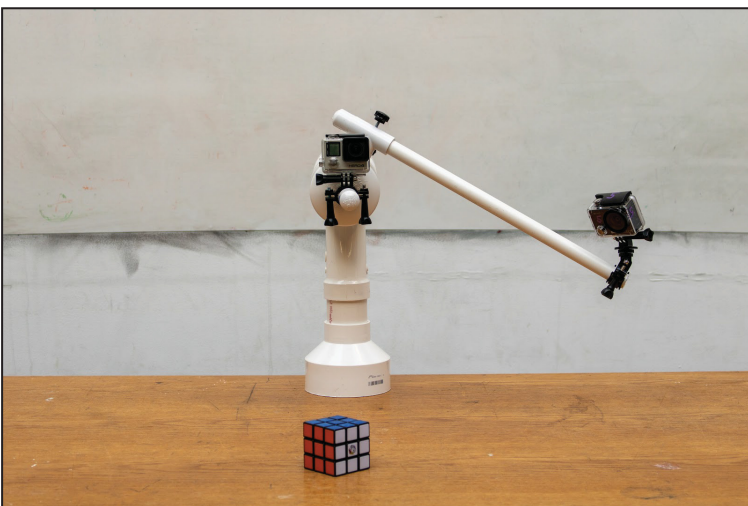
Fig. 68. Prototype Detail View 4

The image at left demonstrates a position that could be used as Secondary or Tertiary.

VOODIO: *3D Modeling*

Fig. 69. VOODIO: Perspective (Top)

Concept 25 was revised while modeling with Solidworks 2017. Main body height without arm pillar is 12." Base footprint is Ø5." Front hub is Ø4." Arm length is just over 18." Arm camera is encased within a Ø2" sphere. Full dimensions can be found below in VOODIO: *Dimensions.*

Special **Manufacturing** needs will be required to create this product. High-quality die-cast aluminum body and stamped components increase the cost of manufacture but also increase the quality.

Use of slip rings and bearings will allow for a smooth rotation without loss of data.

Fig. 70. VOODIO: Front View (Above)

Fig. 71: VOODIO: Camera View 1

To increase the quantity of available cameras, a central primary camera was added to the front of the unit. This boosted the **Camera Angles** parameter value by 1. However, the increased complexity decreased the ease of **Repair & Upgrade** also by a value of 1. While the arm camera may allow for quick exchange with instruction, the central camera is integral. Removal would require disassembly of the hub.

Cameras are based upon a GoPro Hero 7. Specifications for Field of View (FOV) can be found in the next section: *VOODIO: Camera Angles*

Fig. 72. VOODIO: Camera View 2
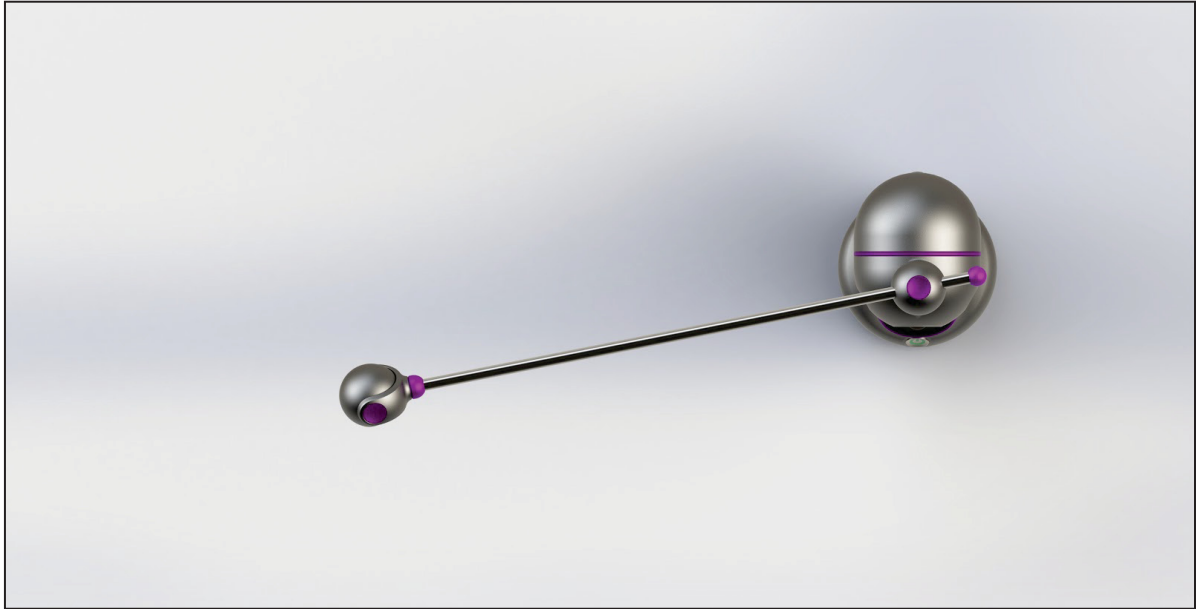
Fig. 73. VOODIO: Overhead View
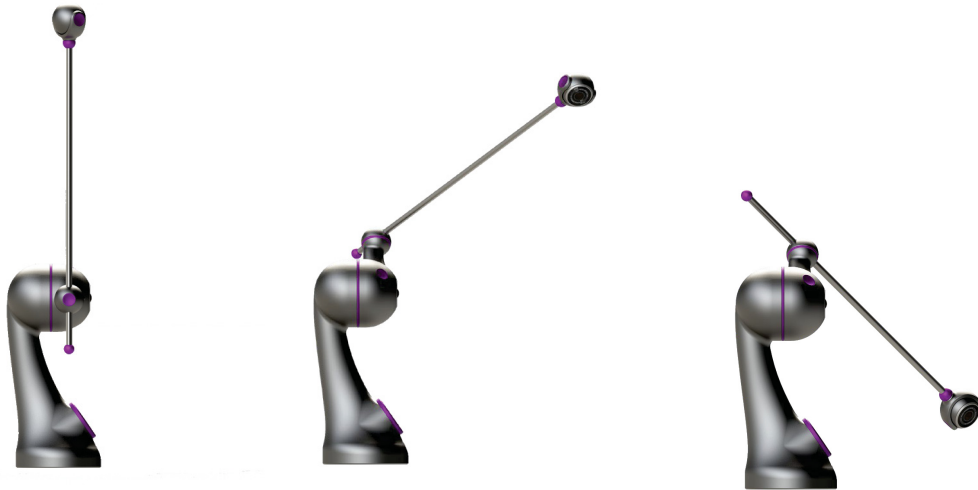
Fig. 74. VOODIO: Arm Rotation Adjustability

Highly **Adjustable**, the arm camera rotates to virtually any direction, allowing the user to position at whatever angle they desire to gain the best perspective of their subject. Indented buttons depress to release the movement of the hub, the arm, and the camera with one hand. This is removed from common knobs and locks, which often require two hands to operate. With the exception of the arm bar, which may require one hand to push the button while the other move in & out, all other functions can be operated with only one hand. Full height at vertical is approximately 30." Full reach of arm is just over an 18" radius, giving the unit an overall depth of approximately 23." Full dimensions can be found below in VOODIO: *Dimensions.*

The **User Interface** has been switched from buttons to a touchscreen & dial similar to a Nest Thermostat. This change reflects a desire to prevent accidental movement of the camera positions through the force of pushing a button. The purple outer dial rotates to scroll through the menu options and zoom in & out. Finger taps allow selection of settings, camera views, and record settings. The LCD screen provides a live camera feed for monitoring. More detailed information can be found below in VOODIO: *Order of Operations*.

Fig. 75. User Interface (Left), & Fig. 76. Detail View 1 (Below)

Stylings borrowed from classic automobiles and aircraft can be found in the **Aesthetic** of the design. The main post and arm pillar were modified from the original monolithic design to sweeping curves and are ovular in cross-section as a nod to airplane propellers. Anodized features starkly separate interactive aspects from the main body for ease of user understanding.

And that color!

It's a bold move, purple. Regal and expensive, it was once made of periwinkle snails, and its use exudes luxury. It reminds the author of ghosts, magic, Mardi Gras - voodoo! At full brightness it holds no subtleties. From an advertising perspective: "Purple contributes to the adopting of creative solutions. It is a color of abstraction and inner concentration, popular among creative people. Purple conveys wisdom, artistry, inspiration, nobility, and mystery. It's good for advertising with an accent on creativity."[42]

Many electronics have indicator lights and accents that feature the color red. This may harken back to its roots in the film industry, with red lights being used to protect paper in the development process. However, newer technologies have moved towards blue, whether to

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[42] Jens, Brian. 2016. "The Proven Impact of Color On Consumer Behavior." Curatti. April 24, 2016. https://curatti.com/how-to-color-your-brand-color/.

describe the product as 'sporty', 'manly' or indicative of freshness, or strength.' By combining the two colors together, we create something unique and mystical.

