Comparison of Video Ethnographic Modes for Design Research

by

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Abstract

Design research is a daunting and time consuming process in which many hours of research is collected through methods such as interviews, surveys, focus groups and visual techniques such as photography and video. This study aims to compare video gathering techniques when coupled with participatory research during in-situ video ethnography. Participatory design has long been a driving force for design companies and researchers in order to better their products through direct user interaction, not only with the product but with the design researcher also, in order to grasp a better understanding of the users needs and wants. This research study will utilize a participatory design strategy for further user involvement. Multiple video techniques are compared where a design researcher may use sports action cameras, tablets and computer applications to record video to immediately interview the user with the collected video without having to return at a later date. This facilitates a fresher mindset for both the user and the researcher to further the understanding of user interactions by collaboratively reviewing the recorded video in-situ.

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Table of Contents

List of Figures

List of Abbreviations

AAA   American Anthropological Association

ASC   Action Sports Camera

FPS   Frames Per Second

IRB   Institutional Review Board

LTE   Long Term Evolution

MBA   MacBook Air

PC   Personal Computer

Chapter 1 Introduction

1.1 Problem Statement

Conducting design research is often a necessary and fundamental element to creating effective design innovations. These innovations are frequently discovered through in depth user-centered research where the design researcher conducts interviews, surveys, photography and observes product/user interactions. The problem lies in the researcher's ability to observe interactions, but also to see areas that may be improved and innovated through the design. Photography and video are indispensable tools for design researchers both to capture a snapshot of the complex interaction between user and product and to document interviews and discussions with users.

Employing visual research in design has resulted in using snapshots of interactions through photography and recording video that would then have to be analyzed during a review process. The time consuming nature of video analysis is often not conducive to the tight timelines that are involved in product design and development. Methods of analyzing video at a later time can preclude the valuable information that users may provide during or immediately after the product/user interaction has occurred.

1.2 Need For Study

Ideally, most design projects begin with the gathering research for a product or process that is being designed. This research has traditionally been done through photography, user

interviews and in-situ observations that may span days or weeks on the same topic or experience. This can also be a labor-intensive process because of the need to go from one research method to another and then combine methodologies together for the final result. There needs to be a methodology that would allow designers to conduct multiple levels of research that would better facilitate a more timely turnaround from initial user testing and observations to user interview and review.

As technology becomes more accessible and readily available, digital cameras, tablets and small devices have an ever-present quality that facilitates their use in emerging research methodologies. Digital media and the sharing of content between devices makes the use of electronics a vital use in design research today.

The use of video not only can increase the productivity of the designer, but also enable the discovery of more unique and complex problems that can plague the user. Bringing the user into the design process through collaboration on the video review gives insights that designers could otherwise only predict as to the user's wants or actions. Merging collaborative design with ethnography provides the designer with a broad area of research opportunities that further enrich the products that are created.

1.3 Study Objectives

The main objective of this study is to compare video research modes and their viability for conducting participatory research pertaining to the field of industrial design. This will be accomplished by conducting research using sets of video ethnographic modes with a participatory research strategy to gain insight into the ability of these modes to be used to gain more knowledge of product/user interactions. Conducting participatory research includes

outlining devices including cameras, tablets and peripherals that may be needed to conduct proper video research. Each device will be detailed, vetted and judged based on their advantages and shortcomings pertaining to video ethnographic modes. This type of research is centered on gauging the development of rapport between user and researcher that associates itself with the interaction of products or services. Research conducted in this manner is meant to bring together the user and research in a way that allows the user to have a vested interest in the design outcomes.

1.4 Definition of Terms

1st Person Perspective: a perspective that is taken from the viewpoint of a person's own vision.

1080p: a high-definition video and screen resolution of 1920 x 1080 pixels.

3rd Person Perspective: a perspective that is taken from the viewpoint of someone watching
    another.

30-pin: the proprietary connection that it used between Apple's mobile devices.

720p: a high-definition video and screen resolution of 1280 x 720 pixels.

Aspherical: varying slightly from sphericity and having only slight aberration, as a lens (Free
    Dictionary, 2013).

Design Ethnography: using video to study the daily practices of (potential) users and to
    communicate findings to designers. It sees users in the role of informants (Ylirisku,
    2007).

Emic: of or relating to features or items analyzed with respect to their role as structural units in a
    system, as in behavioral science or linguistics (Free Dictionary, 2013).

Ethnography: the study of people in their natural settings; a descriptive account of social life and

      culture in a defined social system, based on qualitative methods (e.g. detailed

      observations, unstructured interviews, analysis of documents) (Hanington, 2011).

Etic: of or relating to features or items analyzed without considering their role as a structural

      unit in a system, as in behavioral science or linguistics (Free Dictionary, 2013).

Film: a form of entertainment, information, etc., composed of such a sequence of images and

      shown in a cinema, etc (Free Dictionary, 2013).

Gang Box: a storage container that is used on a construction site which contains tools or

      materials.

Human Centered Design: an integrated process that includes active consultation with people

      (users) through various means of primary research during all phases of design

      development (Hanington, 2011).

In-Situ: being in the original position; not having been moved or transferred to another location;

      as, an in-situ investigator (Free Dictionary, 2013).

Long Term Evolution (LTE): a wireless data standard that is capable of download speeds of

      300Mbps (Schindler et al., 2011).

Objectivity: judgment based on observable phenomena and uninfluenced by emotions or

      personal prejudices (Free Dictionary, 2013).

Participatory Design/Research: involves users as participants in a design process where the user

      works directly with a researcher for the production of design knowledge (Ylirisku,

      2007).

Rapport: elationship, especially one of mutual trust or emotional affinity (Free Dictionary,

     2013).

Realism: an inclination toward literal truth and pragmatism (Free Dictionary, 2013).

Reflexive: directed back on itself (Free Dictionary, 2013).

Self: The total, essential, or particular being of a person; the individual (Free Dictionary, 2013).

Subjectivity: proceeding from or taking place in a person's mind rather than the external world

     (Free Dictionary, 2013).

Video: of or relating to videotaped productions or videotape equipment and technology (Free

     Dictionary, 2013).

Visual anthropology: a subfield of cultural anthropology that is concerned, in part, with the study

     and production of ethnographic photography or film (Free Dictionary, 2013).

1.5 Literature Review

This collection of literature falls in three distinct categories: video research, anthropological guides, and design practices. The basis of research for this study lies within video research practices for both design and anthropology. Therein, many works have been written on photographic anthropological methods that could also be used with video practices in design. Current design practices are vital as they could be tailored and used alongside video design research or to draw from practices that would help review or capture of video be easier and more productive. It is also required that certain areas of ethical standards be addressed, in particular dealing with video research and the use of that research in academic articles, presentations and use or disposal of the video after data is gathered and analyzed.

The most relevant book that directly deals with video practices in design ethnography is a book by Salu Ylirisku and Jacob Buur (2007) entitled *Designing With Video*. Ylirisku and Buur outline many different techniques for the capture and review of video research in design ethnography while focusing heavily on distilling gathered video research by analysis and further review as opposed to focusing more time on the creation of it. The latter is a distinct difference between this study and Ylirisku's work. It offers a highly user-centered design approach mainly due to the use of video in recording interactions between the users and their environments or products. Ylirisku speaks openly about the need for user-centered design:

> User-centered design is an approach to designing products, systems or services that puts the people who will use the product at the centre of the development effort. The approach promotes the active involvement of potential users of the designed products in the process. (p. 6)

This work relates to this study due to its strong user-centered approach through methodically thought-out video ethnographic techniques and review.

Designing with Video lays out the need for video ethnography in design research. It outlines ethnography's highlights and limitations while informing the reader what is necessary to conduct this type of research and that the user is an integral part of it. Ylirisku explains that "activities in real life unfold at an incredible speed. There are too many processes going on, the active structures are too complex, and there are too many aspects to focus on, to create a detailed understanding of what happens when people act" (p. 21). *Designing with Video* explores the background and positive outcomes that become apparent through user collaboration because "interaction analysis also adds a social dimension to the analysis, which is necessary for design,

6

as most products relate to several people, at the same time or at different times" (p. 21). It applies particularly to the direction of this study by enforcing the proposition that "video allows a design team to learn more in short, condensed field studies; it provides a resource for collective analysis; and it may replace the written ethnography to better inform the design process" (p. 21). This study aims to shorten field studies by allowing designers to access the captured video onsite in-situ with the user collaborating the instant after the product interaction occurs. Ylirisku's previous statement solidifies the need for such a study and its usefulness within design.

Video has "enhanced the range and precision of the analysis of real-context interaction remarkably, and the detailed and close-to-reality nature of the video data provides some guarantee that the analytic conclusions will not arise as artifacts of intuitive idiosyncrasy, selective attention or recollection" (Ylirisku, 2007, p. 20). Video serves as a medium in which researchers, users and companies can all understand the interactions without having to be guided through them step by step. Video is open to interpretations of the viewer and those "video materials allow the interactions to turn into catalysts of a dialogical learning process rather than as static sources of objective user data" (Ylirisku, 2007, p. 26). The use of video serves as an added depth of perception. Instead of breaking down a photograph into its criteria, the video speaks to the criteria on its own without the distractions that often plague photographic research. Especially in design, "video is capable of capturing activities in a manner that holds the contextual aspects intact rather than delivering decontextualized generalizations of the issues encountered" (Ylirisku, 2007, p. 45). Ylirisku goes even further and explains three qualities that video ethnography contains:

First, video provides access to the details of talk and visual conduct, enabling a detailed

scrutiny of the activities, if necessary, with slow motion; second, video recordings

enable researchers to share the data with colleagues and thus enable discussion on

the materials on which the analysis is based; and third, video enables the public display

of the findings, thus subjecting the findings to public scrutiny. (p. 45)

Based on these three qualities, the researcher must further understand that video ethnography is

not a simple task to be had with just a camera, a user and a location but instead needs to be

grounded in a methodology to conduct such research.

Methodological approaches in video ethnography are addressed by explaining that a

"method may be understood as organizing a party. People do not plan precisely what the quests

need to do step-by-step, but they put all their energy into organizing the space, the lighting, the

food, the decoration, the songs and the music" (Ylirisku, 2007, p. 34). Even though a method is

essential, it is at its core a rudimentary guide as to the direction a design research should take in

setting up the situation and equipment. The researcher should not guide the research step by step

but, in a sense, be ready for situations as they occur. Ylirisku outlines some guiding principles to

set up methodologies for video based design research:

Natural settings: Studies should be conducted in field settings rather than in laboratory

experiments. Holism: Particular actions can be understood only in the everyday context

where they occur. Description: The accounts of the human practices describe how people

actually behave, rather than how they ought to behave. Members' Points of View: The

descriptions aim to create an insider's view of the situations and describe the activities in

terms that are relevant and meaningful to those who are studied. (Ylirisku, 2007, p.53)

Using these guiding principles, Ylirisku states that it is easier to set up a strict methodology based on the research that is being conducted.

Even though Ylirisku and Buur have given a distinct mindset of how video aids design; it is also stated that there are problems with any methodology and research. Video, no matter the extent to which the design research is taken is unbiased, is inherently biased in some regard because:

> Representations such as film are inherently opinionated because they are inherently incomplete; it is impossible for filmmakers to avoid making choices about what is important. At the same time, filmmakers' biases are constrained by the material they have to film: documentaries cannot simply invent the material they use. (Ylirisku, 2007, p. 48)

Designers should be aware of this at all times and do their best to be unbiased but understand still that there will be biases involved. Another, although almost unresolvable, problem is that of the user being recorded. Any user may change due to video and it must be "noted that people's behavior is influenced by video at various levels. Depending on how automatic or conscious the activities are that people engage in, they may change their behavior to differing extents." (Ylirisku, 2007, p. 49).

Designing with Video is an advocate for video based design research. Ylirisku and Buur explain many advantages and even problems that persist with video in design ethnography and even go so far as to list and describe possible ways that design teams could distill such information. It is an essential work for this study and therefore needs the utmost consideration.

Sarah Pink's *Doing Visual Ethnography* is a primer to an introduction for doing video, or visual, research. It discusses methods, problems and ethics of conducting research with users in many different settings. It must be noted that this work is anthropological in nature and is therefore useful, yet not directly associated, with design practices or ideals. Regardless, many chapters of this book are noteworthy. Pink covers photography in depth with less attention to video but many of the techniques and specifications that Pink describes for photography stand for videography as well. Since this work is anthropological, Pink delves into the ethics of visual research that pertains to both photographic and video situations. She also endeavors to cover the creative ability of both researcher and informant on gaining the ethnographic knowledge.

Pink begins by defining ethnography as "a process of creating and representing knowledge (about society, culture and individuals) that is based on ethnographers' own experiences" (2007, p. 22). Traditionally, ethnography could only be examined and conducted under pretexts of past experiences because footage that is gathered is viewed based on a researcher's personal history and already predisposed facts. She furthers this definition by describing it as "an approach to experiencing, interpreting and representing culture and society that informs and is informed by sets of different disciplinary agendas and theoretical principles" (Pink, 2007, p. 22). Research gathered is only as good as the interpretation that a design researcher attaches to the material.

Since interpretation is rooted both with the researcher and the user, it is important to understand the "role in how both researcher and informant identities are constructed and interpreted. As part of most contemporary cultures, photography, video and other media also form part of the broader context in which researcher and informant identities are situated" (Pink,

2007, p. 26). One researcher may conduct the same research a different way than another and a user may alternatively affect the way in which research is gathered, allowing the observed user to become part of the way in which video is captured, and resulting in an additional depth that may be added to the research. Involving the user directly within research is a way for "photography [to] inspire people to represent and then articulate embodied and material experiences that they do not usually recall in verbal interviewing" (Pink, 2007, p. 28). Even though visual ethnography opens up an area of research, the effect of relationships between researcher and user and equipment used should be considered.

While design ethnography is typically conducted by design researchers, it is actually a collaboration between researcher and user and should not be thought of as researcher-independent. Pink elaborates by saying that "in order to understand the practices of both ethnographers and informants as image-makers it is important to consider how relationships develop between individuals, visual technologies, practices and images, society and culture" (2007, p. 33). For a design researcher to truly be able to analyze data, these factors should be addressed. Attempting to analyze visual data without background knowledge does not allow the data to have a direction or foundation in context. Although research is gathered through video ethnography, "knowledge is produced in conversation and negotiation between informants and researcher, rather than existing as an objective reality that may be recorded and taken home in a note book, camera film or tape" (Pink, 2007, p. 98). Research conducted using video ethnographic methods should not be considered final research. True in-depth knowledge on user/product interactions comes also from applying these video ethnographic methods to interviews with users. Herein lies the basis of this study. Since ethnographic data is, in a whole,

incomplete due to the subjectivity of the designer in capturing and reviewing video, the addition of user interview components is strongly needed. Pink describes ways in which users may become more involved in the research by "formal video-recorded interview[s], during which the informant viewed and commented on video footage of an event in which he had participated, to much more casual screenings in which informants have become involved out of personal interest rather than by request" (Pink, 2007, p. 112). A goal of this study is to similarly include users in research, and to encourage their participation in a manner that would allow them to have a personal interest in the project.

Anthropologists deal with the ethics of visual anthropology much more than designers, but being that both are collecting visual data in intimate settings the topic of ethics needs to be addressed. This work dedicates a large section to ethical treatment of research and participants. For designers "doing ethnographic research in intimate contexts like the home the use of visual media and methods creates new ethical and practical dilemmas as the camera enters personal domains that might not normally be the object of public scrutiny" (Pink, 2007, p.28). The differences between design and anthropology lay in the fact that most of the research gathered by designers is never released to the public and therefore remains more protected.

The information on ethnographic techniques and situations to consider are invaluable to this study. Anthropology is a much older profession where anthropologists have created and perfected methods that cannot be ignored for design ethnography. It is a rich resource with multiple works completed on the topic of anthropological methodology. Pink's assessment of visual anthropology is a strong and distinct work that has many implications for the use of ethnography in design practices.

Pink (2006) has another work entitled *The Future of Visual Anthropology* which was published before *Doing Visual Anthropology,* and has less of an impact on this study. It does, however, offer insights that should be addressed. It covers topics of video ethnography, methodologies, interdisciplinary collaboration and, most importantly, collaboration between user and researcher. Pink's detailed attention to user/researcher collaboration in this work is the most important contribution to this study.

This study's focus on user collaboration encourages relationships, however short they may be, between user and researcher. Pink (2006) states:

> By adding video to the process of telling or talking to, through a method of showing-touring and embodied enacting, our collaborations with informants can involve not simply spoken narratives of their sensory experiences but also visual display, exposure to sounds, smells and textures, thus bringing the ethnographer closer to the sensory, prereflective experiential context. (p. 48)

Using video as a process to interview in-situ creates a depth of reality and information that is not available in photographic research. Video captures multiple facets: sound, conversation and expressions that would be impossible to capture and portray through photography. Using video as a research and interview tool makes it possible to overlook trivial interpretations and, instead, allows focus on the interaction at hand. Through video, users are allowed more freedom to express themselves than they would otherwise and, instead of posing, users can "convey their sensory experiences on camera using sound (playing music, taking me to 'noisy' places), smell (spraying perfumes and household products in the air, inviting me to stick my nose and camera in 'smelly' cupboards) and touch (running hands over surfaces or massaging a 'creamy, smooth'

product into a sponge), as well as vision" (Pink, 2007, p. 60). Photography is an important resource for designers but it cannot match the depth and speed that video ethnography allows between user and researcher.

The Future of Visual Anthropology delivers key steps and thoughts on the production, review and overall insight that is performed before and after video ethnography. Video provides a large amount of contextual data but that data should have pre- and post-contextual information. "A researcher should attend not only to the internal 'meanings' of an image but to how the image was produced and how it is made meaningful by its viewers" (Pink, 2006, p. 29). Even though this quote is based on anthropological film, the idea behind it is valid for video ethnographers to understand that video ethnography begins before filming and even lives outside of its finished product through the relationship that the researchers give it. Once video footage has been captured and the interview has commenced there is "the idea that images exert their own power and agency, and that meanings are thus constructed in negotiation between image and viewer" (Pink, 2006, p. 33). The ability to immediately interview a user who has just been recorded interacting with a product or an environment creates a visual understanding, an "aha" moment, between the user and their recorded interactions. It facilitates deeper and mentally fresh interviewing than otherwise could be achieved.

Collaboration with the user and an ever growing relationship with the interviewees is "needed for designers to 'move beyond "merely" understanding work practices' because 'users are real people with feelings, dreams' - this means an interest in 'experience modeling' and what we might call the cultural brokerage of 'bringing together user culture and design culture'" (Pink, 2006, p. 93). Designers often view users as a means to an end, as their portal to

better understand the relationship that "average" users have with objects. The use of video ethnography and the user collaboration mindset needs to be adjusted. Through this methodology users are now a gateway to better understanding, not just a piece in a puzzle but essentially the piece. That piece needs better understanding and a truer relationship with users for the process to work fluidly and effectively.

To solidify the need for video ethnography, Pink believes that video is important for two reasons:

> First, it facilitated my informants' self-representation. They could 'show' on video how they do things and what is important to them. Second, it gave me a visual record of our encounter, which documented not only what MacDougall (1998) has called the 'deep reflexivity' of the process of knowledge production, but also the material context where we interacted with informants' embodied representations of their sensory experience.
>
> (Pink, 2006, p. 95)

Pink draws from personal experiences using video anthropology and describes the outcomes that came from bringing the camera into the research environment, including using "reflexive" approaches such as asking informants to act out specifics of their day or by asking someone to interact with a product on video. This study aims to bring reflexive approaches to video ethnography in a slightly different way. Post-reflexive video ethnography is not about asking someone how they would interact with a product or an environment but instead allowing interactions to happen naturally, without any direction from the design researcher. Afterwards, this method allows "reflection" on interactions by interviewing the users with video on hand. Using this methodology still has to remain within a broader range of approaches, because one

approach will not work for every situation or context. To a designer the participation and

collaboration for the user is a must and therefore since the research is "normally short-term . . .

methods must be adapted to context" in order for the research to garner the results necessary

(Pink, 2006, p. 94).

Pink's descriptions of personal experience aid in her explanation of video ethnographic

methods in anthropology and outline a broad basis of uses for such research. She also describes

four elements that make up the definition of "applied engagements of visual anthropology" and

those elements are as follows:

1. Engaging with an interdisciplinary context of applied research.

2. Researching, collaboratively or in a participatory design, other people's experience as

they narrate and/or show and perform it.

3. Representing this experience in ways that are framed culturally and institutionally to

try to give the target audience a sense of it that is in a familiar 'language' but

simultaneously causes them to stand back from their existing knowledge and

experience to understand new forms.

4. Ideally also both drawing form and contributing to academic mainstream visual

anthropology theoretically, methodologically and substantively (Pink, 2006, p.

101).

These elements are grounded solely in the pretext of anthropological data through cultural

studies but their validity remain when taken into context in a methodology dealing with design

ethnography.

Both *Doing Visual Ethnography* and *The Future of Visual Anthropology* provide valuable resources to this study. The former work's critical take on video ethnographic research for anthropologists and the guidance that both of them provide are crucial to conduct video ethnography. They, however, lack in the evaluation and critique of the work after its creation. This limitation is understandable: due to their anthropological base the ethnographic film should be interpreted by the viewer and not guided by any preconceived notion that the film maker may have. The other areas these books cover such as ethics, creation, reflexive video ethnography and other methods are true to methodologies that may be created with design ethnography.

One of the most respected works on visual anthropology was written by John Collier Jr. and Malcolm Collier (1986) entitled *Visual Anthropology*. Even though it was published in 1986 the ideas and methods that were devised, using then current photographic and film technologies, is unparalleled. The Collier brothers begin their book like the previous two works by describing the need and the advantages of visual anthropology because "the critical eye of the camera is an essential tool in gathering accurate visual information because we moderns are often poor observers" and that "the camera's value in such recording is that it can catch the simultaneous details of such processes, freezing them for later definition of relationships among difference elements that might well escape the unaided observer" (1986, p. 5, 91). They make it clear that personal observations, without capturing via video, are ultimately inefficient for anthropologists. Considering that statement, if personal observations are not complete for anthropologists then it stands to reason that it will also not be ideal for design ethnography. It is apparent through this, and previous works, that visual design ethnography is needed. Thus, the justifications will not be

overly covered through the dissection of this work and instead the discussion will focus more on the methodology and practices outlined by the Collier brothers.

The Collier brothers offer essential points to the methodology of creating ethnographic video. These methods are as important to design ethnography as they are to anthropological studies. Collier states that "there are defined needs in photographic data," that a designer must use "framing to preserve the context" and that "we also need the details of process as well as the contextual setting. Photographically we need the detailed foreground as well as the wide vista." The idea that a photograph captures the process as well as the background adds an amazing depth to the understanding of the interaction as a whole.

Visual Anthropology works through some of the difficulties that forming a methodology may cause. It provides areas of interest and key points that are essential to creating a methodology. The anthropological method begins with choosing a subject. The Collier brothers briefly outline the main steps in creating a methodology for a research:

> In the field we must decide what is to be recorded with the camera and then record it: in analysis we must discover what those records may tell us. In the communication of findings we must attempt to define what it all means in a form that can be understood by our colleagues and the public. A successful research design should help lead us through these different steps in a manner that makes full use of the potential of visual recording in research. (Collier, 1986, p. 167)

Research methodologies must be considered beforehand. A methodology is an approach to conduct any string of events effectively. Throughout a design process, a designer does not jump head first into ideation and then a final product locked in a room. There is a design method

present for a very good reason. Design is a plan from start to finish of everything that needs to happen in order to create a successful product; research methodology is no different. Therefore, designers must plan out how to conduct video research. They need to think about the areas to research, subjects to conduct the research with and many other factors before they enter the field and conduct the research. The Collier brothers' critical approach to creating methodology in ethnographic video is essential to this study in understanding how ethnographic video may be captured and made simpler using a methodical approach. On the other hand, open approaches to video ethnography paired with structured approaches have delivered findings that otherwise may have been missed. This process allows the researcher to conduct an open approach, just allowing things to happen, and a structured approach, having everything planned, which provides a unique outlook once the video is being reviewed. Using "deliberate combinations of open and structured procedures during analysis enable [them] to discover with [their] full capacities of perception while defining and checking those perceptions through careful reference to specific visual evidence" (Collier, 1986, p. 172). Instead of going into research with one process, there should be combinations of processes that continually work together to create adaptive methods. Using an open approach creates the ability to double check findings between the two processes.

In *Visual Anthropology* the Collier brothers draw on past experiences using video as a way to discover anthropological data and use the video during group review sessions where the

Film would be stopped, reversed, discussed as individuals desired. Some portions might be viewed over and over again. These discussions clarified details, raised important questions, and defined conclusions, and the interplay of ideas sharpened our examination of the evidence and the precision of our analysis. On a conceptual level

these joint viewings were the most productive stages of the research. (Collier, 1986, p. 177)

They analyzed their informant data offsite with other anthropologists to facilitate questions and answers. During the time in which this research was being conducted the film was much harder and laborious to produce and review. However, the use of a group in analysis is still important to design researchers today. This study means to place an extra step in between the capture and design review of the video by creating a quick review done by the user and design researcher. This will also aid in gathering knowledge from the user instead of attempting to interpret the minute details without user collaboration.

In reviewing the gathered video, Collier and Collier (1986) explain three steps in reviewing the video. They start by organizing "[their] film file, then [they] looked at the film together in an unstructured manner, searching for basic patterns and hypotheses. [They] followed unstructured viewing with a detailed, structured examination of the data, and finally [they] returned again to an open immersion in the visual record for production of an integrated conclusion" (p. 178). This study focuses on the latter two steps then reverting to the beginning step. Instead, this study devotes more time to the analysis of video with the user. The following two steps done by the Collier brothers are logical and essential when reviewing video for design research. Although interviewing the user in-situ after the interaction is an added advantage to the design research process, the video must be reviewed afterwards in order to catch the nuances that the user could not provide details on.

Since this study focuses on interviewing the user immediately after capturing their interactions, it is necessary that the designer time stamp the video. The Collier brothers' first

step is to "make a log of the record. With film, this is best done using a viewer with a frame counter so that concrete reference points can be noted" (1986, p. 188). The quote is slightly out of date since the technology of capturing video has become much simpler and easier to produce and review. This has precedence to this study because the designer must be wary of time stamping the video as he records without having the luxury of doing it in post production. This methodology of interviewing the user in-situ is used by the Collier brothers when "film interviews were carried out with key teachers, who watched themselves on film and commented on what they saw. Initial questions were open ended, in an effort to catch their own, undirected reactions to the film" (Collier, 1986, p. 194). These reactions are the essence of what this study is attempting to capture during the user interview process. This study looks to these methodologies that have been used in the past for anthropologists to guide the modes that will be created herein.

Visual Anthropology gave to anthropologists well-thought methodologies and practices that will aid this study by providing knowledge of creating and reviewing video ethnography. The Collier brothers' descriptions of analysis and how to use video ethnography in team based interview sessions and even interviewing the user are directly in line with the type of interactions this study is attempting to define.

Chapter 2 Introduction to Ethnographic Research

2.1 History of Visual Ethnography

The first instances of visual anthropology date back to the Paleolithic era some 15,000

years ago. Even before the written word, humans were using pictograms and cave art to

chronicle tribal life (Sviličić, 2011, p. 187). This type of visual medium "allow[ed] [researchers]

to indirectly reconstruct a range of anthropologically relevant facts concerning various issues

from tribal hunting hierarchy and organization of hunting to the principle of distribution of

prey" (Sviličić, 2011, p. 187). The essence of visual anthropology can be distilled from

pictograms dating from thousands of years ago where researchers are still capable of discovering

anthropological data without firsthand experience. Pictography was the dominant form of visual

anthropology until the the end of the 19th century when photographer Edward Curtis I joined

George Bird Grinella and embarked on the "Harriman Alaska Expedition" (1899) (Figure 1).

This expedition is considered the beginning of modern visual anthropology (Sviličić, 2011, p.

188).

Figure 1 Harriman Alaska Expedition (SitNews, 2013)

To understand modern visual anthropology one must first understand the development of modern anthropological fieldwork and research. Before the beginning of the 19th century anthropology was delegated to a realm of the social sciences and through the works of W.H.R. Rivers, Alfred Kroeber and Franz Boas, anthropology evolved into a "humanistic approach that attempted to understand unfamiliar societies by discovering and representing the principles on which they were organized" (Marks, 1995, p. 340). During this episodic time of anthropological reformation, Rivers and Branislav Malinowski developed a "coherent methodology and philosophy of ethnography." These developments coincide with the ethnographic work in film that was being pioneered by Robert Flaherty (Marks, 1995, p. 340).