VOODIO: *Dimensions*
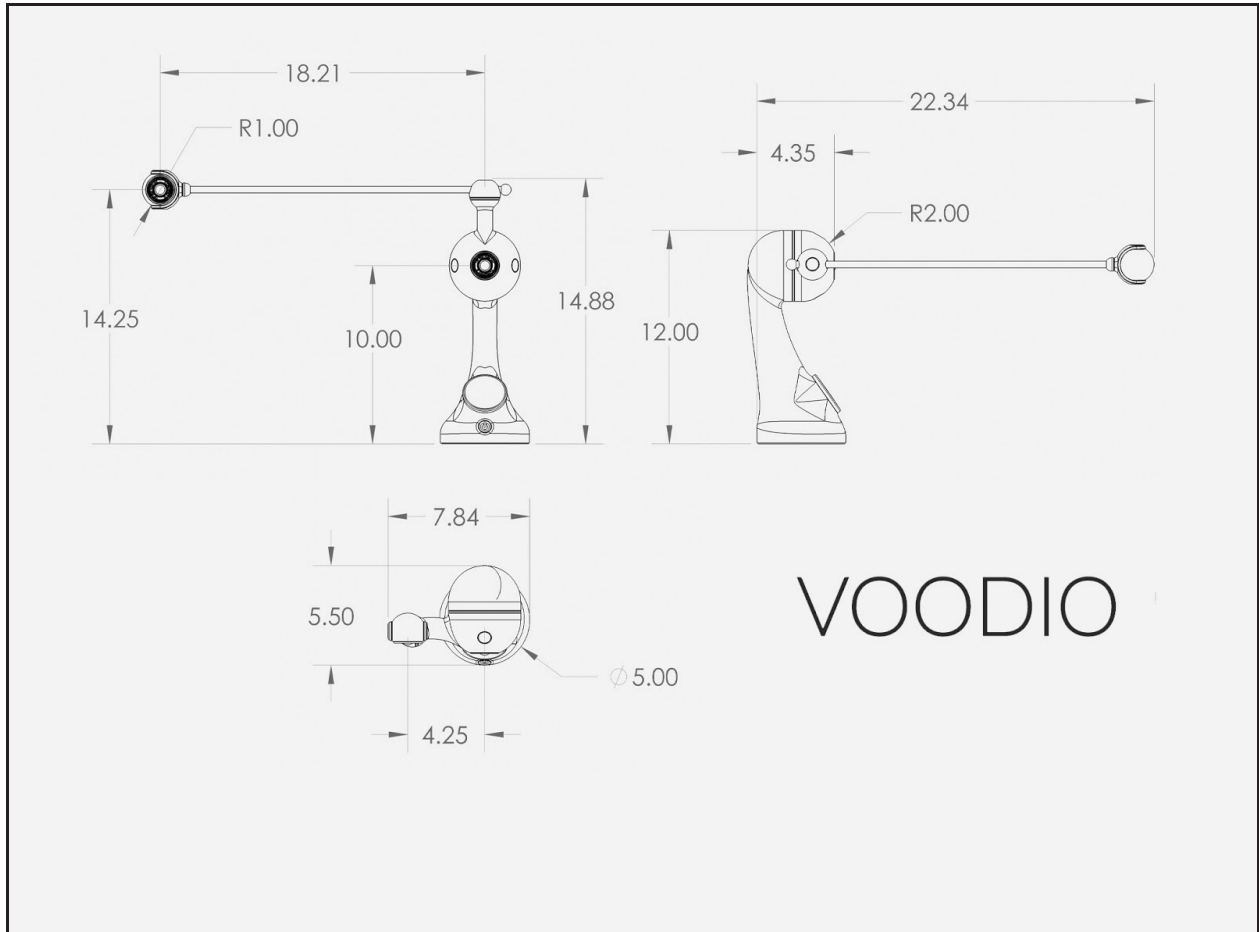
Fig. 77. Dimensions

The Solidworks model of VOODIO estimates the weight around 4 lbs. The center of mass, with arm outstretched to full length toward the user, is approximated 1/2" in front of the primary camera. This suggest the unit may be top heavy. To address this, a steel plate, common in many articulating desk lamps, would be placed to act as a bottom weight. Additionally, the securing knob at the end of the arm opposite the camera could also be made of sufficient weight to counterbalance the leveraged weight of the arm. It is assumed there will be no need to mechanically attach the product to its working surface. VOODIO should be designed to stand and operate in place by itself.

VOODIO: *Camera Angles*

Field of View (FOV)
Linear Mode, Zoom 0%

ASPECT RATIO
GoPro Hero 7
16:9 Linear Angle
Zoom 0%

Horizontal: 16
Vertical: 9

Diagonal FOV   93.7°

Horizontal FOV   85.8°

Vertical FOV   55.2°
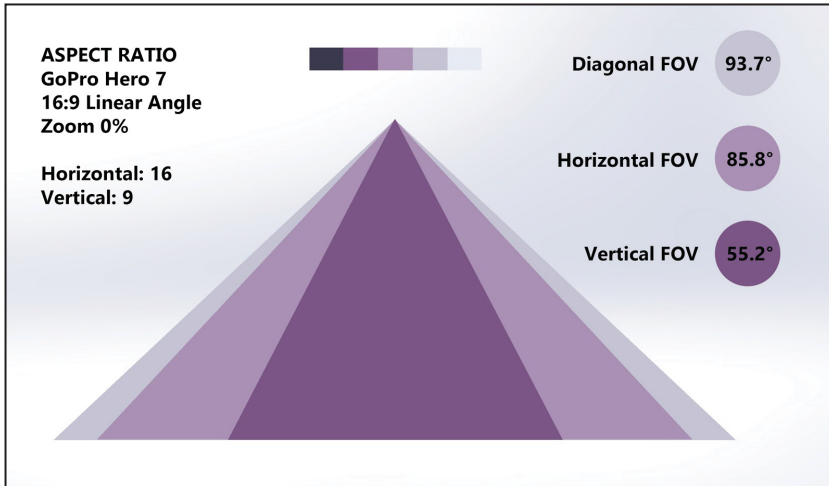
Fig. 78. FOV Angles Side 0%

FOV Angle of Degrees for GoPro Hero 7, Linear Mode, 0% Zoom, per manufacturer specifications[43]

ASPECT RATIO
GoPro Hero 7
16:9 Linear Angle
Zoom 0%

Horizontal: 16
Vertical: 9

Horizontal FOV

Vertical FOV

Diagonal FOV

93.7°

85.8°

55.2°
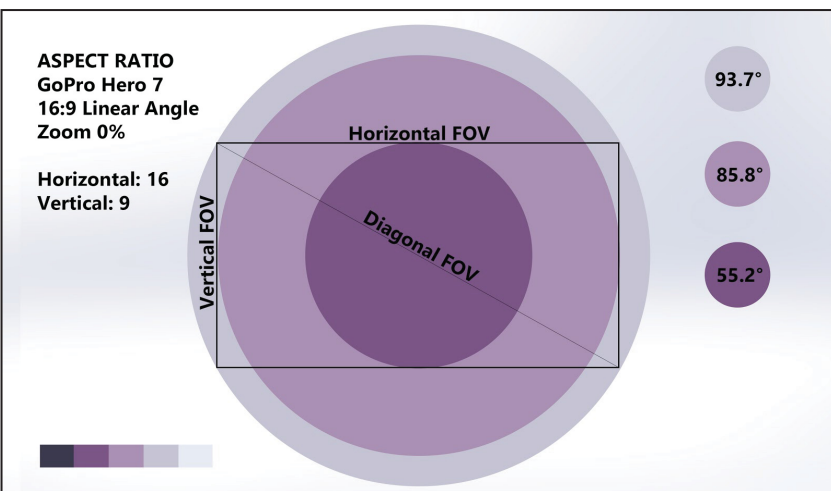
Fig. 79. FOV Angle Overhead 0%

FOV Angle of Degrees for GoPro Hero 7, Linear Mode, 0% Zoom, per manufacturer specifications[44]

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[43] "GoPro HERO7 Field of View (FOV) Information." n.d. Accessed December 24, 2019. https://gopro.com/help/articles/question_answer/hero7-field-of-view-fov-information.
[44] Ibid.

Linear Mode, Zoom 100%

ASPECT RATIO
GoPro Hero 7
16:9 Linear Angle
Zoom 100%

Horizontal: 16
Vertical: 9

Diagonal FOV   56.3°

Horizontal FOV   50.0°

Vertical FOV   29.4°
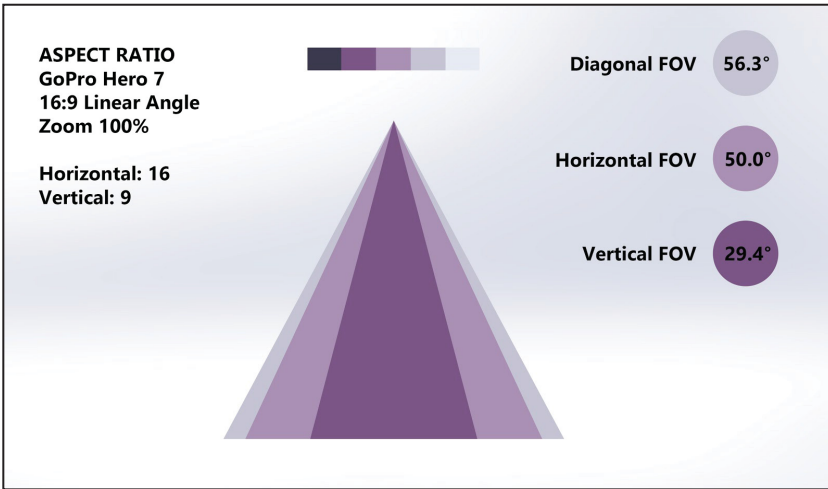
Fig. 80. FOV Angles Side 100%

FOV Angle of Degrees for GoPro Hero 7, Linear Mode, 100% Zoom, per manufacturer specifications[45]

ASPECT RATIO
GoPro Hero 7
16:9 Linear Angle
Zoom 100%

Horizontal: 16
Vertical: 9

Horizontal FOV

Vertical FOV

Diagonal FOV

56.3°

50.0°

29.4°
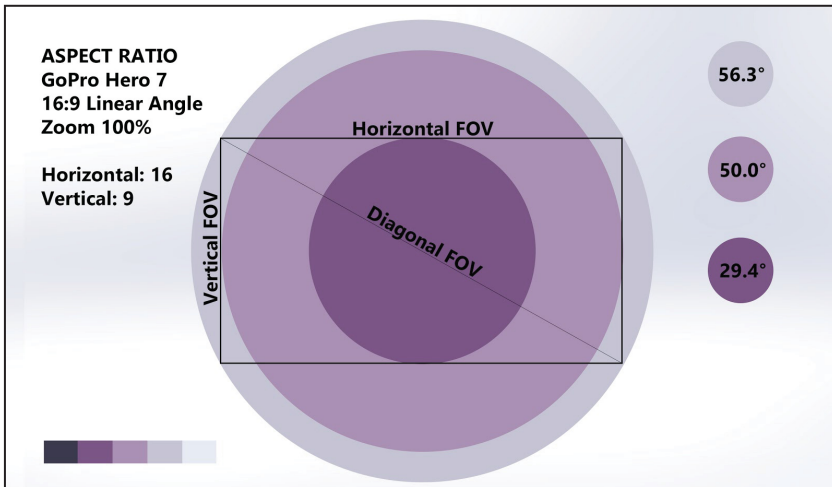
Fig. 81. FOV Angle Overhead 100%

FOV Angle of Degrees for GoPro Hero 7, Linear Mode, 100% Zoom, per manufacturer specifications[46]

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[45] "GoPro HERO7 Field of View (FOV) Information." n.d. Accessed December 24, 2019.
https://gopro.com/help/articles/question_answer/hero7-field-of-view-fov-information.
[46] Ibid.
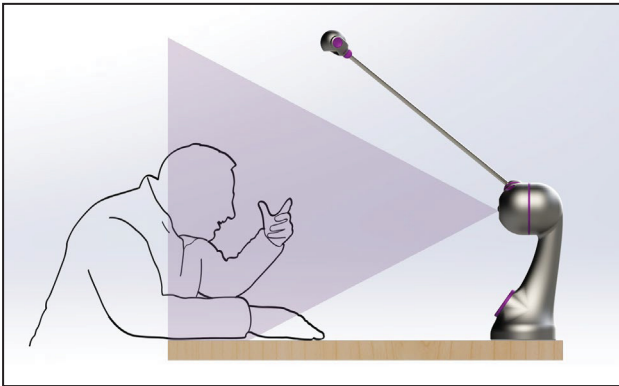
Fig. 82. Primary Camera, Side View

Using the 16x9 Linear Option with 0% Zoom gives the audience a broad area to view. VOODIO is placed on a 30" x 48" table, and ½" from the back edge.
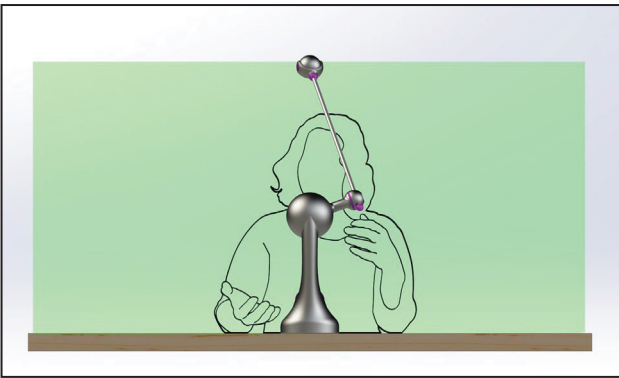
Fig. 83. Primary Camera, Front View

The image at left shows the FOV at the front edge of the table, next to the operator. It captures an area of 24.6" x 47." The bottom aspects of the table, subject, and operator's hands.
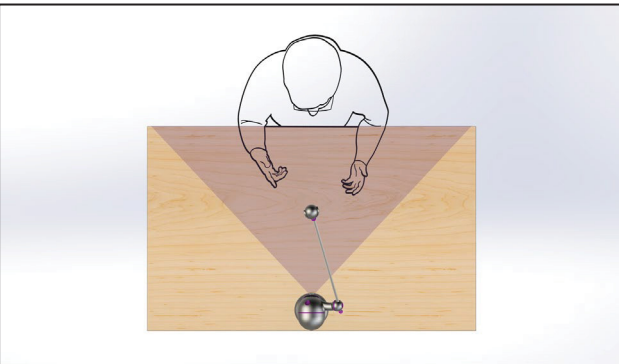
Fig. 84. Primary Camera, Overhead View

Fig. 85. Primary Camera, Front View, Actual

Curvature of the background is caused by a rounded wall, not curvature of camera lens.
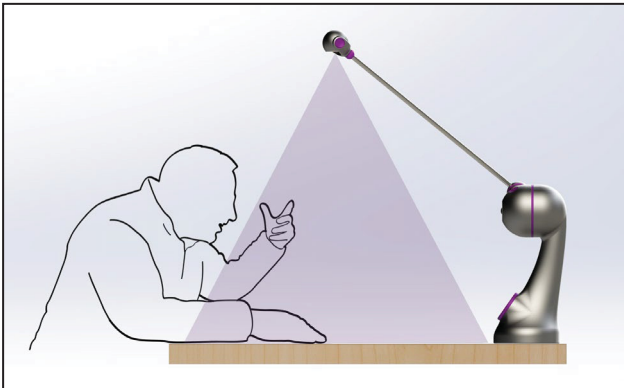
Fig. 86. Secondary Camera, Side View
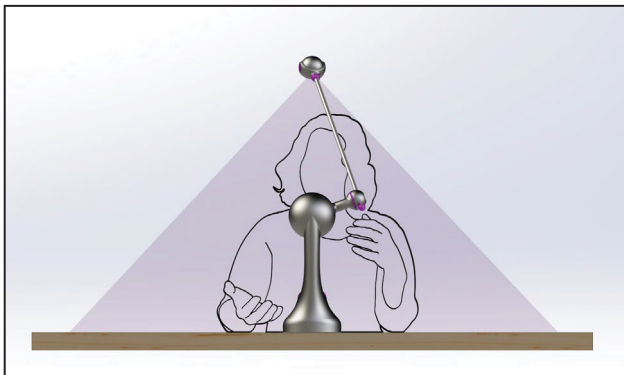
Fig. 87. Secondary Camera, Front View
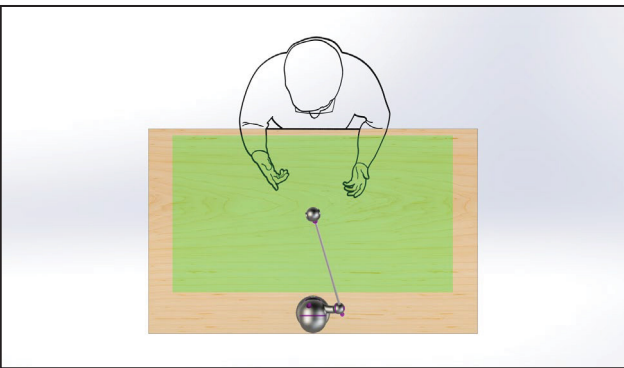
Fig. 88. Secondary Camera, Overhead View

Still using the 16x9 Linear 0% Zoom with the Arm Camera can give excellent secondary views. As shown in the overhead at left, when positioned approximately 22" above the table, the frame captures 23" x 40" of the surface.
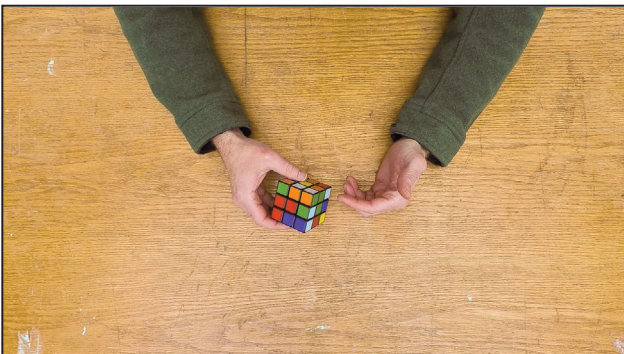
Fig. 89. Secondary Camera, Overhead View, Actual
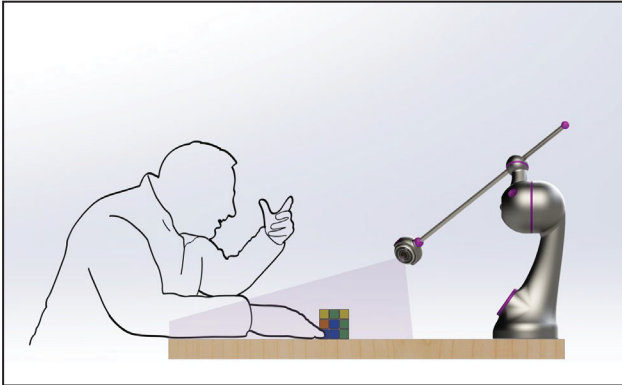
Fig. 90. Tertiary Camera, Side View
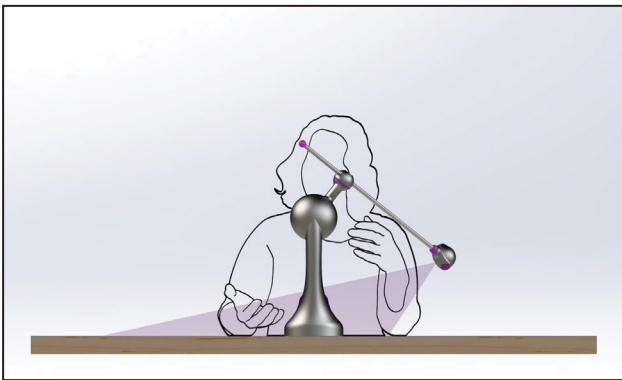
Fig. 91. Tertiary Camera, Front View
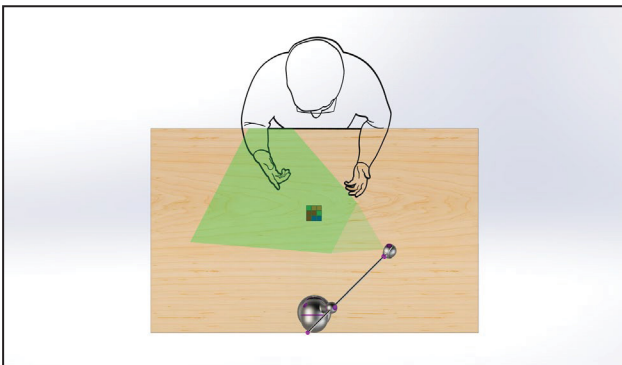
Fig. 92. Tertiary Camera, Overhead View

Depending on the angle, a 100% Zoom can give close details of an object. The particular detail view at left is angled 45 degrees from the main body, placed 6" above the table, and focused on a spot 12" in front of the unit's base.
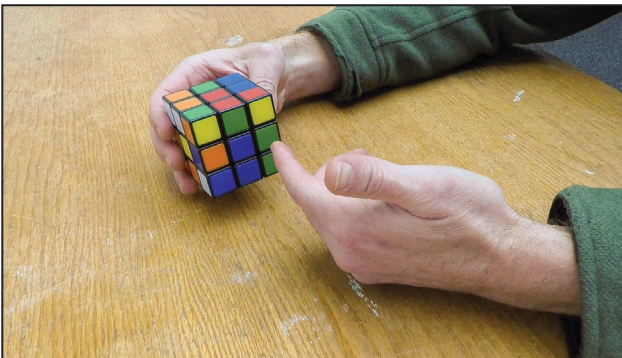
Fig. 93. Tertiary Camera, Detail View, Actual

VOODIO: *Order of Operations*

Below is the presumed order of operations for the VOODIO concept. Actual workings of the user interface is to be determined with future user testing.