Using film as a medium for visual anthropology has a relatively long history, beginning with what is regarded as the first ethnographic film, *Nanook of the North* by Flaherty (Figure 2).

Dan Marks describes two "watershed" moments in the development of visual ethnography (Marks, 1995, p. 339). The two moments happened between 1913 to 1922 and then again forty years later between 1960 and 1970. These eras saw intrinsic advances in the field of anthropology stemming from field anthropologists such as Rivers, Malinowski, Flaherty and Timothy Asch (Marks, 1995, p. 339). Ethnographic film began a renaissance in the lead up to the second watershed moment during the 1960's. During this time, film began to be considered a viable form of anthropological research, much more than it had during the early 1900's. The presence of film allows "an impressionistic overview of broad-scale societal patterns, [and] film in anthropology had become a means to record social action at a level of detail that no ethnographer could match" (Marks, 1995, p. 341).

Figure 2 Nanook of the North (Silent Volume, 2013)

During the 1940's and 50's visual anthropology was continuing to gain momentum as a viable form of social and cultural research. A leading figure in this era was an anthropologist by the name of Margaret Mead. Mead contributed to visual anthropology by her belief that "the visual could be harnessed to support the objectives of the social science research. . . [that] the realist recording of 'objective' data [] could be analyzed to the ends of anthropological inquiry" (Pink, 2003, p. 182). Pink continues to describe the notion of "objective" data as an "observational approach. . . that simply to watch someone is to learn something about them and in doing so to generate knowledge that can be later analyzed and converted into intellectual capital" (Pink, 2003, p. 182). Mead's work with Gregory Bateson produced the *Balinese Character* (1942) in which Mead used images and film that were later critiqued by the people she was studying. She made sure to "show her openness about the images they produced and her collaboration with informants to understand them" (Marks, 1995, p. 182).

It was during this time that Timothy Asch, who studied under Mead, began to develop interest in anthropological film while attending Oxford University (Marks, 1995, p. 341). Asch, with his associate Napoleon Chagnon, created one of the most influential ethnographic films entitled *The Ax Fight*. Its notoriety stems from the ethnographers' awareness of themselves in research. The film demonstrates the first representation of the "Other" in anthropology wherein an "unknown" culture is described through narrative film (Pink, 2003, p. 180). It chronicles a confrontation between two tribes that begins with a club fight that ends up escalating into using axes. Asch and Chagnon become narraters during filming where they attempt to chronicle firsthand their assumptions and the development of events during filming. Marks describes it as

"an acute awareness both of the filmmaker's presence relative to the subject and of the status of the resulting film in subjective and objective terms" (Marks, 1995, p. 343). During this time ethnographic film developed into a method of recording interactions with increasingly more detail than could have been accomplished before because it was either impossible or improbable due to the previous implications that film was only a way for researchers to portray their research to the masses (Ruby, 2005, p. 24).

These final points in anthropological film were viewed as a turning tide in the way in which the relationship between the ethnographer and subject were seen. Revelations were made between differences in choosing between an emic or etic objective position. The outcome became the merging of these two opposite viewpoints that the ethnographer would have to facilitate both sides of objectivity (Marks, 1995, p. 343).

Visual anthropology is currently separated into three positions: concentrating on ethnographic film used in teaching, pictorial media such as television and film, and visual communication. The last concerns the production of "visual and pictorial culture as well as the production of anthropologically intended visual products" (Ruby, 2005, p. 159). Visual communication in anthropology is the act of what people make for others to see. It comprises "their facial expressions, costumes, symbolic uses of space, their abodes and the design of their living spaces" (Ruby, 2005, p. 165).

2.2 Visual Research Methods

Data is as beneficial as the defined methodology that precedes design research. Methods are needed to "engage with the role of video in the ethnographic encounter, as a medium through

which knowledge is produced [and] represented" (Ruby et al., 2001, p. 24). Through the use of well thought-out design research methodologies, the information gathered is structured and more readily represents proposed research outcomes.

Methodologies for visual research are numerous and many methods are not standard across disciplines or even across researchers within the same discipline. Design methodologies focus on the user interacting with a product and choose to portray how a product is used or operated. Many of these are not guidelines to the creation of observational video but the review of that video. Designers may implement the use of video diaries, where the user takes a camera and documents their own interactions, or shadowing, where the designer follows the user throughout a specified time or interaction. Another is for designers, or a multidisciplinary group, to act out interactions between one another or products. This is called play-acting which may be recorded and reviewed later. It connects groups of researchers together through better understanding and an enjoyable environment to study.

Other methods take on varying parts of these observational activities and may employ new or diverse ways of observational research. It is impossible to cover all methods of design ethnography but many of them incorporate the same basis of ideas that create design knowledge.

2.3 Current Trends in Video Research

Today's technological advances in cameras and handheld electronic devices have created a unique position for video-based ethnographic research. These advances have put high-end video capability in the hands of the masses, including the ability to transport, shoot and edit video without expensive programs or equipment. Technological innovations have once again

revived the idea of using video as a viable form of qualitative research methodology (Pink, 2001, p. 586).

In anthropological and sociological fields the use of video is sometimes delegated as a way for anthropologists to represent data in a "purely illustrative, archival or documentary way rather than giving them a more analytic treatment" (Pink, 2001, p. 586). It is, however, growing with the mindset that video has the ability to see everything. Video is non-biased and will only capture that which is presented in front of the lens. The observational approach of current video research allows for the footage to be reviewed and therefore one may analyze everything that is seen.

The notion of reflexive video ethnographic research is a strong component of current anthropological video capture. Reflexivity is the act of recording an interaction and then allowing the participants of that interaction to review the outcome for further understanding. Reflexivity is in demand in anthropological fields because of the "increasing engagement with the visual [that] is echoed in both the series of recent publications on visual methods and visual anthropology and sociology courses on offer in the UK and US" (Pink, 2001, p. 590-591). As with all research, a methodology must be employed so that the information created by the user and researcher in collaboration is fully understood through visual and qualitative knowledge (Pink, 2001, p. 595).

A design researcher has a steady stream of valuable data only if they have a user to conduct research with. Collaborative research is a trending subject in the anthropological field. Pink (2007) states in *Doing Visual Ethnography* that "knowledge is produced in conversation

and negotiation between informants and researchers, rather than existing as an objective reality

that may be recorded and taken home in a notebook, camera film or tape" (p. 98).

As as example anthropologist Jay Ruby used a method wherein he would conduct face-

to-face interviews holding a digital camera to record the interview session. His methodology

consisted of employing a video camera away from his face and without the need to look through

the viewfinder to capture the question and answer session. This required constant practice to

perfect this ability but it created a relationship between informant and researcher which Ruby

(2001) describes as "the same type of relationship with [informants] as non-visual

anthropologists would have" (p. 24). This was an impossible feat with previous methodologies

when physical film was the only way of capturing interactions. Technological developments in

video equipment have reduced the bulky, intrusive film cameras to portable handheld devices

that allow this methodology to be effective (p. 24).

2.4 Participatory Design

The term participatory design has been used by a number of different disciplines to

describe their methods for collaboration between researcher and user or informant. Participatory

design is meant to "broaden the perspective we have of what [products] are and how they are

used... participatory designers are interested in the social, political, cognitive and practical facets

of [product] usage." It is also "an approach to the assessment, design and development of

technological and organizational systems that places a premium on the active involvement of

practitioners in design and decision-making processes" (Brizee et al., 2012, p. 343). Research

interactions between designer and user create relationships that better facilitate larger amounts of usable data while giving the user a sense of credibility in aiding with the design outcome.

These users become more involved through repeated collaboration between researcher and user. Information is gathered equally that allow both parties to become more invested in the final outcome of the study. This "helps ensure product success to a method of collaborative, discursive interaction between stakeholders whose roles, needs and expectations may all be different" (Brizee et al., 2012, p. 345).

2.5 Researcher in Context

Through the work by Mead, Collier, Asch and others the "camera is no longer a mere recording device and the anthropologist need no longer be considered as the man behind the camera recording the scenes unfolding before his eyes" (Dion, 2007, p. 75). The researcher is now part of the information being gathered instead of taking a backseat approach and describes the ethnographer as someone who should not eradicate his or her position in the work altogether.

The researcher, as a piece in the interaction between user and product, instills a path that is now shared by both researcher and informant together (Dion, 2007, p. 74). A designer that is conducting research must be "accepted in the community he's studying" and in doing so the researcher needs to "motivate [users] to invest in themselves in the research process" (Dion, 2007, p. 74). The researcher forms immediate relationships with those which he or she researches.

The ethnographer and the camera should not be considered a hidden piece of ethnographic research. "Conscious of the disturbance caused by his very presence, the

anthropologist must seek to personally place himself at the heart of the observation. The anthropologist should not try to escape but, on the contrary, he should accept his status" as being constantly visible by the user (Dion, 2007, p. 65). The camera should, instead, be placed "at the center" situated between researcher and user. This avoids the user having the impression that they are being filmed unknowingly and allow the user to fully understand the way research is being performed (Dion, 2007, p. 65).

To gain a steady relationship with informants, and for research to provide strong outcomes, the researcher needs "to move toward openness, toward other people's experiences, knowledge, and ideas (divergence); they also need to move toward closure, drawing conclusions and delivering results (convergence)" (Steen, 2012, p. 77). An ethnographer should provide an open mindset towards the informant and the information that is gathered; followed by closing it down to bring formulated, cohesive outcomes to the process. Simultaneously, ethnographers should not disguise themselves in the sense that they should bring their own "interests, ambitions, methods, skills, knowledge, and ideas" into the research context (Steen, 2012, p. 76-77). Researchers should be aware of their own culture, personality and mindsets that can come to the forefront when interacting with informants.

2.6 Limitations of Video Ethnography

The use of video in respect to research is not without its limitations. Ethnography is an inherently intrusive research technique that at times may invade homes and work places to capture private and possibly intimate social interactions. Video "encourages intimacy" even when the informant may not be fully aware of the outcomes or distribution of gathered material

(Ruby et al., 2001, p. 24). Therefore, it is the researcher's responsibility to continually keep the user's interests in mind.

Historically, many anthropologists and sociologists have been averse to the use of visual research methods. According to anthropologists "images have not been seen to be trustworthy, being related to entertainment and persuasion rather than objectivity" (Mason, 2005, p. 329). A few criticisms included that "[anthropologists] should not be producing images at all as 'visual data should be thought of not in terms of what the camera can record but of what the eye can see" (Pink, 2001, p. 587). Ethnographers have viewed visual anthropology as a sub-discipline to anthropology instead of a vital and legitimate source of data (Pink, 2001, p. 587). Ethnographers should take visual research in the same sense that any other anthropological methodology is viewed. It's understood that "interfering with subjects may distort their behavior; that judgements are made about what is selected and the interpretations which is derived from its use; [and] that any narrative produced is based upon such a selection" (Mason, 2005, p. 329).

The researcher, however hard he or she may try to avoid it, has a role in the creation of ethnographic research and it is "impossible to record an image without some interference." The answer to this problem is the use of reflexivity in the review process and for the ethnographer to have "awareness of the production and use of the image throughout the research process" (Mason, 2005, p. 331). However, using observational video in a reflexive approach may create large amounts of visual data.

In conducting visual ethnography the amount of data collected can be immense and reviewing that data may be even more time consuming. According to Mason, "in order to assess

how material might be used for evaluation, it was necessary to watch all of the footage: initially to watch all that had been collected up to that point, then to watch it in regular 'chunks' as it was produced" (Mason, 2005, p. 336).

A common phenomena associated with videography is a user's camera (or video) self-consciousness. Ruby was "taught to let the respondents slowly get used to the camera, even to use it without actual film[ing]" (Ruby et al., 2001, p. 24). This encourages the users to adapt slowly to the camera so that when the camera begins to capture interactions camera consciousness begins to become less of an issue.

Essentially no methodology, visual or non-visual, is a complete representation of that which is being observed. The ethnographer's decision "regarding framing, focus, length of shot, angle, scenes and individuals to be photographed or filmed" has an effect, either averse or beneficial, to the final outcome (Dion, 2007, p. 65). Dion further explains that anything observed is "rooted in a social context, cultural conventions, collective norms and each individual's personal experiences" that may or may not inadvertently affect the production or outcome of the visual research (Ruby et al., 2001, p. 65).

Common limitations with recording and photographic devices include battery life and storage capacity, which vary based on device and expandable storage options. The size and portability of devices may affect the way in which an informant acts during the recording or the way in which a user may act towards the researcher. The resolutions of the photographs or videos could possibly alter the outcomes during review because captured visuals may not be seen with true clarity.

2.7 Ethics of Visual Research

Anthropologists have been abiding by the American Anthropological Association (AAA) Code of Ethics since its ratification in 1998 (Fluehr-Lobban, 2003, xii). The code states that "research is to be open about the purpose(s), potential impacts, and source(s) of support; about funders, colleagues, persons studied, or those providing information; and about relevant parties affected by the research" (Fluehr-Lobban, 2003, xii).

Per the AAA code, informed consent should be gathered in advance of any ethnographic research with informants. This can be gathered either verbally or written, where written forms provide an initial conversation between researcher and informant (Fluehr-Lobban, 2003, p. 228). Informed consent is an ongoing conversation between researcher and informant from the beginning of the study and throughout (Fluehr-Lobban, 2003, p. 19). Researchers should practice full disclosure on informed consent and it is the sole responsibility of the researcher to be ethically conscious to the decisions that are made regarding treatment and use of informants (Fluehr-Lobban, 2003, p. 20). When ethical questions or conflicts of interest arise, the informant comes before the study. "Confidentiality and the protection of community and informant anonymity" is the ethnographer's foremost responsibility (Fluehr-Lobban, 2003, p. 232).

The intimate nature associated with collaborative design research results in ethical dilemmas that may arise through visual research. A researcher entering into an intimate environment such as the home or workplace may be faced with ethical choices as to the visual methodology being utilized or if visual research is warranted in such an area. It is a designer's responsibility, both to the informant and to the work, to make "ethical judgements" in the best

interest of the user and therefore to "judge how [they] will affect those whom [they] film and act responsibly towards them" (Ruby et al., 2001, p. 25). Other writers echo these statements, as noted by Fluehr-Lobban (2003) "primary ethical obligations and responsibility to the people and the animals with whom they work and to the materials and people whose lives and cultures they study" (p. 18). Outcome of the research are secondary to this tenet. The researcher should "only assist in the implementation of objectives set by somebody else" and should, therefore, be present without directly changing acts performed by the informant (Paine, 1985, p. 14).