Fig. 94. Package Arrival

VOODIO arrives on the user's doorstep in a boxed package.
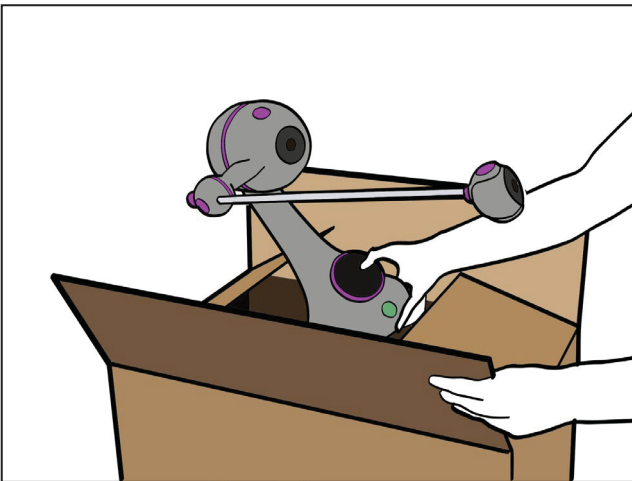
Fig. 95. Unboxing of VOODIO

After opening, the camera rig is removed from its foam encasement, the plastic is removed, and the unit is set upright.
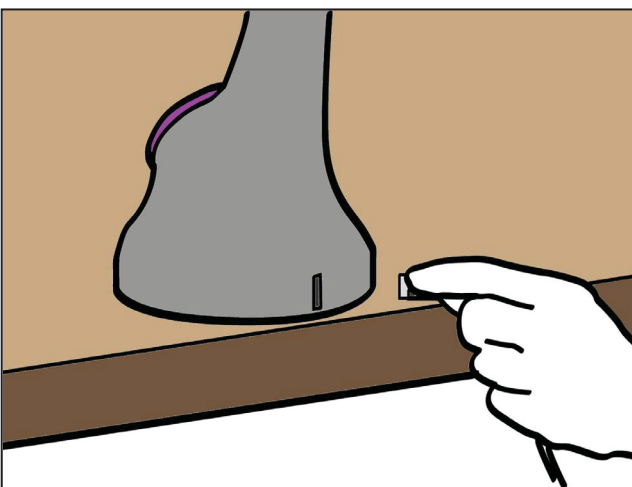
Fig. 96. Plugging in VOODIO

The user connects the power supply, which allows them to begin use while also charging the unit for wireless possibilities.
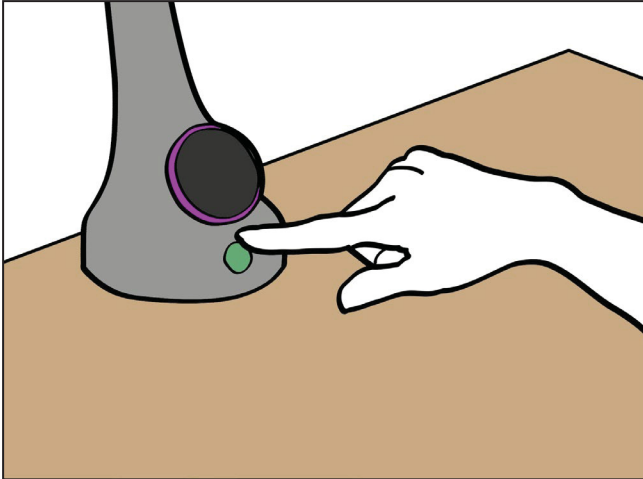
Fig. 97. Turning on VOODIO

The user presses the ON button, located on the front.
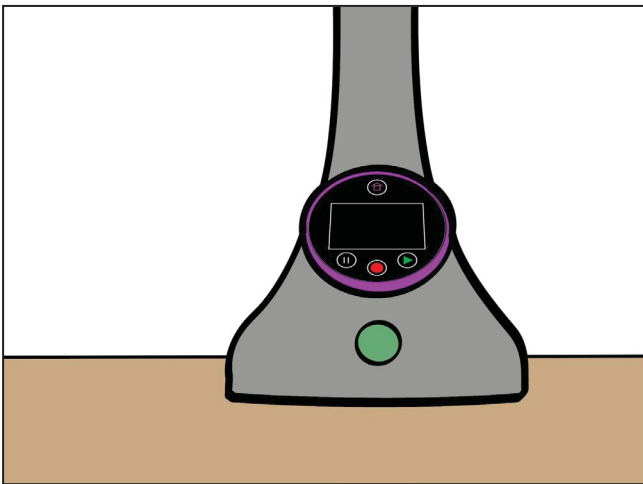
Fig. 98. UI Detail ON

The LCD screen illuminates and presents the user with a menu. By default, the menu is prepared to record, but other options such as record settings, FOV for each camera, resolution, and formatting are available at a touch.
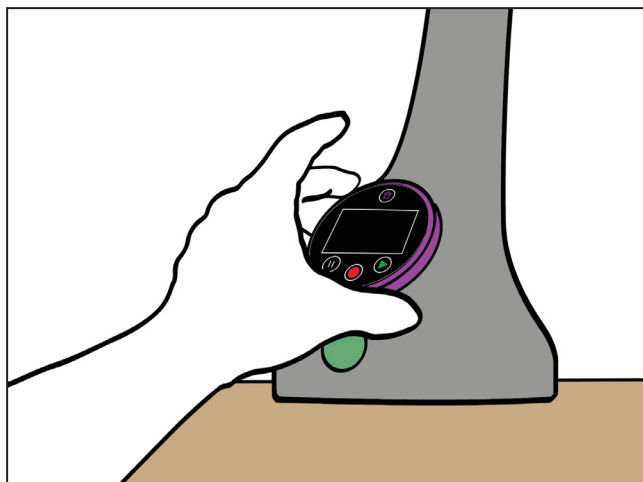
Fig. 99. Rotation of Dial

The LCD's outer ring rotates to dial among the menu options. A touch of the finger allows selection.
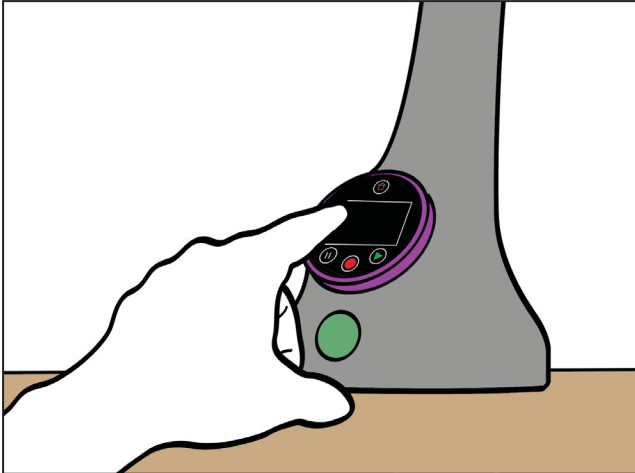
Fig. 100. Touching LCD Screen

A touch of the finger allows selection.
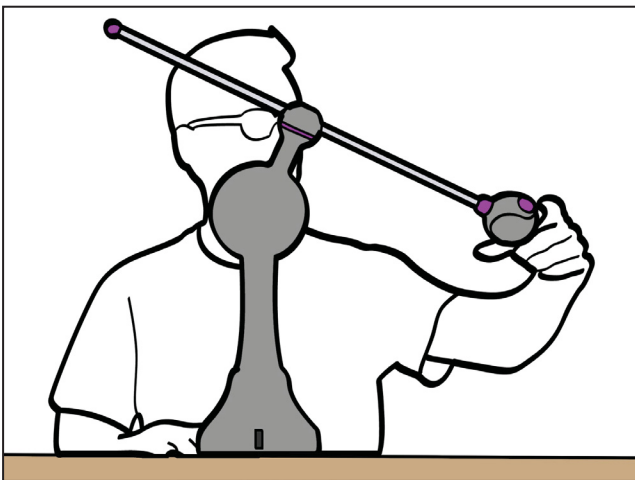
Fig. 101. Positioning of Arm

The arm camera is placed in position while the screen displays its frame.
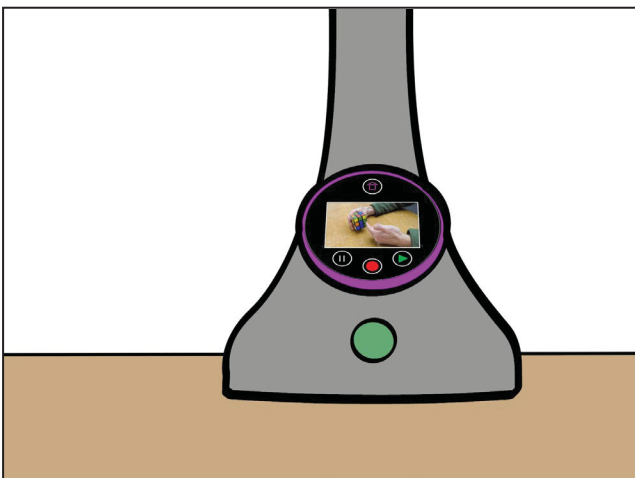
Fig. 102. UI Detail with Camera Frame

This allows the user to adjust or readjust the particular view.
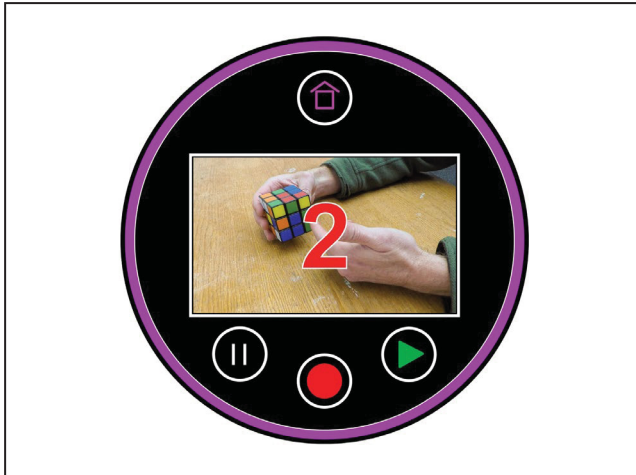
Fig. 103. Countdown

With the touchscreen or voice command, VOODIO record, an onscreen countdown allows the user an opportunity to prepare themselves. Once the red record button pulses, the cameras are recording. The LCD screen acts as a monitor.
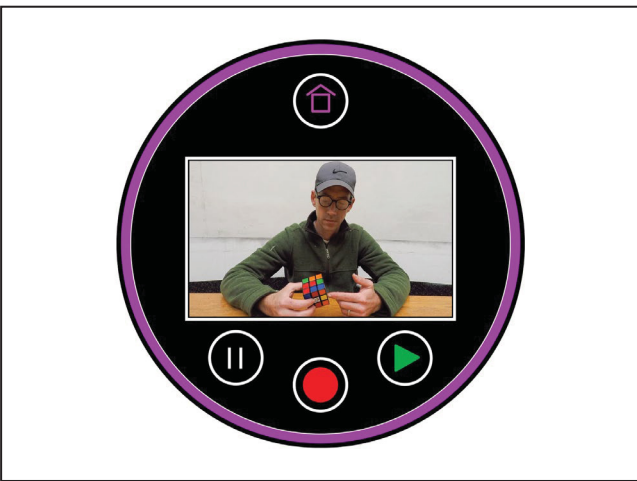
Fig. 104. UI Detail with Frame of Primary Camera

Once recording setting is prepared, the LCD screen defaults to display the front view, as it is primary. The user has the ability to switch between views with a touch of the screen or a voice command. "VOODIO switch." The LCD screen displays the current view, which allows the user to understand which camera is operating.

UI Detail of Frame-in-Frame View

An option for an in-frame window view allows both cameras to be displayed. The primary camera will be larger, the smaller window shows the secondary camera. This can be selected in the menu or with commands.

Fig. 105.

while

voice

A full selection of voice commands are to be determined pending actual user testing. Much as Siri or Alexa may be called by name, VOODIO begins the interaction, followed by the command. VOODIO pause. VOODIO playback. VOODIO switch.

It is assumed the VOODIO software will edit out voice commands from the final video. A red light might be displayed to inform the user the software is adjusting and is paused. Another command, VOODIO record, begins the process again.
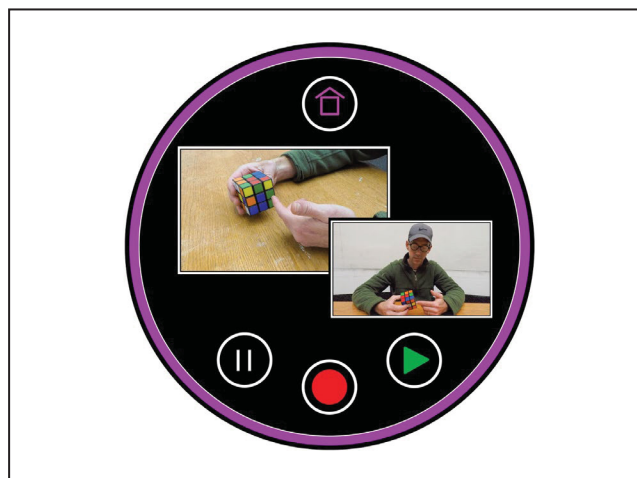
VOODIO: *Post-Production*

When finished recording, VOODIO prepares three separate files on the SD card. The primary output will be the full video as recorded and directed by the user. The recordings of the individual cameras will also be saved separately as secondary videos. The user can either upload the files directly to YouTube or download these files to their preferred video editing software, where they can add banners, titles, and other manipulations. A plugin for Adobe Premiere or Final Cut Pro will allow all files to be available during final edit. If the user desires to switch camera angles in their video or extend a scene, the native files, stored in the secondary folders, can be recalled for quick adjustments. This feature is common with high-end specialty cameras like Insta360 VR cameras.

Full editing software is not installed on the concepts. A small LCD screen, though clear enough for the user to operate and make decisions, is not large enough for detailed editing. Modern video editing software like iMovie, Adobe Premiere, and Final Cut Pro provide very powerful tools to users at modest prices. Before the advent of YouTube, availability to video editing software was limited mostly to professionals and video hobbyists due to high costs ($849 in 2005). With the popularity of posting videos to sites like YouTube, Facebook, Vimeo, and Twitter, the demand for editing software has significantly decreased this barrier of entry. If inflation rates of approximately 2% are added over the last 14 years, that price would have been $1,120. Today, Adobe Premiere only costs $240. That may still be a high price to pay, but the benefits are significant. If a person owns a Macintosh computer, iMovie is installed for free. Additionally, YouTube's platform has limited editing capabilities users can use for free.

Market Value

Existing Market

Regardless of overall camera market decline, purchases of cameras for the purpose of vlogging has increased. Vlogging, or video blogging, is a popular way artists and influencers create video content. Despite the decline in camera sales, the "vlogging camera segment is the lone shining star in declining digital camera market, which sold ~19 million units in 2018. Smartphones pose a serious threat to the future of digital camera industry."[47]

Embracing the power of vlogging and other online content creation can boost the value of any company or institution. It isn't a fad. It's here and not going anywhere any time soon. If VOODIO can be brought to the marketplace, there stands a chance it could not only make an impact, but be of financial benefit for the producer.

According their 3rd Quarter Financial results[48], Canon projects $4.36 billion in global camera sales for this fiscal year. If we understand that Canon holds the market at 40.5%[49] we can calculate the overall global market for digital cameras to be approximately $10.8 billion. Other manufacturers like Nikon, Sony, Fujifilm and Olympus make up 85.2% of the market, and, like Canon, are hard to compete with. However, despite this, 14.8% of the overall total remains on the market. If VOODIO can capture but 1% of that, $108 million in annual revenue could be reasonably earned.

Competitor Advantage

There's nothing like VOODIO on the market, however, with some quick Google searches for the best cameras for YouTube, a large selection can be found for an average of $500.[50] OBSBOT[51], by Remo-AI, which prices for ~ $475 has a similar style to the Concept 25, but only maintains one camera which follows a given object. This may not be the option for a stationary tutorial. Hero 8[52], by GoPro runs for $399. This is the most popular action camera on the market. However, you would still need two of them and attachments to gain the same views as VOODIO. Manfrotto 393B-3[53] by Manfrotto is a very versatile camera arm mount. It retails at $125. If you attached two Hero 8's to two 393B-3's, the overall costs would be in the range of $1050.

VOODIO Pricing

I believe with similar scale of manufacturer as a competitive camera company like GoPro, VOODIO could easily be produced for a retail price in the range of $1199-1499. This still commands a higher price than the two other products combined, but for the range of motion

[47] admin. n.d. "Global Vlogging Camera Market 2019-2025 | Size- Share-Opportunity-Trends | ABNewswire." Accessed December 17, 2019. https://www.abnewswire.com/pressreleases/global-vlogging-camera-market-20192025-size-shareopportunitytrends_449959.html.

[48] Canon Inc. "Third Quarter 2019 Results." Canon. October 28, 2019. https://global.canon/en/ir/conference/pdf/conf2019q3e.pdf

[49] Cade, DL. 2019. "Canon Increased Market Share in 2018 But Camera Market Continues to Bleed." 2019. PetaPixel. July 8, 2019. https://petapixel.com/2019/07/08/canon-increased-market-share-in-2018-but-camera-market-continues-to-bleed/.

[50] Kronfli, Basil. "The best YouTube cameras: perfect cameras for getting your videos online." Digital Camera World. September 21, 2019. Accessed December 30, 2019. https://www.digitalcameraworld.com/buying-guides/best-youtube-cameras

[51] Frontend, Remo Tech Web. n.d. "Remo-Ai.com." Remo-Ai.com. Accessed December 4, 2019. https://www.remo-ai.com/obsbot-tail.

[52] "GoPro | The World's Most Versatile Action Cameras." n.d. Accessed December 4, 2019. https://gopro.com/en/us/.

[53] "3-Section Double Articulated Arm with Camera Bracket." n.d. Manfrotto. Accessed December 28, 2019. https://www.manfrotto.com/us-en/3-section-double-articulated-arm-with-camera-bracket-396b-3/.

and versatility that comes with the new product, the user would never have to leave their seat again.

Profit Margins

If we consider GoPro's 6-month revenue report came in 52% gross profit margin,[54] and we understand their Hero8 to retail $399, we can estimate their profit to $207 per camera. This means their manufacturing and operational costs should be around $192 per camera.

If VOODIO can be manufactured at the same ratios, then the profit range would be approximately $623-779 per camera. In the global market previously mentioned, annual profit would be over $56 million.

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[54] "GoPro Announces Second Quarter 2019 Results." August 1, 2019. https://investor.gopro.com/press-releases/press-release-details/2019/GoPro-Announces-Second-Quarter-2019-Results/

Discussion Points

Only Two Views

VOODIO only allows two views at one time. It may be possible for a combination of Concept 25 along with Concept 10 to make this better. However, complications will arise with the complexity of multiple arms. In the interim, artists who wish to upload videos to YouTube will have within their possession a third camera. Be this from the computer, their tablet, or their mobile device, the information has to be uploaded from one of these devices. The artist may even have a digital camera and could use this as supplement until another iteration of VOODIO can be produced.

Limited Usage

VOODIO is currently limited to desks and tabletops. It is possible to incorporate a ¼" thread into the bottom of the unit to allow for standard tripods and camera mounts. The size of VOODIO, though small enough to be compact, is not small enough for many camera mounting accessories. A separate product could be produced that would be more compact, similar to a standard DSLR. However, options like the use of the LCD screen, as currently configured with VOODIO, may not be an option. That is undetermined.

AI & Robotics

It has been speculated by Virginia Tech instructor Bill Green that forms of AI along with servo motors or other robotic elements could be incorporated into the VOODIO design. However, this is not within the scope of the current research. Future research could be done to see if this is a) a viable option for the market or b) if costs of manufacturer would be cost prohibitive to launch if another, simpler, and more analog option like VOODIO exists. Robotics can be very expensive to develop and construct. Even if cost effective means can be found to create a cheap & practical product, software will have to be designed to allow easy inputs for the user. Will they have to hold down an XYZ button until the arm comes into position, or use a joystick? If this is the case, an analog system by which you physically manipulate the arm may be a better choice. VOODIO is designed to reposition quickly with one hand. A robotic solution would have to match or overcome the ease of use.

Additionally, could an intelligence be given to the robotic version of VOODIO, where the user has no need to input commands or reposition? Great thought and research must be done to decide what is the best view for a tutorial. The author's current hesitation is taking the artistry away from the artist. However, that idea suggest that everyone knows what they're doing when it comes to creating visually engaging content, which is not the case. An automated system may be created, but would the benefits outweigh the costs? Would content created by separate users become repetitive and hack? Possibly. Possibly not, for there are a vast number of techniques used by multiple artists alike and we take little note. That is all to be determined. However, it may be possible that if robotized, VOODIO could have presets, like fly-overs or zoom-in-out like a manual camera operator or even a drone might. For instance, GoPro's now-defunct Karma drone had preprogrammed options to follow, circle, pan, zoom-in, and fly-by autonomously. Bugs within Karma's system caused drone crashes, initiating a product recall, and

ultimately tanking GoPro's UAV division.[55] That doesn't mean the ideas behind it weren't, and aren't of value to VOODIO.