Technological advances in digital video have ultimately caused additional ethical dilemmas by creating smaller, compact digital recording devices accessible to a broader number of people (Ruby et al., 2001, p. 24). These advances in video technology need additional consideration when entering into "realistic and intimate situations" (Ruby et al., 2001, p. 25). In some instances this may cause the researcher to disregard the privacy of the user because digital video has become so ingrained in today's culture (Chau, 2010).

Furthermore, it is essential that before any type of visual research is conducted with an informant that there is "consensual cooperation between the [researcher] and his [informants]" (Dion, 2007, p. 74). The design researcher must be in constant cooperation with design informants because the ethical process requires "collaboration, reflexivity and to represent 'voices' of informants" at all times (Pink, 2001, p. 587-588).

If research is being conducted through a university or other institute of learning it is important to cooperate with the Institutional Review Board (IRB). The IRB's main goal is to protect the rights and welfare of subjects being researched and will review the research and

methodology that is in the best interest of participants involved. At times the original

methodology must be altered for certain research situations that may include undue harm to

subjects, intimate environments or personal information that may affect employment or social

standing. It is necessary to be in constant contact with the IRB if anything changes to the

methodology. Each change must go through IRB approval before that change can be

implemented.

   Design research resides in a complicated area of ethics. A design researcher tends to

focus on researching products instead of writing and conveying the intricacies of cultures and

their peoples that anthropologists attempt. These differences between the study of peoples and

the study of products, when dealing with visual research, is that design researchers studying

products may not be directly intrusive into user's lives. This, however, requires ethically diverse

decisions to be made. Recording video or photographing user product interactions in intimate

settings may need IRB approval. Also, the use of surveys and or interviews being transcribed,

recorded, taped or just person-to-person may also require IRB approvals (Auburn University,

2013) (Marc Steen, Human-Centered).

Chapter 3 Technology Overview

3.1 Electronic Devices used for Study

This study's focus weighs on the integration of advances in portable device technology

with visual product research modes. A few specific devices were selected for use in this study

based on their popularity, usability and general accessibility. Outlined hereafter are action sport

cameras, portable tablet computers and their accessories.

3.1.1 Action Sport Cameras

An action sports camera (ASC) is a relatively new genre in portable cameras. It is a

small, portable video and photo camera that is designed for sports and outdoor enthusiasts as a

way to capture footage with minimal interaction with the camera. It is geared towards users who

are looking for wearable, mountable high-definition cameras that causes little interference during

activities. These cameras are particularly suited for this study because of their portability, size

and features (Figure 3).

Figure 3 Action Sports Camera Specification Chart (Mountain Bike Review, 2013)

GoPro Hero3	Contour+2	Drift HD	Sony Action Cam	JVC Adixxion
1080P @ 30 fps 960P @ 48 fps 720P @ 60 fps	1080P @ 30 fps 960P @ 48 fps 720P @ 60 fps	1080P @ 30 fps 720P @ 60 fps	1080P @ 30 fps 720P @ 60 fps	1080P @ 30 fps 960P @ 48 fps 720P @ 60 fps
170° Ultra Wide Medium Narrow	170° Wide Angle 270° Rotation	170° Wide Angle 130° Medium 300° Rotation	170° Wide Angle 120° Medium	170° Wide Angle
Built in Wi-Fi	Built in Bluetooth	N/A	N/A	Built in Wi-Fi
Micro-HDMI Port, Composite A/V Adapter, USB, Micro SD, HERO Port, 3.5mm Stereo Mic Adapter	MicroSD, USB	Micro-HDMI Port, USB, Micro SD	Micro-HDMI Port, USB, Micro SD, 3.5mm Stereo Mic Adapter	Micro-HDMI Port, USB, Micro SD
MicroSD Class 4 or higher recommended; Up to 64GB capacity supported	Up to 32gb MicroSD compatible	Up to 32gb MicroSD compatible	Memory Stick Micro (Mark 2), Micro SD/SDHC Memory Card (Class 4 or Higher)	SD/SDHC/SDXC Memory Card
HERO3: Silver Edition Camera 197' / 60m W aterproof Housing Assorted Mounting Hardware Rechargeable Li- ion Battery 1 Quick Release Buckle 1 J-Hook Buckle 1 Curved + 1 Flat Adhesive Mount 3-Way Pivot Arm	HERO3: Silver Edition Camera 197' / 60m W aterproof Housing Assorted Mounting Hardware Rechargeable Li- ion Battery 1 Quick Release Buckle 1 J-Hook Buckle 1 Curved + 1 Flat Adhesive Mount 3-Way Pivot Arm	HERO3: Silver Edition Camera 197' / 60m W aterproof Housing Assorted Mounting Hardware Rechargeable Li- ion Battery 1 Quick Release Buckle 1 J-Hook Buckle 1 Curved + 1 Flat Adhesive Mount 3-Way Pivot Arm	HERO3: Silver Edition Camera 197' / 60m W aterproof Housing Assorted Mounting Hardware Rechargeable Li- ion Battery 1 Quick Release Buckle 1 J-Hook Buckle 1 Curved + 1 Flat Adhesive Mount 3-Way Pivot Arm	HERO3: Silver Edition Camera 197' / 60m W aterproof Housing Assorted Mounting Hardware Rechargeable Li- ion Battery 1 Quick Release Buckle 1 J-Hook Buckle 1 Curved + 1 Flat Adhesive Mount 3-Way Pivot Arm

GoPro Hero 3

Arguably one of the most popular action sports cameras, the GoPro Hero has been a top choice for sports enthusiasts (Tarr, 2013). The newest edition, the Hero3 (Figure 4), is sold in three variants: White, Silver and Black editions. Each of the editions comes with a minimum accessory set including a waterproof housing, mounting hardware, a proprietary quick release buckle and adhesive mounts. All of them include built in Wi-Fi, a Micro-HDMI port and a MiniUSB Port as well as a proprietary GoPro expansion port located on the back of the device. It is cost effective maintaining the resolution and specifications necessary to carry out proper reflexive video ethnography.

Figure 4 GoPro Hero3 (GoPro, 2013)

The Silver edition's resolution tops out at 1080p at 30fps. 1080p resolution, however crisp and detailed, did not facilitate the best all around option. Instead, 720p at 30fps was chosen for the most efficient battery life and use of removable storage. A MicroSD memory card slot is the only expandable media supporting storage sizes up to 64GB. The included battery is a 1050mAh lithium ion battery with varying recording times based on the camera settings. An aspherical plastic lens provides an ultra-wide angle with a viewing radius of 170°, which makes it an ideal camera for capturing physical interactions without the need to constantly adjust the camera.

In addition to high resolution video recording, the Silver edition has the capability of capturing 11MP still photographs. One advantage the Black edition has over the Silver is its capability of capturing stills while simultaneously recording video. This feature allows the ethnographer to snap pictures without the interruption of having to use an additional camera and allows him or her to keep their focus on the user.

GoPro is not the only manufacturer of ASCs. Many large electronics corporations, such as JVC and Sony, are beginning to enter the ASC market with varying specifications. Companies such as Drift and Contour specialize in ASCs, like GoPro, and offer product lines that are in accordance with some of the product specifications that GoPro delivers.

3.1.2 Camera Accessories

Action sports cameras have a large selection of accessories and attachments that are beneficial to conducting visual research. These accessories were designed to be used by athletes in extreme sports so that an athlete could attach the device to their bodies, their equipment or

even attach them to a stationary object to record in a third-person perspective. Only accessories

that have been used for this study, and those that would be beneficial, are described.

"The Frame"

Included in the purchase of the GoPro Hero3 is a waterproof enclosure that doubles as

protection for the camera. The housing does not provide access to the ports or removable storage

and decreases the sound quality of the audio. GoPro provides another housing option titled "the

frame" (Figure 5) (GoPro, 2013). It is a slim plastic enclosure that wraps itself around the

exterior of the Hero3 while keeping the front and rear of the camera open. The only accessible

port through the frame is the MicroUSB. The black low profile frame creates a minimalist look

for the camera and creates less of distraction for the research participants by visually integrating

the camera into the case of the iPad.

Figure 5 The Frame Housing (GoPro, 2013)

Suction Cup Mount

The ability to quickly and securely attach the Hero3 to a surface is an added benefit for

ethnographers. Using the suction cup mount (Figure 6) that GoPro offers provides an

articulating arm with an industrial strength, lockable suction mount. It is fully adjustable and

even expandable with added extension and pivot arms. The suction cup can be attached to any

flat, slick surface.

Figure 6 Suction Cup Mount (GoPro, 2013)

Pole Mount

The pole mount (Figure 7) gives researchers access to attach it to any round pole up to an

inch in diameter. It may be attached to handles, to capture the user operating a product, or to a

boom arm that would allow the researcher to set different angles that could have been impossible

without it. It is attached to a pole by two half-circle plastic pieces that are tightened by two

threaded screws; therefore, it takes time to set up compared to the quick attachment of the

suction cup mount. Therefore, using the pole mount requires foresight before conducting

research to scout out suitable locations for mounting.

Figure 7 Pole Mount (GoPro, 2013)

Adhesive Mounts

A universal attachment method is with the curved or flat adhesive mounts (Figure 8).

The 3M adhesive pad on the mount is waterproof and secure enough to stay attached while still

being capable of being removed, with some force.

Figure 8 Adhesive Mount (GoPro, 2013)

3.1.3 Tablets

Tablet computers, historically, have been large, fully functional computers running heavy

desktop operating systems (OS'). The introduction of mobile operating systems such as Apple's

iOS and Google's Android have fueled the adoption of mobile tablets. Touch-screen

technologies are the basis of interacting with these mobile operating systems. Rapid adoption of

mobile tablets has occurred because of the simplicity of touch screen controls that do not require

an instruction manual to operate (Johnson, 2013). Mobile tablets fit well for use in video

ethnographic research. Their compact sizes, portability and extended battery lives combined

with "icon-driven menus" provide easy and simple device interaction (Johnson, Tablet Takeover,

79).

iPad

After its introduction in 2010, the iPad revolutionized the way in which the tablet was

seen within the computing world. Previous incarnations of tablet based computing had only a

marginal impact on the personal computer (PC) market. The iPad's quick adoption was influenced by the integration of both hardware and software to create a device that was enjoyable to use and easy to learn (Griffey, 2012). Its software is Apple's popular mobile operating system, iOS. Apple's tablet has sold more than 84 million units since its introduction in January of 2010 until February 2013 (Johnson, 2013).

The current iPad, the fourth generation model (iPad 4), has a 9.7" touchscreen with a resolution of 2048 by 1536 pixels (Figure 9). This display eclipses the resolution of 1080p which allows any video captured by the Hero3 to be displayed in full high-definition (HD) video. A dual-core Apple A6X processor powers the iPad which provides more than enough power to handle the applications needed to conduct and review ethnographic video. Storage options maxing out at 128GB is ample to store hours of HD video and additional data for research. An iPad comes equipped with a proprietary Lightning connector and a 3.5mm headphone jack.

Figure 9 iPad

Possibly the most useful feature of the iPad is the ability to access data anywhere with its Wi-Fi and cellular data antennas. The iPad 4 is Long Term Evolution (LTE) equipped which is capable of download speeds equaling or surpassing that of traditional Wi-Fi speeds, 300Mbps. LTE has become the standard in mobile data technologies and has been selected to be used by the leading mobile providers today (Schindler et al., 2011).

Additionally, the iPad is capable of recording video on its own. The iPad has two separate cameras, a smaller lower resolution camera on the front, a FaceTime camera, and a 5MP camera, dubbed an iSight, that is capable of recording 1080P video on the back. When using the iSight camera to record video, the researcher can also snap photographs while recording for further documentation.

3.1.4 Tablet Accessories

The simplicity of mobile tablets brings about minor limitations in usability when accessing external media sources and integrating certain attachments. Apple's iPad and iOS is one of the most closed tablet systems on the market (Vascellaro, 2012). This forces researchers to seek out ways to accommodate video ethnographic research.

Case

Portability, protection and necessity calls for a simple and thin hardshell iPad case (Figure 10). The case was needed to attach an adhesive mount to the back of the iPad without causing damage to the device and allows for the case to be removed with the Hero3 continually attached to the case. Apple provides a magnetic protective cover for the iPad and the case design allowed for the Apple cover to still be used.

Figure 10 iPad Case

Camera Connection Kit

Apple's proprietary Lightning and 30-pin connections make it difficult to connect any external peripheral devices or external storage options. Their solution is providing a "camera connection kit" (Figure 11) that adds functionality that is otherwise unaccessible. The connection kit includes two small devices that have either a USB input or an SD card reader. A camera can be attached directly into the device through a USB cord or the SD card can be removed for wire-free storage input (Apple, 2013).

Figure 11 Camera Connection Kit (Apple, 2013)

3.1.5 Other Mobile Devices

An action sports camera and tablet computer make it simpler to produce ethnographic knowledge but other devices may be used in conjunction or as a replacement device. Point and shoot cameras, smart phones and a number of portable devices that have a camera and SD storage options can serve as possible replacements. Mobile phones may be the most advantageous replacement and can even work with both the action sports cameras and tablets.

Smart Phones

Smart phones account for a 53% of mobile handsets as of March 2012 (Moscaritolo, 2012). Current smart phones are equipped with cameras, internet connections and third-party apps. Of those smart phones owned, 91% of them are running Google's Android operating system or Apple's iOS (Segan, 2012). Advantages are not skewed towards one or the other and both have their merits in conducting visual ethnography.

Smart phones sales have steadily been increasing and their specifications have been

growing alongside their popularity. Screen sizes are offered from 4 inches to 5.5 inches with

resolutions maxing out at 1920 x 1080 pixels or 1080p. Smart phones are beginning to rival

entry level laptops with dual-core processor architecture up to 1.9GHz with 2GB memory.

Mobile handsets have enough power to conduct any necessary ethnography that researchers

demand. Equipped cameras reach a high 13MP resolution while many of them offer 1080p video

recording (Shanklin, 2013). Large screens, high resolution cameras, massive and removable

storage options, and added LTE data make smart phones a strong contender for use in visual

ethnography. An added benefit is having a device in a researcher's pocket and to quickly access

a camera to conduct research on the fly and a large screen to interview users.