Along the same lines, Jonas Hauptman questioned whether or not this product would be too late to market because of the lack of integration of AI and tracking software found in many products today. If robotics and AI were incorporated into VOODIO, could software be used to follow the operator or the product? Simple camera tracking run with software may benefit from this to allow better capture of the subject and artist. However, more complicated operations may require preprogramming of the system to indicate which positions are most desirable to the user. For instance, if the user wanted a 1/4-front right view 6" from the table surface that was aimed 12" in front of the unit as the preferred closeup shot, it could be possible to program that position into the unit, and with a quick touch or voice command, the action could be called in. Until a motorized gimbal system is incorporated inexpensively into VOODIO, this option is set aside for future research.

Another AI recommendation, given by Steve Harrison for the improvement of VOODIO could be the incorporation of infrared sensors that feed suggestions back to the user. This could be in the form of location sensing and recommending the user readjust to better optimize the presentation of the subject or person. Predetermined suggestions could also be made, such as specific locations for the arm camera, that when positioned within tolerance, prompts the unit to indicate suitability. Additionally, software could be incorporated into the system much like Apple Facetime where the LCD's frame view reverses the recordings like a mirror for the user to better gauge movements, while still allowing the viewers to see the video normally. This could easily be incorporated into VOODIO as is without adding servo motors and robotic software.

[55] Rose, Brent. 2018. "GoPro's Karma Drone is Officially Dead." Outside Magazine. January 9, 2018. https://www.outsideonline.com/2273076/gopros-karma-drone-officially-dead

Implications and Contributions to Knowledge

Practical Implications
Online Education

Online education currently accounts for nearly 1/6th of all higher education in the United States.[56] Platforms like YouTube allow teachers to record lessons and tutorials, which then permit students to review information and complex ideas at their own pace. Nevertheless, only 4% of students who take online courses complete them. There are many factors that might explain this vast discrepancy, such as the lack of proper structuring for online as mentioned, but the number one reason, according to The Muse, is that they are just boring.[57] How can you compete with the volume of entertaining content available online? You make it engaging. Videos, whether used for education or otherwise, are no exception. Additionally, many concepts within design education require an ability to discuss three-dimensional objects. With in-person instruction, students have the ability to move around an object and gain insights from multiple viewpoints. This is difficult to replicate in a two-dimensional video realm where many tutorials only provide a single camera angle. This one view may provide many details, but we believe multiple viewpoints should be available as concepts become more complex. If online video tutorials are to gain equal footing as in-person tutorials, then providing students with multiple views may be the resolution.

Online vs On-campus

We need to point out a few things concerning videos and how they relate to education. In a cooperative study performed by Harvard and MIT, researchers found evidence that MOOC's, or massive open online classrooms, can be just as effective as traditional campus classroom environments as long as considerations are made in the design of the coursework to account for the fact that there are structural differences between online content and on-campus education.[58] Videos, along with text, interactive problem solving, group forums were part of the study. The author will be focusing on videos.

Online Abroad

Harvard is not the only institution using online content. A 2012 study in Taiwan noted that students with access to online video content related to their classes performed significantly better than students learning the same material without access to the videos.[59] This shows that even if brick-and-mortar institutions are sought for higher education, integration of supporting online video content will be of great benefit for student's ability to learn.

Theoretical Implications
Will use of multiple cameras increase the efficacy of three-dimensional concepts? We aim to test this hypothesis in future research by constructing a multi-camera system to take simultaneous videos from multiple viewing angles. In brief, we will record a series of tutorials,

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[56] "The NCES Fast Facts Tool Provides Quick Answers to Many Education Questions (National Center for Education Statistics)." n.d. Accessed December 27, 2019. https://nces.ed.gov/fastfacts/display.asp?id=80.

[57] Birnir, Adda. 2015. "Why People Quit 90% of Online Classes." The Muse. January 23, 2015. https://www.themuse.com/advice/why-people-quit-90-of-online-classesand-how-to-beat-the-odds.

[58] Ho, Andrew, Justin Reich, Sergiy Nesterko, Daniel Seaton, Tommy Mullaney, Jim Waldo, and Isaac Chuang. 2014. "HarvardX and MITx: The First Year of Open Online Courses, Fall 2012-Summer 2013." https://doi.org/10.2139/ssrn.2381263.

[59] Chen, Yuh-Tyng. 2012. "The Effect of Thematic Video-Based Instruction on Learning and Motivation in E-Learning." *International Journal of Physical Sciences* 7 (6): 957–65. https://doi.org/10.5897/IJPS11.1788.

present them to student subjects, and test their ability to replicate the information. The video tutorials will cover three simple design concepts: sketching of a sphere, foam model making, and ceramic pinch pots. The students will come from a design background (architecture, industrial design) with an expected age range of 18-24 years. Half the students will see the multicam video. Half will see a video with one camera view. Students will be evaluated on their ability to replicate the lessons from the videos. It is assumed that students with access to multiple camera views will perform the task better than students with access to a single camera view. Using this ability to share three-dimensional videos of three-dimensional concepts, educators of design can teach across greater distances and engage with greater impact. Students of all backgrounds will absorb the information from a personal vantage without obstructing the view of others in the process. More information about the research design can be found in Appendix B.

As mentioned in the *Multi-Cam Prototype* and other sections, there are possible some important human-computer interaction questions that were raised. These questions of video-image presentation as they relate to learning and understanding concepts, as well as handedness within those presentations may provide valuable information to future researchers.

Future of Multiple Angles
The ultimate use of camera imaging with arrays is virtual reality (VR). Various technologies provide image data with different techniques such as new camera arrays

From a single camera running at high speed and stitched together, volumetric techniques in video provide promise to the areas of entertainment, education, and sports. The adoption of this technology has been slow, possibly because of the intensive, and expensive, processing needs. Expansions of VOODIO technology along with reduction in processing power and size may increase the adoption of this promising form of media.

Conclusions

A camera is a very powerful tool. It tells a story. Many stories combine to become masterpieces as they add new perspectives. The history of videography shows how the use of multiple cameras supersedes a single camera. With these multiple views, entertainers and educators alike will benefit by keeping interaction with the content for longer periods of time. By creating a tool with multiple cameras, we make a statement: you need more than one perspective to create this story. The product commands it, as there are no other options.

For our design, we have created a sleek tool based upon many factors, including the variable utility, ability to repair, and ease of use. Compared to other concepts created, VOODIO stands out among the rest. It performed high in within the Design Parameters, however, its actual construction, overall design, and weight of importance to the parameters will have to be evaluated after proper user testing.

It is uncertain whether or not this theoretical product will in fact prompt users to discover better ways to film. It is also unclear without testing whether or not multiple viewpoints within a video are more effective at describing and teaching objectives or not. With future research, these questions may be answered. If VOODIO is found to be of valuable use to fit user needs, and, if proven that multiple viewpoints provide clearer understanding and value to both educators and students, then a market exists to introduce this product to the world.

Questions remain for future study into the many human-computer interactions this research and possibly this product will bring up about handedness and video presentation for learning concepts. The user-interface of this product requires continued study and human subject studies to discover the best methods for delivering a seamless and intuitive experience for the operator.

Appendix A: Image Rights & Permissions

Bon Appétit: Figs. 1, 2, 3

VIRGINIA TECH.

Benjamin Kirkland <bkirkland@vt.edu>

May I refer to your videos in my thesis?
4 messages

Benjamin Kirkland <bkirkland@vt.edu>   Sat, Nov 23, 2019 at 6:48 PM
To: savannah_jackson@condenast.com

Good evening, Ms. Jackson,

Thank you so much for responding to the Instagram DM. I'm certain loads of things come flying your way. As mentioned, I am currently working on my master's thesis and am wishing to refer to some videos and processes produced by Bon Appetit. I am not profiting from any of this work, except for graduation, and am willing to forward on the work for your review prior to final completion if desired. You have every right to refuse this.

In brief, my thesis describes camera setups used in online video tutorials. I consider almost all of the Bon Appetit videos as forms of tutorials in that one of the aims of the videos are to provide thoughtful information and descriptions of products and processes. As much as I absolutely love all the personalities and perspectives Bon Appetit provides, it is videos of Amiel Stanek I am most interested in, specifically, the 'Almost Every...' videos. (The Handcrafted vids are also in line with my vision, as are some Epicurious videos, but I'll take what I can get, if I get - specs below).

Since I am focusing specifically on the cameras and chosen angles used (like the wide overheads, front head-on cameras, side camera tight shots, etc of the various videos, I would be taking screen grabs from your content to display the angles and types of shots as examples of the quality framing, production, etc.

All images from the videos will be credited to the channel (unless you would prefer the credit be to individual person(s) or videographers). The end goal of this information is to model a theoretical product for creating quality tutorial video content from a desktop. Again, this is for academic purposes only - none of this is for profit.

I hope that I might have your permission for use. However, any reply is most appreciated. If I don't hear from you this week, I certainly hope you have a wonderful Thanksgiving. Beat Bama!
So many thanks for your consideration, again!! Cheers

Ben Kirkland | Industrial Designer | Architecture Graduate Student
Virginia Tech | 540.250.8009 bkirkland@vt.edu
Appalachian Bonsai | YouTube | Website

Benjamin Kirkland <bkirkland@vt.edu>   Fri, Dec 6, 2019 at 11:45 AM
To: savannah_jackson@condenast.com

Good morning, Ms. Jackson,

I reached out to about two weeks ago hoping to gain permission to use screen grabs from Bon Appetit's YouTube channel in my thesis, specifically Amiel's Every Way playlist. Again, the content is 100% your company's and will be credited as such. I'm just hoping to show how the use of various camera angles makes the production of the videos elevated above all others. I hope that I might be able use them. I certainly appreciate your consideration and of course, the many channels your company provides. I am also happy to answer any questions you might have about the thesis and the limited use of your content.

Hoping the day is well. Cheers!

Ben Kirkland | Industrial Designer | Architecture Graduate Student
Virginia Tech | 540.250.8009 bkirkland@vt.edu
Appalachian Bonsai | YouTube | Website

[Quoted text hidden]

Jackson, Savannah <savannah_jackson@condenast.com>   Fri, Dec 6, 2019 at 12:06 PM
To: Benjamin Kirkland <bkirkland@vt.edu>

Hi Benjamin -- apologies for the delayed response! Yes, you're welcome to include screen grabs from the BA videos in your thesis using "Credit: Bon Appétit / Condé Nast Entertainment."