Ultraportable Laptops

Ultraportable laptops (ultraportables) have been a growing market in the mobile PC genre

(Westover, 2012). Unlike traditional, bulky laptops, ultraportables offer exactly what their name

suggests, increased portability. With thin and light bodies, ultraportables enable a design

researcher to carry around a fully functional laptop running desktop operating systems. They

contain a larger screen than many tablets and a physical keyboard. This genre of laptops contain

incredibly fast solid state hard drives or flash storage that decreases the time needed for the

laptop to start up and run (Frakes, 2012).

Another advantage of ultraportables is the increased battery life accompanied with low-

power processors (Case, 2012). Even though these processors do not create as much power as

their larger laptop siblings, they do produce enough for the needs of this study. The study only

required USB and SD card inputs, which are standard on many ultraportable laptops (Cheng, 2011). The screen resolutions differ between manufacturers but many provide 1080p resolutions which is more than is needed. The MacBook Air was limited to 1440 x 900 pixel resolution on a 13" screen that can handle a maximum of 720p resolution (Frakes, 2012).

Based on available devices, this study chose to use the MacBook Air as the ultraportable laptop. This allowed installation of ScreenFlow (see 3.2.1), which is a Mac OS X only software. The researchers were also familiar with Mac OS X, so the MacBook Air provided the best solution.

3.2 Computer and Mobile Applications

Cameras and mobile devices provide the hardware but applications provide the muscle for visual ethnographic research. The iPad's closed OS limits the functionality of their applications, whereas the Android's open-source OS provides more flexibility to develop applications (Gandhewar, 2011). Many applications are developed for both Android and Apple OS, leaving the decision of devices to the ethnographer.

3.2.1 Screencasting

Screencasting is a relatively new concept where a user may capture what is occuring on a computer screen and save it as a video. Telestream's application ScreenFlow (Figure 12) is a robust screen capturing software, built specifically for Apple's Mac OS X operating system, that records a computer screen while in operation. ScreenFlow can, simultaneously, capture and record a computer screen, video and audio, both from the computer's internal microphone and the computer's output audio.

Figure 12 ScreenFlow (ScreenFlow, 2013)

StreamFlow has many in-depth editing capabilities that a designer can use to present data

that has been gathered through visual ethnographic research. A designer can create callouts,

screen highlights and video animations to convey findings or points of interest. These powerful

tools help to produce ethnographic knowledge by creating callouts and animations that can be

used to quickly convey and recollect data that has already been reviewed and stored (Screen

Flow, 2013).

3.2.2 GoPro App

GoPro's introduction of the Hero3 included built-in WiFi as a standard in all editions.

Hero3's WiFi capability enables the researcher to create a connection between a mobile device,

running either Android or iOS, and the Hero3. An application (app) (Figure 13) controls every

functional aspect of the Hero3; it controls the resolution, field of view (FOV) and other

miscellaneous settings. A researcher can start or stop recording and the app provides a live

preview to frame the shot and make sure angle and material are being recorded.

Figure 13 GoPro App
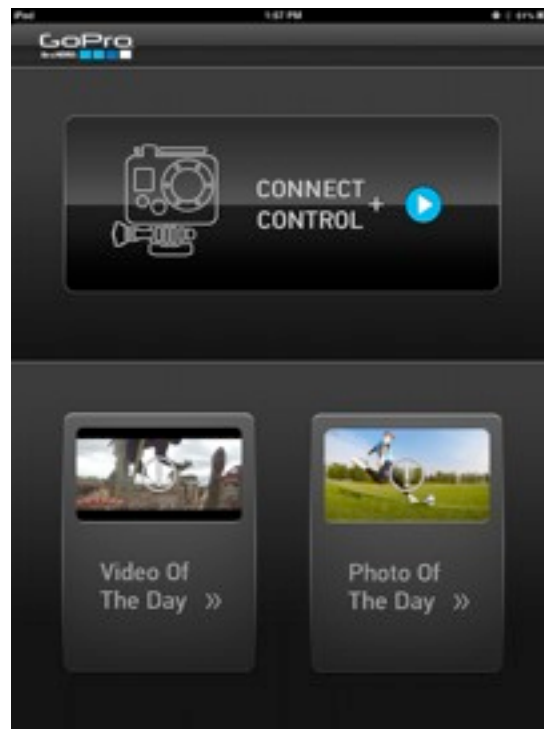
3.2.3 Photos iPad App

Apple's built in Photos app (Figure 14) is the only direct way to take visuals from an SD

card or camera onto an iPad. Once an SD card or a camera is attached to an iPad using the

Camera Connect Kit, the Photos app opens automatically and gives the option to either import all

or import selected. The visuals are imported directly into the iPad through the Photo app and

catalogued there. Individual photo albums can be created to organize photos and video from

research sessions.

Figure 14 Photos App

Chapter 4 First Person Study

In the spring semester of 2011 a video ethnographic study was conducted in a senior

design thesis studio with a corporate sponsor. It focused on the use of both first-person and

third-person video ethnographic techniques to discover pain points with the interaction between a

user and a consumer level portable generator. Six industrial design students participated in the

study and were paired in doubles with one, first-person, directly interacting with the generator

and the second, third-person, filming the interaction between designer one and the generator. A

article was written by the professor, Tsai Lu Liu, entitled "Do You See What They See?"

4.1 "Do You See What They See?"

Liu describes the need for additional video ethnographic studies in industrial design. His

focus was on capturing what the user was seeing to get a better understanding of their thoughts

and actions by implementing first-person video. Liu believes that "first-person POV starts a new

chapter of user ethnography by providing the user's perspectives that have been missing in the

third-person POV" (Liu, 2011). In addition to using both first- and third-person POV

videography the studio implemented the use of video narrative, wherein the designer conducting

the first-person POV would narrate their actions and thoughts throughout the process. This

method provided the video with "emotional responses [that] were captured throughout the

process" (Liu, 2011). Dialogue was permitted between the designers so that they both felt

comfortable between one another. This methodology showed promising results with the short

research time that was allotted.

4.2 Senior Design Studio First-Person Study

A first-person study was conducted for a sponsored senior design studio wherein six

students conducted visual ethnographic research on portable generators. These students did not

have prior video ethnographic experience and were conducting the research amongst one

another. The sponsor provided multiple generator models and were sent as a customer would

purchase it, in a box and not assembled.

The ethnographic study was conducted from an out-of-the-box experience and followed

the two designers from opening, assembling and, eventually, using the product. Designer A,

conducting the first-person ethnography, had a makeshift camera attached to the forehead. It was

a simple strap with an iPhone attached via a phone case with phone padding to protect the

designers forehead and keep it comfortable for the duration of the study. Designer B, conducting

the third-person footage, was in an observational capacity only, filming with a handheld portable

camera without any direct interaction with the product or designer A (Figure 15).

Figure 15 First Person Study

Throughout the process, designer A gave a narrative account of what was occurring during filming. The designer verbally walked the camera, or audience, through the steps and process that was happening at the time. When the designers reviewed the film, this narrative catalogued the emotional state so that this information can be recorded without the need for written documentation during the study. The narration provided both designers a recorded verbal list of problems and possible solutions.

Both designers reviewed the footage they captured, independently of one another. Designer A reviewed the first-person video whereas designer B reviewed the third-person footage. Neither of them reviewed the other's video. The time it took to unbox, assemble and

operate the generator averaged around twenty to thirty minutes. In order to adequately review

the video the designers had to watch the video multiple times, taking hours to thoroughly review.

Once reviewed the results were presented in a chart format denoting the timestamp and

the insight gained from that piece of video. Both first- and third-person video was reviewed in

this manner and the results were not compiled together but left separate to compare the

differences in POVs. The clips were placed in descending order so that someone watching the

footage in full could keep up with the results. It was then edited and cropped so that the footage

could be used during presentations for the sponsor.

4.3 Ramifications of Study

This study highlighted the need for visual ethnography in the field of industrial design,

especially using minimally invasive small, portable video devices to capture user/product

interactions. The use of both first-person POV with third-person POV creates two unique

perspectives on one interaction, increasing the likelihood that problems will not be missed.

Since this was a new methodology being incorporated for the first time, there were

problems with needed solutions. The iPhones were problematic to use and the make-shift strap

would not stay in place. It also had to be removed and replaced if it needed to be turned off or

on. The third-person POV portable cameras had cassette-based storage which made it difficult to

import. Once imported into a video editing program, the footage could be reviewed.

The footage had to be reviewed in full, which took ample time to thoroughly go through.

Advantages here were that the designer was the user, so he could both describe the video and

emotional state while providing problem/solution areas. Unfortunately, conducting research on a

user who has not had design experience tends to skew the results. Footage was also reviewed a

day or two after the research was conducted which provides downtime that runs the risk of

details being forgotten.

Visual ethnography in the form of using video to record interactions is invaluable to the

industrial design field. This study opens the gates for further studies of video ethnography.

However beneficial the first-person study was, there are issues that need to be addressed

concerning review, cameras and filming perspectives. A researcher's experiences are also

necessary for ethnographic research to become successful.

Chapter 5 Opportunity to Explore and Compare

During the last year certain research opportunities have presented itself that would facilitate the use of visual ethnographic research through the use of video. These situations provided rigorous evaluation of devices and modes of observational video recording. One situation in particular resulted in thorough trials for this study that provided a rather intensive examination of video ethnographic modes.

5.1 Building Science Research Overview

Two building science students were conducting research for a corporation who manufactures construction specific gang boxes, large on-site storage containers made of steel, in fulfillment of their senior thesis class. Their objective was to determine the viability of four revolutionary prototype gang box designs (Figure 16). Research was conducted with specific trades that the gang boxes were designed for.

Figure 16 Prototype Gang Boxes

There were three main jobsites on Auburn University's campus that were locations for research: the South Donahue Residence Hall, the Health and Wellness Center and the Small Animal Hospital. Not each jobsite utilized all four gang boxes and certain jobsites were selected for certain boxes depending on the stage of construction a particular jobsite was currently in.

Conducting research with construction tradesmen proved beneficial for this study but it was also found to be difficult for many reasons. Construction workers seemed passionate about their trades and their desire to advance their field, even if it was through the use of storage,

seemed to be quite strong. They, however, were not interested in any loss of time due to their participation in this study. Therefore, the techniques utilized needed to be quick, effective and minimally invasive.

Gang boxes fit well with video ethnographic modes. The boxes were varying sizes, ranging from large cabinets to moveable carts, and were used daily. Capturing the user interaction with the storage boxes tended to be simple to frame but the designer had to actively move around to capture everything. Workers immediately became acquainted with the camera and, visually, showed no signs of video self-consciousness.

Construction posed a unique research topic. Throughout their day, tradesmen are being overseen by the project managers and their supervisors. The work of many of the trades; electricians, plumbers and carpentry, are specialized and mistakes cost money and accidents are dangerous. The tradesmen are a unique subject that are used to being overseen and that may possibly allow them to accommodate to the camera more quickly without any ill effects on the research.

5.2 Device Combinations

Four devices were selected to be used for the particulars of this study: a GoPro Hero3, an Apple iPad 2, an iPhone 5 and an MacBook Air. These particular devices were chosen based on their availability and usability. The Hero3 was used as the camera in the combinations where a camera was utilized. Both of the iOS devices, Apple's iPad 2 and iPhone 5, were selected because of their intuitive touch-screen interfaces and the availability of GoPro's application that controls the Hero3. Last, the MacBook Air was chosen for its portability as a fully functional PC

and use of ScreenFlow which is only developed and sold on Apple's Mac OS X operating system.

The first combination of devices pairs the Hero3 with the iPad 2. By pairing these devices it provides maximum portability with a large screen. The iPad 2's 9.7" screen size provides ample screen real estate for framing a shot and reviewing footage with the user. A touch screen interface, like that on the iPad 2, and its lightweight construction enable the designer and user to collaborate easily during the review process by passing it to one another or to hold it between each other for interview and review. The Hero3 has two distinct uses on its recording capabilities.

The Hero3 may be attached to the iPad through the use of an adhesive mount to a shell casing on the iPad that allows the designer freedom and the ability to move around the user and actively frame the shot based on the their actions. The second option is to have the Hero3 set up as a standalone device. Using certain mounts made for the Hero3, it is possible to attach the camera to locations, products or users to get a different viewpoint while the designer steps back and watches the events unfold both in person and through the live view with the GoPro app on the iPad.

The second combination is comprised of the iPad accompanied by a smartphone, in this instance an iPhone 5. Using devices that are both running iOS makes for a simpler interaction between them. Incorporating a smartphone, a pocket device that is used everyday, to capture video should help the users become more acquainted with the device more quickly. Smartphones, and their software, are devices that can record quickly and need very little in the

way of setup or use processes. The large screen sizes of many smartphones frame the footage well without many of the distractions such as buttons and on-screen menus. However, a larger screen may be needed for users with impaired vision or for use with certain applications built for a desktop alone.

In the last combination, a Hero3 is used with a MacBook Air to go slightly beyond the capabilities of the other two combinations. This combination will need the use of an iPad or an iPhone to take advantage of the GoPro app to actively frame the shot to account for any changes from the user. Therefore, this combination requires the most devices to set up and execute effectively. The choice to use the MacBook Air as an interviewing device was influenced by the use of ScreenFlow to capture the interview process along with the built-in iSight camera on the Macbook Air.

These combinations were used during personal research and to assist in a study conducted with two building science students researching gang boxes. Certain combinations fit within specific research criteria and not all combinations were used in the same research context, location or users.

5.3 Device Combination Comparison

Through extensive study three combinations were subject to real world and private situations that exposed the limits and advantages of each. The separate combinations were composed of the previous four devices that were tested and compared to examine their ability to conduct video ethnography for industrial designers. The research began by studying the limitations of the devices themselves.

5.3.1 Recording Device Capacity Limitations

GoPro's Hero3, albeit a mighty, capable little camera, has its limitations. Battery size in a small device tends to be an issue when recording for long durations of time. The included 1050mAh lithium ion battery was capable of recording 1080p (30 fps) video two hours and fifteen minutes (2:13:14) on average without the power drain of having WiFi turned on. When WiFi was enabled the life of the battery dropped thirty minutes to an hour and forty-five minutes (1:46:24) on average while recording in 1080p (30 fps). This study focused on recording solely in 720p. In testing, 720p didn't increase battery life drastically but did add an average of between four to eight minutes to the total recording time (2:20:16 without WiFi and 1:52:49 with WiFi). GoPro does, however, provide an accessory to increase the battery capacity by adding a second battery. Additional batteries may also be purchased and are replaced through a small door on the back of the Hero3 (Figure 17). Shooting in a lower resolution setting offers a median where the recording is still HD and ample enough for reviewing while reducing file sizes.