Glad to hear you enjoy them. Thanks!

[Quoted text hidden]

--

SAVANNAH JACKSON | Sr. Communications Manager, Bon Appétit & Condé Nast Traveler
1 World Trade Center, New York, NY 10007 | o: 212.286.5077 | m: 703.472.2281

CONDÉ NAST

Benjamin Kirkland <bkirkland@vt.edu>   Fri, Dec 6, 2019 at 12:19 PM
To: "Jackson, Savannah" <savannah_jackson@condenast.com>

That's so wonderful! Made my Friday.

Ben Kirkland | Industrial Designer | Architecture Graduate Student
Virginia Tech | 540.250.8009 bkirkland@vt.edu
Appalachian Bonsai | YouTube | Website

[Quoted text hidden]

Bob Ross: Figs. 4, 5, 6

VIRGINIA TECH.

Benjamin Kirkland <bkirkland@vt.edu>

May I refer to your videos in my thesis?
6 messages

Benjamin Kirkland <bkirkland@vt.edu>   Thu, Nov 21, 2019 at 3:41 PM
To: jesse.janson@janson.com

Good morning, Ms. Janson and Bob Ross crew,

I am currently working on my master's thesis and am wishing to refer to your videos and process. I am not profiting from any of this work, except for graduation, and am willing to forward on the work for your review prior to final completion if desired. You have every right to refuse.

In brief, my thesis describes camera setups used in online video tutorials. I consider all of the Bob Ross videos as proper tutorials, in that the aim of the videos are to provide thoughtful information and descriptions about the process (and of course the joy) of painting.

Since I am focusing specifically on the cameras and chosen angles used (like the detail cam of the palette, front head-on cameras, canvas camera, etc of every video, I would be taking screen grabs from your content to display the angles and types of shots as examples of quality framing, production, etc.

All images from your video will be credited to the Bob Ross channel (unless you would prefer the credit be to individual person(s) or the business). The end goal of this information is to model a theoretical product for creating quality tutorial video content from a desktop. Again, this is for academic purposes only - none of this is for profit.

I hope that I might have your permission for use. I would be absolutely honored, having grown up in the 80's with Bob Ross on the tube. And the excitement surrounding the revival of his popularity have swelled my heart. However, any reply is most appreciated.
Many thanks,

Ben Kirkland | Industrial Designer | Architecture Graduate Student
Virginia Tech | 540.250.8009 bkirkland@vt.edu
Appalachian Bonsai | YouTube | Website

Benjamin Kirkland <bkirkland@vt.edu>   Fri, Dec 6, 2019 at 11:42 AM
To: jesse.janson@janson.com

Good morning, Jesse,

I reached out to about two weeks ago hoping to gain permission to use screen grabs from the Bob Ross YouTube channel in my thesis. Again, the content is 100% yours and will be credited as such. I'm just hoping to show how the historical use of various camera angles makes the production of Bob's videos elevated above all others. I hope that I might be able use them. I certainly appreciate your consideration and of course, your channel. I am also happy to answer any questions you might have about the thesis and the limited use of your content.

Hoping the day is well. Cheers!

Ben Kirkland | Industrial Designer | Architecture Graduate Student
Virginia Tech | 540.250.8009 bkirkland@vt.edu
Appalachian Bonsai | YouTube | Website

[Quoted text hidden]

Jesse Janson <jesse.janson@janson.com>   Fri, Dec 6, 2019 at 12:01 PM
To: Benjamin Kirkland <bkirkland@vt.edu>, Sarah Strohl <sarah@bobross.com>

Hi Ben,

Thank you for the reminder here. I am cc'ing you with Sarah Strohl from Bob Ross Inc.

She can discuss this with you in further detail.

best,
[Quoted text hidden]
--
JESSE JANSON
Executive Vice-President for Acquisitions & Development @ Janson Media

---

Benjamin Kirkland <bkirkland@vt.edu>   Fri, Dec 6, 2019 at 12:18 PM
To: Jesse Janson <jesse.janson@janson.com>
Cc: Sarah Strohl <sarah@bobross.com>

Thank you so much.

Ben Kirkland | Industrial Designer | Architecture Graduate Student
Virginia Tech | 540.250.8009 bkirkland@vt.edu
Appalachian Bonsai | YouTube | Website

[Quoted text hidden]

Sarah Strohl <Sarah@bobross.com>   Fri, Dec 6, 2019 at 1:28 PM
To: Benjamin Kirkland <bkirkland@vt.edu>, Jesse Janson <jesse.janson@janson.com>

Hi, Ben,

Thank you very much for your interest in Bob Ross and appreciation for the show's videography.

You have permission from Bob Ross Inc. to use screenshots from episodes of The Joy of Painting as part of your master's thesis providing the end product is for academic purposes only and will not be professionally published or used in a manner that would tend to destroy or diminish the goodwill in Bob Ross Inc.'s intellectual property, or be pornographic, scandalous or defamatory, or denigrate, ridicule, degrade or tarnish any of the property or any of the rights of Bob Ross Inc. therein.

Please send an "I agree to the above terms" and you will have permission to use screenshots from The Joy of Painting in the manner your emails have described.

Happy Painting!

Sarah Strohl

Executive Assistant

Bob Ross Inc.

From: Benjamin Kirkland [mailto:bkirkland@vt.edu]
Sent: Friday, December 06, 2019 12:18 PM
To: Jesse Janson <jesse.janson@janson.com>
Cc: Sarah Strohl <Sarah@bobross.com>
Subject: Re: May I refer to your videos in my thesis?

Thank you so much.

Ben Kirkland | Industrial Designer | Architecture Graduate Student

Virginia Tech | 540.250.8009 bkirkland@vt.edu

Appalachian Bonsai | YouTube | Website

On Fri, Dec 6, 2019 at 12:02 PM Jesse Janson <jesse.janson@janson.com> wrote:

> Hi Ben,
>
> Thank you for the reminder here. I am cc'ing you with Sarah Strohl from Bob Ross Inc.
>
> She can discuss this with you in further detail.
>
> best,
>
>
> [Quoted text hidden]

Benjamin Kirkland <bkirkland@vt.edu>   Fri, Dec 6, 2019 at 1:53 PM
To: Sarah Strohl <Sarah@bobross.com>
Cc: Jesse Janson <jesse.janson@janson.com>

I (absolutely) agree to the above terms, and I am so delighted!!

Thank you for your generosity. I am humbled for this gift.

Most sincerely, and God Bless, my friends.

Ben Kirkland | Industrial Designer | Architecture Graduate Student
Virginia Tech | 540.250.8009 bkirkland@vt.edu
Appalachian Bonsai | YouTube | Website

[Quoted text hidden]

Marques Brownlee/MKBHD: Figs. 7, 8, 9

VIRGINIA TECH.

Benjamin Kirkland <bkirkland@vt.edu>

May I refer to your videos for my thesis?
3 messages

Benjamin Kirkland <bkirkland@vt.edu>   Thu, Nov 21, 2019 at 9:16 AM
To: marques@mkbhd.com

Good morning, Marques & crew,

I am currently working on my master's thesis and am wishing to refer to your videos and process. I am not profiting from any of this work, except for graduation, and am willing to forward on the work for your review prior to final completion if desired. You have every right to refuse.

In brief, my thesis describes camera setups used in online video tutorials. I consider the unboxing process as a form of tutorial, in that one of the aims of the videos are to provide thoughtful information and descriptions of a product. You recently (January) posted a video of UnboxTherapy's video setup. I have reached out to them as well, in hopes of also gaining permissions.

Since I am focusing specifically on the cameras and chosen angles used (like the overhead, middle camera (head on), side cameras, etc of the main studio (not the new one), I would be taking screen grabs from your videos to display the angles and types of shots they (& you) used (It's an incredible BTS video you produced, btw). I would also like to use images from the BTS of *your* studio that Sam Sheffer did a few months ago. I am also contacting him.

All images from your video will be credited to your channel (unless you would prefer the credit be to individual person(s)). The end goal of this information is to model a theoretical product for creating quality tutorial video content from a desktop. Again, this is for academic purposes only - none of this is for profit.

I hope that I might have your permission for use. However, any reply is most appreciated.
Many thanks,

Ben Kirkland | Industrial Designer | Architecture Graduate Student
Virginia Tech | 540.250.8009 bkirkland@vt.edu
Appalachian Bonsai | YouTube | Website

Marques Brownlee <marques@mkbhd.com>   Thu, Nov 21, 2019 at 12:33 PM
To: Benjamin Kirkland <bkirkland@vt.edu>

Sure go for it! Best of luck.
[Quoted text hidden]

Benjamin Kirkland <bkirkland@vt.edu>   Thu, Nov 21, 2019 at 12:36 PM
To: Marques Brownlee <marques@mkbhd.com>

Forever grateful. So many thanks. 🙏

Ben Kirkland
Industrial Designer and Graduate Student
Virginia Tech | Blacksburg, VA
[Quoted text hidden]

12/27/2019   Virginia Tech Mail - May I refer to your videos in my thesis?

VIRGINIA TECH.

Benjamin Kirkland <bkirkland@vt.edu>

May I refer to your videos in my thesis?
4 messages

Benjamin Kirkland <bkirkland@vt.edu>   Tue, Nov 26, 2019 at 1:45 PM
To: dnunsworth@yahoo.com

Good evening, Mr. Dan Unsworth,

I am currently working on my master's thesis and am wishing to refer to your Ingleton Pottery videos and process. I am not profiting from any of this work, except for graduation, and am willing to forward on the work for your review prior to final completion if desired. You have every right to refuse.

In brief, my thesis describes camera setups used in online video tutorials. I consider your pottery videos as forms of tutorials, in that the aims of the videos are to provide thoughtful information and descriptions of your process.

Since I am focusing specifically on the cameras and chosen angles used (like the front head-on views, side cameras, recent use of overheads) in the various videos, I would be taking screen grabs from your content to display the angles and types of shots as examples of quality framing, production, etc.

All images from your video will be credited to your channel (unless you would prefer the credit be to you as an individual person). The end goal of this information is to model a theoretical product for creating quality tutorial video content from a desktop, or in your case, a potter's wheel. Again, this is for academic purposes only - none of this is for profit.

I hope that I might have your permission for use. I've enjoyed your videos for years, have found them continually enjoyable to watch, and finally began pottery classes this fall. (My wife and I love container-grown potatoes as well!) However, any reply is most appreciated.