Figure 17 Battery Door on Hero3

Hero3's built in WiFi antenna directly links an iOS or Android device running GoPro's app to add the capability of live-view of the subject matter. It not only causes a drop in battery life but has a limited working distance. With a direct line of sight to the Hero3 the WiFi connection was lost between 100 to 125 feet. Barriers, such as walls, shorten that distance to between fifty and seventy-five feet depending on the barrier.

A 32GB Class 10 MicroSD card was used as the storage device for the study. Recording at 720p the 32GB card can store up to seven hours of video. Even at the highest resolution, 1080p, the 32GB card could still hold roughly four hours and forty-seven minutes of video (4:47). Therefore, in research instances, the limitation of the card was a non-issue because the battery life was not capable of reaching that threshold. The iPhone (Figured 18) was the only other recording device use in this study.

Figure 18 iPhone 5 (Apple, 2013)

iPhones are drastically more limited in their functionality and storage. Storage capacities are available in 16GB, 32GB and 64GB but the operating system does consume some of that storage, along with applications and a number of other factors. The camera only records in 1080p and cannot be set to a lower resolution which takes up additional storage space than would a 720p resolution. Because free storage on an iPhone is not standard across devices, it is impossible to determine the number of hours it is capable of recording. However, it may be calculated. One minute of 1080p video takes up around 63MB of space, whereas 1GB of video will provide roughly fifteen minutes and forty-five seconds (15:45) of footage. Battery life is another issue that cannot be completely quantified. It is reasonable to assume that with a 1440 mAh battery and unknown hard drive space that the storage will fill before the battery dies from a full charge (Apple, 2013).

5.3.2 Action Sports Camera and Tablet

An ASC and a tablet were setup in two separate iterations for study. First, an iPad was fitted with a minimal hardshell case where a Hero3 was attached through the use of an adhesive mount and secondly, the Hero3 was set up in a fixed location while still being controlled by the iPad and GoPro app.

In the first iteration, C1, the ASC is attached with the iPad that is in the horizontal orientation. It is centered on the back shell of the iPad and attached near the top (Figure 19). GoPro's quick attachment design provides quick removal and exchange between different mounts. Therefore, another adhesive mount may be placed on the iPad's case in a separate

location offering, whatever situation arises, a solution. The case, while providing protection,

remains alterable and keeps the tablet unharmed.

Figure 19 Buckle on Back Case of iPad

The clip-on case needed slight altering to work with some device attachments. The

opening to the 30-pin was too small to accept the Camera Connect Kit. Using a Dremel

multitool, the 30-pin slot on the case was widened to accommodate the kit (Figure 20). The

purchased case was black and, while using the black frame housing for the Hero3, the parts

blended well together for fewer possible distractions for the user (Figure 21).

Figure 20 Edited 30-pin Slot on Case

Figure 21 Back of iPad with Hero3

Throughout research with the C1 iteration, the users did not visually seem to show any outward signs of video self-consciousness. Inherently speaking, because there was no prior interaction with the users it is impossible to determine if their actions were altered during video observation. Under the best circumstances, users should be observed during tasks beforehand without being recorded for the user to become accustomed to being observed and to the researcher themselves.

Having the Hero3 attached directly to the iPad proved beneficial. It allowed dynamic control to constantly reframe content as needed to follow specific interactions between user and product. However, researcher's repetitive movements will cause distractions for the user no matter how many precautions are taken to avoid them. The Hero3's size limits the camera's internal adjustability controls. It has no built in zoom which forces the researcher to move closer to zoom in and vise versa to zoom out. At times, it may be necessary for the researcher to adapt to the equipment and situation.

Externally, the Hero3 was attached to a J-hook buckle (Figured 22) that locks into the adhesive mount providing one way physical adjustments. It provided tilt capabilities to adjust to the way in which someone may hold the iPad. For this study the Hero3 was mounted upside down into the buckle so that it fit closer to the iPad while providing correct angles for recording. Fortunately, internal settings may be set to record in an inverted orientation, saving time in editing or manipulating the footage. A 3-way pivot arm provides a more adjustable option if the need arises. It makes the mount bulkier and takes additional time to get in the proper position

but provides more flexibility when the researcher is uncertain to the situation in which the

ethnography will take place.

Figure 22 J-Hook Buckle

In the second iteration, C2, the ASC is set up in a fixed location while the researcher is

observing in a separate, still visible, location. This requires advanced initial setup which has to

be conducted before the ethnography takes place. This study did not have the luxury of much

scouting beforehand which forced the researchers to setup the camera upon arrival. The user was

already present and often was already in the process of conducting their work duties. The

camera placement had to be decided upon and set up quickly so that there was minimal user

interference.

There are, however, trade offs to this iteration and tends to work best in certain situations.

For recording an interaction as a whole, or making adjustments on the fly, the use of C1 would

be more advantageous. Setting up the Hero3 in a fixed location prevents zoom adjustments and

adaptive reframing which has the chance of missing interactions. Retrieving the MicroSD card

to transfer the footage to the iPad required the researcher to return to the camera, adding an additional step and more time.

C2's configuration works best in two situations. The first, where the interaction is with a small product in a non-movable location; i.e. a driver interacting with a dashboard, a camera may be set up with the knowledge that the camera should not have to be reframed. The second is affixing the camera to a movable object to follow the interaction as it progresses. The camera may be fixed to a cart through an extension apparatus where the camera captures a bird's eye view of a user interacting with the cart. A camera may also be attached to the user, i.e. in a first-person point of view where the user could wear a headstrap mount (Figure 23).

Figure 23 Headstrap (GoPro, 2013)

Using these two setup iterations in the field was productive and enlightening. Overall, the iPad was a natural selection for the setup but its 9.7" screen size made the device seem slightly bulky. Some tablet sizes around the 7" range may work better for reduced overall weight and size efficiency. The Camera Connect Kit only accepted full-size SD cards whereas the Hero3 only accepted MicroSD cards. Footage could only be transferred through the use of an SD adaptor because the USB adaptor was not formatted to work with the Hero3. This required removal of the MicroSD card from the Hero3 and the use of a SD card adaptor that would allow the MicroSD to be used with the Camera Connect Kit (Figure 24).

Figure 24 SD Adaptor with Camera Connection Kit

The MicroSD's size, .53" x .44", made it a small critical piece that could be dropped or easily misplaced when moving it from the camera to the iPad. During research, the frame housing did not accommodate access to the MicroSD storage card. The access port was adapted by using a Dremel multitool to cut a larger, .50" x .63", piece out of the frame to grant that access.

While conducting research it became more advantageous to record in shorter clips. One of the ways this was achieved is by watching the recording time and limit it to set increments of a certain lengths, roughly two minutes for this study. This required the researcher to mentally time stamp the data and to remember which clips, and the location of interactions within those clips, to review with the user, adding another step to the process that could cause additional problems.

Another was to end recording ten to fifteen seconds after an interaction of interest and to immediately start recording again. This provided a timestamp that the researcher would not have to mentally log. It was quicker and easier to scrub through the video during interview, taking less time away from the user and their task.

Transferring the video in smaller increments was more efficient than transferring large sections of footage. Importing multiple smaller clips was quicker than importing one large one. When importing groups of smaller clips, once the first video had finished it can be reviewed while the others continue to import.

Interviewing with smaller clips limited the time that was taken away from the user's tasks. To interview, the researcher had to interrupt the task being undertaken by the user to show

the footage on the iPad for questioning. Upon showing the footage it was discovered that if the

researcher asked a question before or even during the review of the video, the user oftentimes

went back to the product before finishing the clip to explain their thought process or their

reasoning for interacting a certain way. During review it is better for the researcher to allow the

footage to play to the end of the interaction so that both of the viewers' focus will stay on the

video with fewer distractions. This method cuts the time taken away from the user's activities

and from the researchers observations.

5.3.3 Smartphone and Tablet

A logical combination of devices was to pair Apple's iPhone with the company's tablet,

the iPad. Both devices ran Apple's iOS 6 operating system. This meant that the researcher

needed knowledge of only one operating system and the setup increased cross-device

compatibility. Additionally, the iPhone provided an "out-of-pocket" recording device that users

may be more accustomed to.

With this mode there is no thorough initial setup. It has a "plug-and-play"-like capability

whereas the researcher only needs to take the phone from their pocket, open the camera app and

start recording video. This is an on-the-go video solution for a researcher to observe product/

user interactions and allows, after a time, the choice to record further interactions on the spot.

An iPhone's home screen gives researchers instant access to the camera app (Figure 25),

reducing time lost through unlocking the phone, searching for the app and opening it. The

camera app on the iPhone 5 has a minimalist display for simple input.

Figure 25 iPhone Home Screen

Recording settings cannot be changed on the iPhone 5 and it can only record in 1080p

resolution. The camera app has only five input selections. Those options are to switch between

front and back cameras, turn flash on or off, switch between video and photographs, a record

button and a selection to access the photo library on the iPhone. Upon hitting the record button,

a small red light flashes inside the button interface, giving visual feedback on the recording. All

previous buttons vanish and are replaced with the button to snap a photograph while

simultaneously recording and an additional time indicator showing the recording length of the

clip (Figure 26).

Figure 26 iPhone Camera App

Flash
Switch between front and back cameras

Switch between Photo and Video

Record Button

Photo Library

Take Photo

Recording

Time of Recording
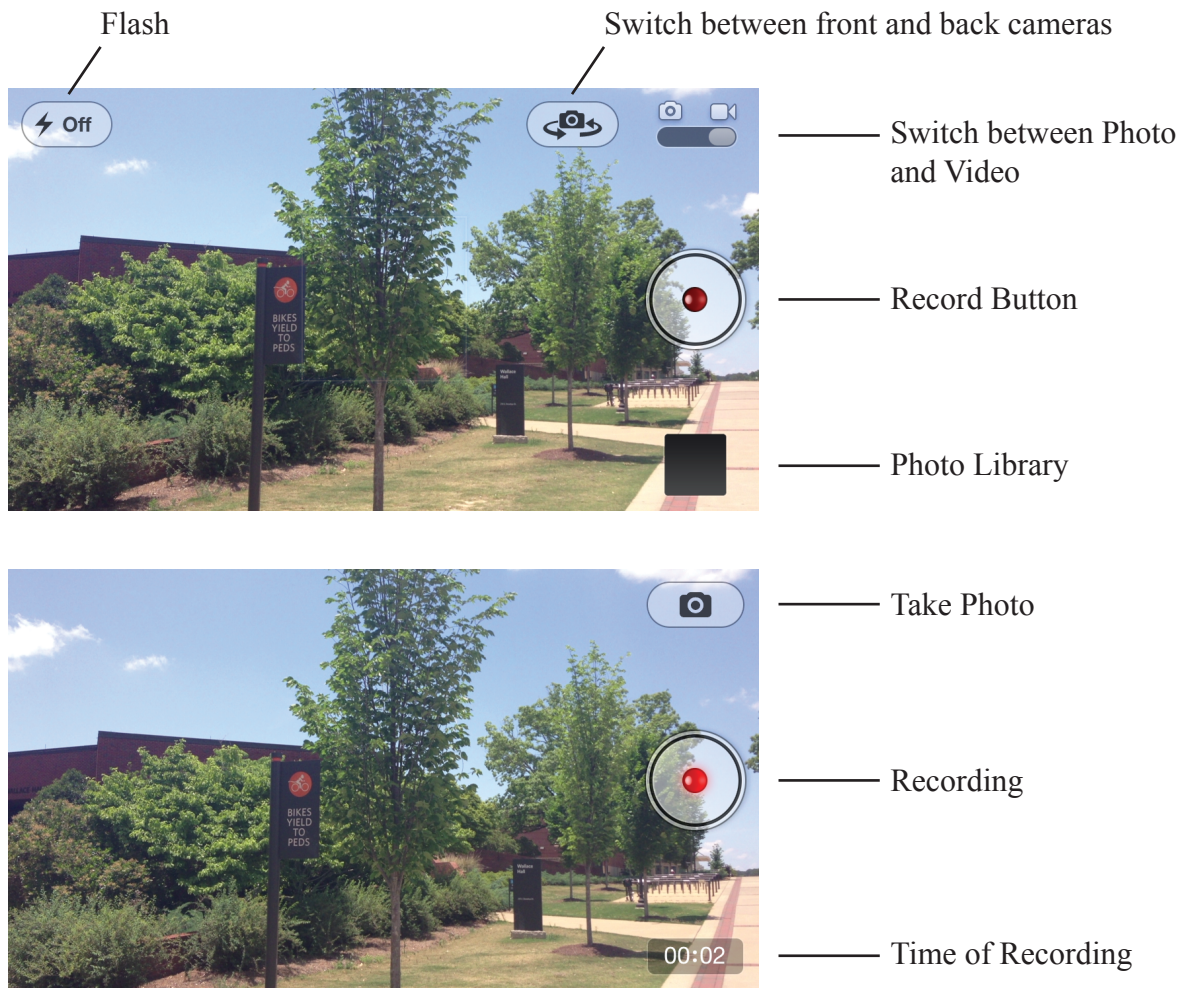
A 4" high-resolution screen compliments the iPhone 5's recording resolution and in and of itself could provide a moderately acceptable screen for reflexive video ethnographic review. However, this study conducted the review by transferring the footage from the iPhone directly onto the iPad. The connection kit was used, with the USB input, to connect the iPhone via the provided Lightning cable. Transfer times were quite long; a ten minute clip took nine minutes and thirty-eight seconds (9:38) to transfer into the iPad. Additional clips transfer times tended to

take almost the length of the video to transfer. Smaller clips were more efficient, as was with the

Hero3, but took longer compared to the transfer rate between iPad and the MicroSD card.

In this combination to transfer the data the researcher has to manage two separate

devices. Once the researcher has finished recording he or she then has to return to the iPad, or

carry it with him or her, and set up the transfer process. Having the iPhone attached through a

cord to the iPad can cause some fumbling issues. The researcher now has to hold both devices or

find a solution to put away the iPhone. It is a distraction to have to keep up with both devices

when trying to focus on reflexive user interviews. As with the previous mode, once the first

video has transferred from the iPhone to the iPad it may be viewed while the others finished

downloading. Other methods of transferring video were attempted through wireless transfer

capabilities.

Two other methods were attempted to transfer video between the iPhone and the iPad.

The first was to use Apple's own cloud upload service entitled iCloud. It has potential because it

uploads photos directly to a user's account that can be accessible across all iOS devices.