So many thanks, and I look forward to more of your content.
Cheers!

Ben Kirkland | Industrial Designer | Architecture Graduate Student
Virginia Tech | 540.250.8009 bkirkland@vt.edu
Appalachian Bonsai | YouTube | Website

Benjamin Kirkland <bkirkland@vt.edu>   Fri, Dec 6, 2019 at 11:48 AM
To: dnunsworth@yahoo.com

Good morning, Mr. Dan,

I reached out to about two weeks ago hoping to gain permission to use screen grabs from your YouTube channel in my thesis. Again, the content is 100% yours and will be credited as such. I'm just hoping to show how your use of various camera angles makes the production of your videos elevated above all others. I hope that I might be able use them. I certainly appreciate your consideration and of course, your channel. I am also happy to answer any questions you might have about the thesis and the limited use of your content.

I'd also love to ask you some questions, specifically about the possibility of using multiple cameras for your vids. Routinely, you change the direction of your camera angles, and most recently, you gave us an overhead shot. Would you ever consider a camera setup that shot from multiple angles at the same time, or would the editing process be just too much of a hassle given how time intensive it can be? Anyways, I thank you so very much.

Hoping the day is well. Cheers!

Ben Kirkland | Industrial Designer | Architecture Graduate Student
Virginia Tech | 540.250.8009 bkirkland@vt.edu
Appalachian Bonsai | YouTube | Website

[Quoted text hidden]

https://mail.google.com/mail/u/2?ik=26582766bf&view=pt&search=all&permthid=thread-a%3Ar2005904515571402520&simpl=msg-a%3Ar201416693...   1/2

Dan Unsworth <dnunsworth@yahoo.com>   Thu, Dec 12, 2019 at 9:42 AM
To: Benjamin Kirkland <bkirkland@vt.edu>

    Hi, you may use some screen grabs of my videos.
    Thanks.
    Dan.

    [Quoted text hidden]

Benjamin Kirkland <bkirkland@vt.edu>   Thu, Dec 12, 2019 at 10:25 AM
To: Dan Unsworth <dnunsworth@yahoo.com>

    Thank you.

    Ben Kirkland | Industrial Designer | Architecture Graduate Student
    Virginia Tech | 540.250.8009 bkirkland@vt.edu
    Appalachian Bonsai | YouTube | Website

    [Quoted text hidden]

Mark Crilley: Figs. 13, 14, 15

VIRGINIA TECH.   **Benjamin Kirkland <bkirkland@vt.edu>**

May I refer to your videos in my thesis?
2 messages

Benjamin Kirkland <bkirkland@vt.edu>   Thu, Nov 21, 2019 at 3:22 PM
To: mark@markcrilley.com

Good afternoon, Mr. Mark Crilley,

I am currently working on my master's thesis and am wishing to refer to your videos and process. I am not profiting from any of this work, except for graduation, and am willing to forward on the work for your review prior to final completion if desired. You have every right to refuse.

In brief, my thesis describes camera setups used in online video tutorials. And of course, your drawing videos are forms of tutorials. Since I am focusing specifically on the cameras and chosen angles used in tutorial videos, like the overheads you use, I would be taking screen grabs from your content to display the angles and types of shots as examples of your quality framing, production, etc.

All images from your video will be credited to your channel (unless you would prefer the credit be to you as an individual person. The end goal of this information is to model a theoretical product for creating quality tutorial video content from a desktop. Again, this is for academic purposes only - none of this is for profit. I hope that all makes sense.

I hope that I might have your permission for use. However, any reply is most appreciated.
Many thanks,

Ben Kirkland | Industrial Designer | Architecture Graduate Student
Virginia Tech | 540.250.8009 bkirkland@vt.edu
Appalachian Bonsai | YouTube | Website

mark <mark@markcrilley.com>   Thu, Nov 21, 2019 at 4:47 PM
Reply-To: mark <mark@markcrilley.com>
To: Benjamin Kirkland <bkirkland@vt.edu>

Go right ahead, Ben. Glad my videos can be of use to you!

Mark
[Quoted text hidden]

NikkieTutorials: Figs. 16, 17, 18

VIRGINIA TECH.   Benjamin Kirkland <bkirkland@vt.edu>

May I refer to your videos in my thesis?
4 messages

Benjamin Kirkland <bkirkland@vt.edu>   Thu, Nov 21, 2019 at 3:45 PM
To: info@nikkietutorials.com

Good afternoon, Ms. Nikkie,

I am currently working on my master's thesis and am wishing to refer to your videos and process. I am not profiting from any of this work, except for graduation, and am willing to forward on the work for your review prior to final completion if desired. You have every right to refuse.

In brief, my thesis describes camera setups used in online video tutorials. All of your videos are wonderful, but I'm really excited how you use the single head-on shot so effectively - it's awesome. Since I am focusing specifically on the cameras and chosen angles used, I would be taking screen grabs from your content to display the angle as examples of quality framing, production, etc.

All images from your video will be credited to your channel (unless you would prefer the credit be to you as an individual person). The end goal of this information is to model a theoretical product for creating quality tutorial video content from a desktop. Again, this is for academic purposes only - none of this is for profit.

I hope that I might have your permission for use. However, any reply is most appreciated.
Many thanks,

Ben Kirkland | Industrial Designer | Architecture Graduate Student
Virginia Tech | 540.250.8009 bkirkland@vt.edu
Appalachian Bonsai | YouTube | Website

NikkieTutorials <info@nikkietutorials.com>   Thu, Nov 21, 2019 at 3:45 PM
To: bkirkland@vt.edu

Hi!

Thanks for reaching out. If you read this, we want you to know that we see you, and we have read your e-mail. We get a lot of requests on a daily basis and because of that we have to set priorities. Therefore we will only be able to follow up on e-mails that are of interest to us. If not, it has to do with personal matters, conflicting partnerships, timing or matters we can't share any details about.

Oh and if you were so kind, just sending an e-mail to tell me that you like me, I love you too!

--
Regards,

NIKKIE DE JAGER
Owner, NIKKIETUTORIALS

YouTube
Instagram

Wes van Os <wes@wes44.com>   Fri, Nov 22, 2019 at 5:34 AM
To: bkirkland@vt.edu

Hi Ben,

Thank for your reaching out. Sure go ahead! I just don't give permission to publish your thesis online or for public matters.

I understand that you can present it to professors etc.

Maybe you can share the final result with me? Anyway, good luck!!

Yours sincerely / Met vriendelijke groet,

Wes van Os
Manager NikkieTutorials
Owner, WES44

M: +31654616797
E: wes@wes44.com

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        Please don't print this e-mail unless you really need to.

On Fri, Nov 22, 2019 at 11:28 AM NikkieTutorials <info@nikkietutorials.com> wrote:

Regards,

NIKKIE DE JAGER
Owner, NIKKIETUTORIALS

YouTube
Instagram

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[Quoted text hidden]

Benjamin Kirkland <bkirkland@vt.edu>   Fri, Nov 22, 2019 at 7:22 AM
To: Wes van Os <wes@wes44.com>

Forever grateful. So many thanks.

Ben Kirkland
Industrial Designer and Graduate Student
Virginia Tech | Blacksburg, VA
[Quoted text hidden]

Appendix B: Future Research Design: Effectiveness for Learning

Research Design and Methods

Aims and Objectives

The goal of this research is to establish a base of knowledge surrounding the effectiveness of video tutorials in design education. Specifically, we hope to:

1. Determine whether or not video tutorials using multiple camera views will be as effective, or more effective than video tutorials using single camera views.
2. Answer possible human-computer interaction (HCI) questions that arose during initial research.
3. Open a discussion surrounding the value of online video tutorials and their future role in design education.

Methods and Sources

We aim to quantitatively test this hypothesis by constructing a multi-camera system to take simultaneous videos from multiple viewing angles. We will record a series of tutorials, present them to student subjects, and test their ability to replicate the information against predetermined guidelines. The video tutorials will cover three simple design concepts: 2D sketching of a perfect sphere, sanding a perfect radius in foam, and forming a ceramic pinch pot. The video instructor will provide a rubric to the investigators prior to the start of the study as a guide to assess the artifacts produced by the study. The student subjects will come from a design background (architecture, industrial design) with an expected age range of 18-24 years. Subjects will be offered a $10 gift certificate each in return for their time and participation in the study. Half the subjects will see the multi-camera video. The other half will see a single camera video. All subjects will be asked to replicate the tasks with given materials. The produced artifacts will be blindly evaluated against the provided rubrics. It is assumed that students with access to multiple camera views will produce better artifacts than students with access to a single camera view.

Surveys will be given at the beginning and at the end of each study. Survey questions will assess prior knowledge of the tasks to be performed. Understanding prior knowledge may allow the researchers to establish the amount of bias in the study.

Practicalities and Potential Obstacles

Some factors at play are the experiences of our subjects. Some subjects may have prior experience with the materials and tasks, which will allow them a level of proficiency above novices. To determine the makeup of subjects, a questionnaire will be provided at the beginning of the study. Subjects will then be arranged to provide two groups of study subjects with balanced levels of experience. 'Balanced' will mean that an equal ratio of experienced and novices should be present in each group.

Requiring subjects to provide a baseline form at the beginning of the study automatically introduces bias into the study in the form of a practice round. By default, each experience informs the next.

Funding: Currently, there is no outside funding for this project. A $3000 SEAD grant from ICAT is proposed.

Timing: It is believed there will be little time to perform this study prior to Virginia Tech's Fall graduation date of December 20, 2019. However, a hypothetical study with hypothetical results will be issued for this thesis. Assuming this case, the actual study will be performed in the Spring 2020, to be completed by the end of the same academic year.

Implications and Contributions to Knowledge

Practical Implications

In practice, multiple camera views, if properly used, should provide a fuller picture of a concept. Much as a student might walk around an object to gain a clearer picture of concepts specific to them, multi-camera tutorials may also give students an ability to choose the view most desirable to them. However, as found within initial research, multiple views shown simultaneously may create confusion unless properly arranged on the viewing screen. Understanding this during the research will help us understand the implications of such a presentation.

Theoretical Implications

Assuming the results are in favor of multiple camera angles, use of them in online tutorials should increase.

As greater understanding of camera angles, as they relate to educational information, increases, so will our ability to assign values to online content's effectiveness.

Important HCI questions may be addressed, answered, and possible be raised.

Call greater attention to the use of online tutorials as a viable means to present information. It may also lead to further research in the areas of three-dimensional videography, specifically volumetric.

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