Unfortunately for now, iCloud only syncs photos, not video, across devices. It is still relevant for

photograph storage and accessibility if necessary in the field. Secondly, Dropbox, a cloud

storage service, will wireless sync photos and videos from iOS and Android devices through

their mobile app. Photos will sync across cellular data but videos will only sync through a WiFi

connection. This can prove problematic if a researcher is in a location that does not have WiFi

access, such as a construction site. Using WiFi as the transfer method was slow and cannot be

quantified because it needed time to both upload to the service's cloud and then additional time to be recognized by the device receiving the data.

Capacity limitations are tied directly to the amount of free space on both devices. Shooting in 1080p means the storage will be consumed rather quickly. Upon transferring video onto the iPad its recommended that the video should be deleted from the iPhone to conserve space if further recordings are necessary with the iPhone. After importing, the Photos app will ask if the researcher would like to keep or delete videos from the input device. It is one less step that has to be taken to remove video from the recording device.

This mode would work best if the research being conducted was a short interaction in which the user could finish the task entirely. This would make way for the researcher and user to, essentially, have a sit down, casual review of video. It may also be seen in its entirety without being chopped into multiple smaller events. Since this mode works best in situations with shorter interactions it may facilitate longer user review times.

5.3.4 Action Sports Camera and Laptop

The final mode was to pair an action sports camera with a laptop. Configuring the setup as such still needed the use of an iOS device, an iPhone or iPad, to frame the Hero3 correctly, therefore, requiring the researcher to monitor three devices, albeit, not simultaneously. An Apple Macbook Air (MBA) (Figure 27) was chosen as the laptop for the mode because of its portability, battery life and use of flash storage which provides quicker power up and speedier applications.

Figure 27 MacBook Air (Apple 2013)

Conducting the recordings worked just as they had throughout the first mode. The Hero3

was used as the recording device and an iPhone was used to frame the video. Video was still

cropped into sections during recording by stopping the video ten to fifteen seconds after the

researcher observed interactions of interest. This tended to keep the video sections short with a

physical, instead of mental, timestamp.

An SD card slot is standard on the Macbook Air (MBA), providing an easy solution to

read the MicroSD card. It is still necessary for a full-size SD card adaptor, with the MicroSD

card installed from the Hero3, to fit in the MBA. Additionally, the videos stored on the MicroSD

card may be viewed directly from the card without having to transfer that video to the MBA, cutting out a possible time consuming step.

Even though the MBA is an ultraportable laptop it is still large and awkward for quick ethnographic field research.   Reviewing video on the MBA takes the user away from the tasks at hand. It is not productive for the researcher to carry the laptop over to the user as easily as it was using the iPad. This setup is best used under circumstances where the user and researcher may casually sit down and review the video through conversational interviews.

Review like this works best where the product/user interaction is not a prolonged observational session. For example, a researcher may observe a user operating a generator in a short set of steps where the conclusion is met rather quickly. Afterwards, the user may have time to conduct the sit-down review. An ultrabook laptop may be set up in a secondary location from the interaction, allowing the conversational interview to move to a more comfortable and relaxed environment.

This is the advantage the MBA has over the other two modes. The computing and multitasking power of the MBA can create additional depths to the interviews. A researcher may use the ScreenFlow app to capture the video under review and the user may be recorded throughout the interview. It takes practice to set up ScreenFlow to work this way.

First, the ScreenFlow app needs to be opened. Once opened it is immediately ready to capture the screen. Second, the video file, captured from observational research, must be opened in a player program such as QuickTime or Windows Media Player. The third step requires a program, PhotoBooth (used on the MBA), to record the interview from the built in webcam on

the laptop. To start the process, the researcher must start recording the screen from ScreenFlow

and then begin recording the interview with the built in webcam. Afterwards, the observational

video will be played to begin the interview. These applications have to be fit on the screen so

that both programs, the observational video and the program recording through the webcam, are

visible. This ensures that ScreenFlow will grab both applications and their video (Figure 28).

Ultimately, the reason for capturing both simultaneously allows capture of the reactions of the

user with the video side by side for future review.

Figure 28 ScreenFlow
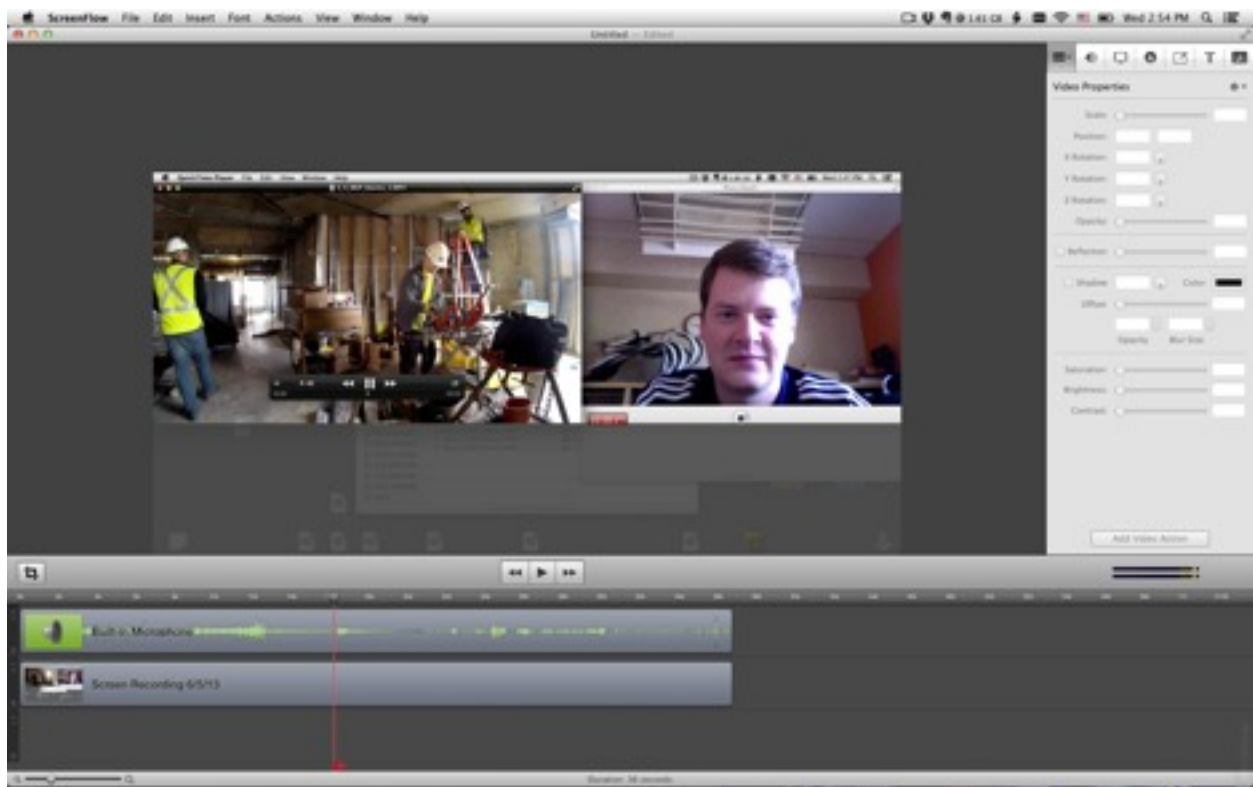
Ultimately, there were issues that occurred using this process. The video being recorded

through the webcam is ever-present during the interview, possibly causing the interviewee to

become distracted or self-conscious because they are watching themselves being recorded in real

time. The laptop will also have to be oriented directly facing the user, which may lower the visibility the researcher has of the screen. Reviewing multiple videos will cause lags in this process.

Once a video has ended, the interviewee must pass off the computer to the researcher to open up and set up the next video. This causes small interruptions in reviewing that may be awkward for the parties involved or distract from the interview process as a whole. It also produces a little fumbling by the researcher in opening additional videos and possibly having to reshape the viewing screen for everything to fit properly. However, if the user and the researcher have an ongoing friendly relationship these problems may be non-issues.

This mode consumes the most time for setup and use. It also provides the largest margin of error on the end of the researcher. It is necessary for the researcher to practice this setup and know it well in advance. However time consuming it may be to use, this method probably produces the best final documentation for further review than the previous two modes. Interviews and observational video are stored on the computer providing access to the researcher. ScreenFlow also provides review and editing tools that may be used for time stamping, coding and review of observational and interview video.

5.4 Application Design for Mobile Video Ethnography

An application specifically designed for use in video ethnographic research would greatly increase the use and effectiveness of design researchers creating research knowledge. The research and conclusions reached in this study have been utilized to develop a simple application

with an intuitive interface for ethnographers to capture interactions and to review those

interactions with users in-situ (Figure 29).

Figure 29 Process Chart for EthnoGraph
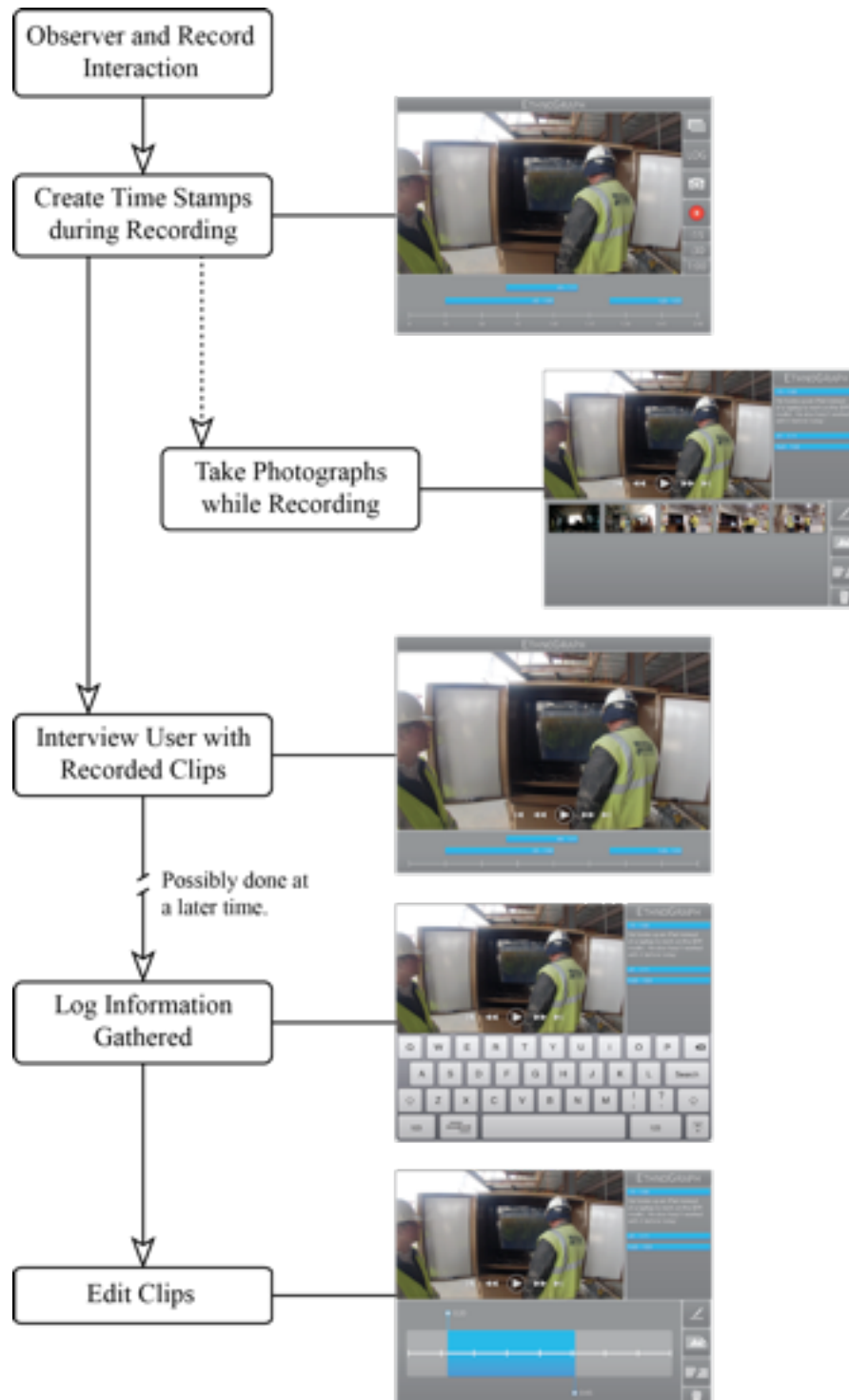
The designed application, EthnoGraph, is built for Apple's iOS operating system for the

9.7" iPad. It utilizes the most available camera, the one located on the back of the iPad, to record

interaction. The iPad provides an ample screen to review, edit and log ethnographic knowledge

from captured video. EthnoGraph opens directly into the main screen for recording video

(Figure 30).

Figure 30 EthnoGraph Main Screen

The main screen provides a large recording area with a time stamping timeline graph

located in the lower part of the screen. Input buttons are placed on the right side of the screen for

best accessibility for right handed users while holding the device. They include enlarge video

screen, log data, capture photograph, record and time stamping buttons. Enlarging the video

screen creates a less cluttered screen for fewer distractions while reviewing with the user (Figure

31). The time stamping buttons are set in timestamps of :15, :30 and 1:00 minute. During

recording the ethnographer may realize that they are watching an interaction of importance and,

since an ethnographer cannot see the future, these buttons store footage backwards. If an

ethnographer sees an interaction of twenty seconds or so, he or she may then select the :30 button

and that will create a timestamp for thirty seconds prior to that point in the recording. This

allows the ethnographer to watch the video without having to remember sections of video.

Figure 31 EthnoGraph Enlarged Video Screen

The timeline graph at the bottom shrinks slightly but allows the ethnographer to select a

timestamp (selections in blue) to play that section of video. This allows the researcher to

navigate back and forth for interview and omit any recordings that do not need to be reviewed at

the time. Full video controls hover over the lower part of the video. To return to the main screen

the ethnographer only needs to click the header where "EthnoGraph" is displayed to go back. At

any time, the ethnographer can enter into LOG where they may be able to write their findings or

edit sections of stored footage (Figure 32).

Figure 32 EthnoGraph Log Screen
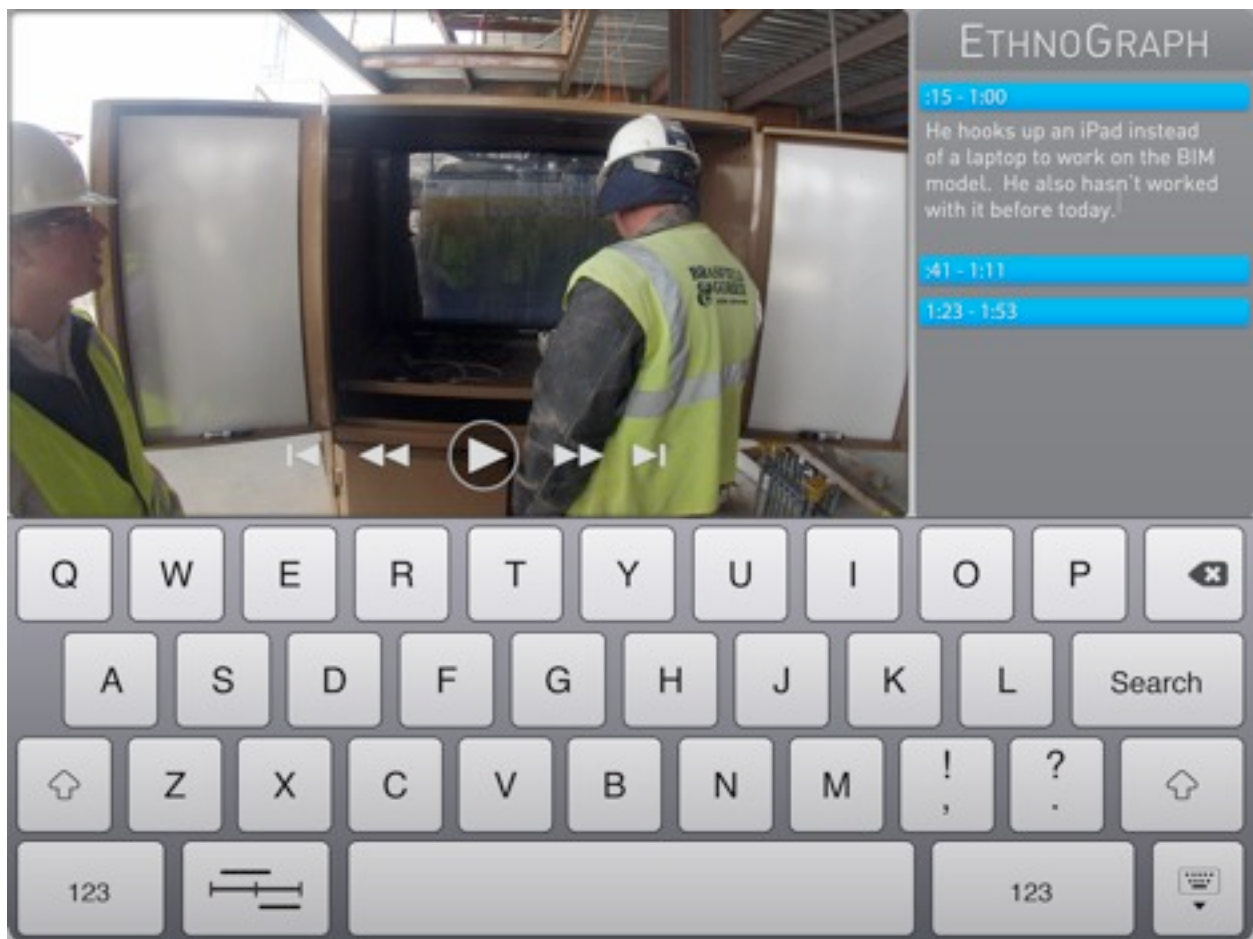
Logging information is the best way for the ethnographer to remember and describe the

actions that have taken place in the section of video. Upon selecting any of the blue timestamps

the ethnographer is capable of typing their findings. It is possible that the stored clip was too

long and needs to be edited to store only the necessary sections of footage. An icon beside the

space bar on the keyboard jumps into an editing mode (Figure 33).

Figure 33 EthnoGraph Editing Mode

Editing mode includes simple editing tools that provide sliders to get the content break

points in the right place. It also has a button to cut clip and the area shaded in blue is what is

ultimately stored. This area is also where the ethnographer may access photographs that were

captured during recording (Figure 34). A clip may also be trashed if found that it does not

provide knowledge for the subject at hand.

Figure 34 EthnoGraph Photographs
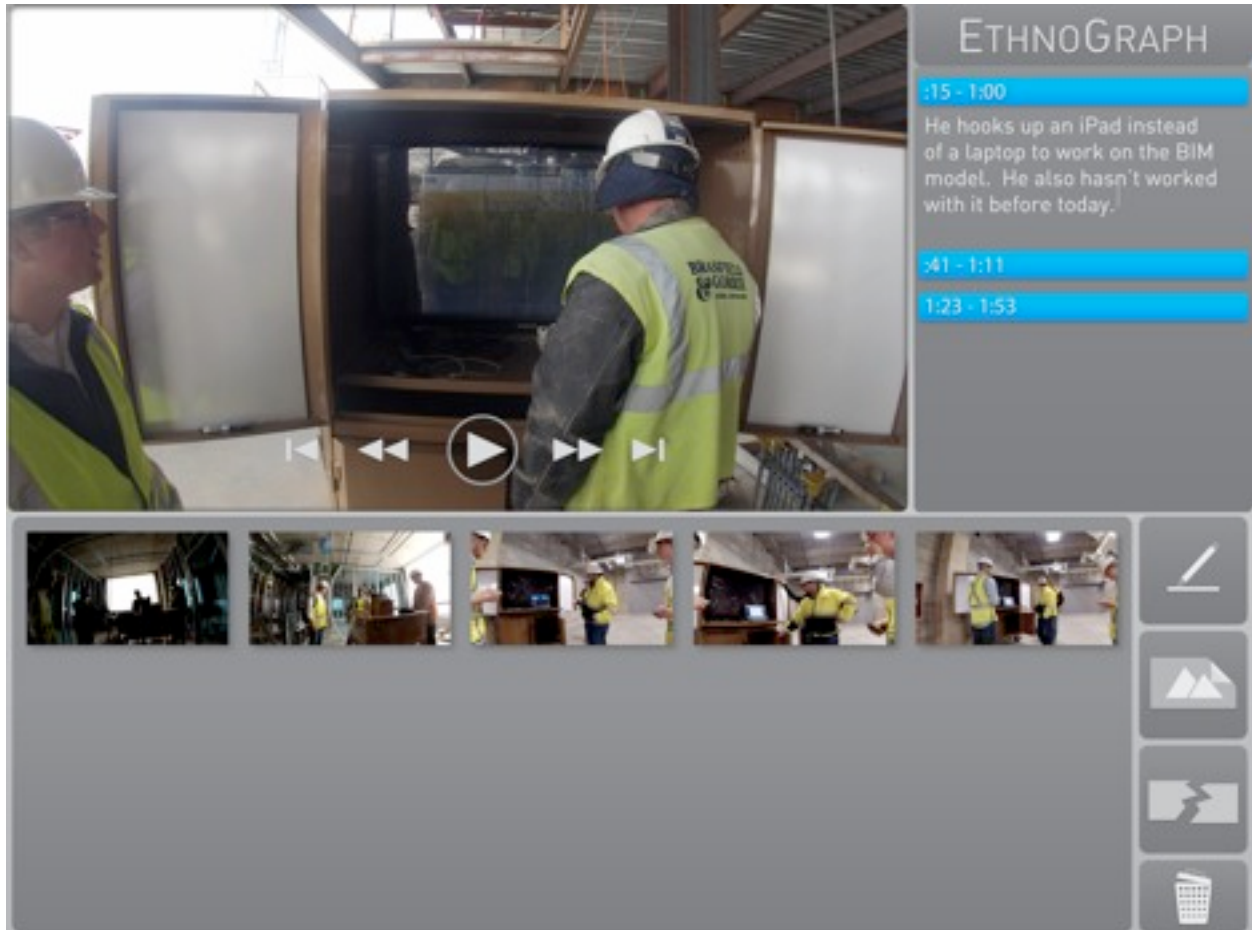
5.5 Conclusions

As with any type of research, this process tested in this study works best within certain observational and situational criteria. The first mode, an action sports camera attached to an iPad, was intuitive, quick and offered the user and researcher a reflexive video ethnographic technique that could provide more truthful findings. When subject to in-situ field research, this combination provided superior portability and minimally invasive use. The mode did create a fluid relationship between researcher and user in a shorter period of observation time. A researcher's ability to conduct reflexive visual ethnographic techniques quickly, with minimally invasive techniques, decreases research time and increases findings.

The other two modes needed further setup times compared to mode one. Users were taken away from their tasks for prolonged periods with mode two but even more so with mode three. Situationally, these two modes are best executed when circumstances allow for a relaxed conversational review wherein both user and researcher have time to sit down for interviewing. All three of these modes had advantages and limitations that determined their usefulness within certain research contexts (Figure 35).
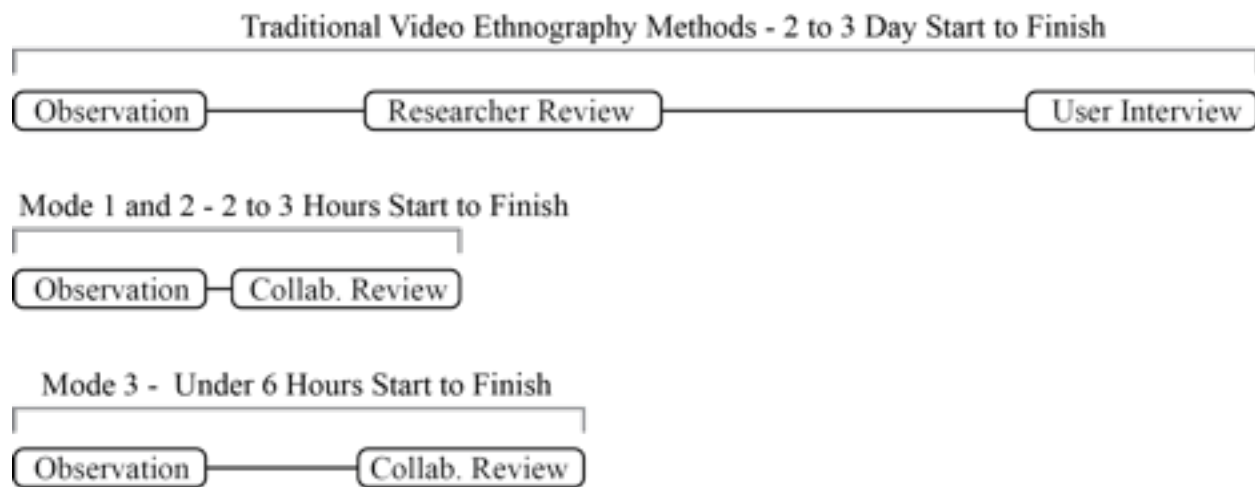
Figure 35 Comparison of Modes

Mode 1 Action Sports Camera with Tablet	Mode 2 Smartphone with Tablet	Mode 3 Action Sports Camera with Laptop
Advantages	**Advantages**	**Advantages**
Ease of use, minimally invasive operation, camera and review is operated from one display, ability to conduct quick in-situ interviewing, turn on-and-go functionality, handheld camera live-view, intimate video recording, dynamic viewpoints.	Pocket devices, can use devices with one unified operating system, users may be more acquainted with these devices, easy to use, has no "in your face" video device, non-intimidating nature of these portable devices, few on-screen ditractions.	No video transfer times, easy video playback, ability to record interview, can use an portable camera, very large review screen, can capture the user's facial expressions through an onboard camera, short or long video playback, more personal review, creates a conversation.
Limitations	**Limitations**	**Limitations**
Distracting having to move around user, no camera zoom, 2-3 second live-view lag in GoPro app, MicroSD cards are small and easily lost, transferring video is time consuming, limited to action sports camera's recording limitations.	Distracting having to move around user, no camera zoom, transferring video is clumsy with an additional cord and slow, easy operation of smartphone camera, limitations based on smartphone.	Cluttered review screen, laptop may be intimidating, laptop is a little clumsy, may need to use multiple locations for research and review, must take camera to laptop for review, use of many devices that may not be compatible, review self-consciousness.
Conclusions	**Conclusions**	**Conclusions**
Best mode for in-situ reflexive video ethnography, large 9.7" screen is great for video interview and easy to hold, applications create a more unified experience.	Great for instant and quick video ethnography, "out-of-pocket" experience, device acquaintance for users may limit camera-consciousness.	Works best with short recorded interactions where the review is conversational in a separate setting, records the user being interviewed, no transfer times for video.

It is important to utilize video as a gateway to discovering design knowledge through quicker ethnographic techniques. Using these modes enables research to be conducted in shorter time intervals with further possible insight than otherwise could have been achieved (Figure 36). All of this was dependent on the use of current technology. However, technology will continue to change and provide a better experience for parties involved.

Figure 36 Comparative of Times to Conduct Video Ethnography

Traditional Video Ethnography Methods - 2 to 3 Day Start to Finish

Observation —————— Researcher Review —————————————— User Interview

Mode 1 and 2 - 2 to 3 Hours Start to Finish

Observation — Collab. Review

Mode 3 - Under 6 Hours Start to Finish

Observation ——————— Collab. Review

Eventually, expectations would be that limitations of current devices will be overcome, that newer devices will provide exactly the necessary criteria to conduct these modes without work-arounds. Hardware, such as GoPro's action sports cameras, could play video through live streaming instead of limited to just live-view, eliminating many nuanced tasks that currently have to occur for video transfer and review.

Evolution is the next logical step in the continuing development of these modes. This study conducted research with devices that were available at the time and devices that were estimated to provide the best fit for this study. Cameras, tablets and other mobile devices will

continue to be improved, most likely at a rapid pace, that will facilitate more efficient visual ethnographic research.

For tablets, or tablet PCs, future evolution will undoubtedly provide extended portability, speedier processors and advanced operating systems. As of now, the future of these devices is unknown, which makes it difficult to speculate as to further uses they may provide in the future. A few things are certain: devices will improve, and those improvements will facilitate better visual ethnographic techniques. Hardware and software will continue to work together for creation of ethnographic knowledge and may eventually only be bound by physical limitations of ethnographic research.

Conducting design research has, and will continue to be, the relationship between user, product and researcher. Research is ultimately centered around people and the emotions and the relationships that form between them. A designer must always ensure that the user, not the devices or methodology, receives the primary attention while conducting ethnographic research.

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