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ABSTRACT

This inquiry focuses on Air Force commanders' personal experiences with motion imagery when used as a tool in the decision-making process. It adopts a grounded theory approach to analyze emergent themes from the commanders' phenomenological perspectives. Strauss and Corbin's methodology of open, axial, and selective coding was used to analyze semi-structured interviews and senior leaders' videotaped interviews. The results indicated a substantive level theory based on Boyd's OODA (observe, orient, decide, act) loop in military decision-making. I label this emerging theory as Clear Canopy: Motion imagery use expedites the OODA loop in the first phase, approves/disproves mental images commanders might have in the orientation stage, validates/challenges pending decisions if more imagery is obtained, and provides feedback after action is completed.

ABSTRACT

This inquiry focuses on Air Force commanders' personal experiences with motion imagery when used as a tool in the decision-making process. It adopts a grounded theory approach to analyze emergent themes from the commanders' phenomenological perspectives. Strauss and Corbin's methodology of open, axial, and selective coding was used to analyze semi-structured interviews and senior leaders' videotaped interviews. The results indicated a substantive level theory based on Boyd's OODA (observe, orient, decide, act) loop in military decision-making. I label this emerging theory as Clear Canopy: Motion imagery use expedites the OODA loop in the first phase, approves/disproves mental images commanders might have in the orientation stage, validates/challenges pending decisions if more imagery is obtained, and provides feedback after action is completed.

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MOTION IMAGERY'S EFFECT ON AIR FORCE COMMANDERS'
DECISION-MAKING PROCESS: A PHENOMENOLOGICAL PERSPECTIVE

A Thesis
Presented to the
Faculty of
California State University, Fullerton

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
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By
Sandra Higgins

Approved by:

Edward J. Fink

Edward Fink, Committee Chair
Department of Radio, Television, Film

05/17/02

Date

Diane Witmer

Diane Witmer, Member
Department of Communications

5-17-02

Date

Olan Farnall

Olan Farnall, Member
Department of Communications

4/29/02

Date

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CHAPTER 1

INTRODUCTION

Purpose

The purpose of this study is to understand the role of motion imagery and its effectiveness when a commander makes critical decisions. In warfare, decision-making at all levels is critical. Uniformly, commanders' decisions are time-sensitive, may follow certain national or international criteria, and may involve life or death determinations. Also, commanders have the option of employing small group decision-making by the use of advisors or acting alone. Furthermore, decisions may or may not involve specific guidance from higher levels of command. I sought to explore commanders' perspectives on motion imagery use in the decision-making process.

Clarification

I use the term "motion imagery" to represent all forms of visual communication that involve moving images, which may or may not include sound. These images may be recorded by film, video, or digital sources: commercial source imagery, such as war footage broadcast on networks or cable companies; satellite imagery from military or commercial satellites; streaming video from unmanned

aerospace vehicles; and/or military source imagery, such as combat camera units deployed in theater.

Importance

This study is valuable to understand the commanders' personal experiences with field-acquired motion imagery when used as a tool for their decision-making processes. Leaders of tomorrow will need information in a form that is timely, reliable, relevant, and tailored to the war fighter's information needs (Murphy, Bender, Schaefer, Shepard, & Williamson, 1996). Studying current leaders' experiences with motion imagery from a phenomenological perspective might provide insight for leaders making tomorrow's decisions. I explored lived experiences to create a narrative for rich analysis that quantitative methods would have failed to provide.

Theory

Lester (1995) divides the use of theory for visual communications research into two sections: sensual and perceptual. Sensual theories (gestalt, constructivism, and ecological) explain that images are simply compositions of light and little else. Perceptual theories (semiotic and cognitive) investigate what particular meanings people assign to the image elements they view. Symbols and signs dominate the crux of perceptual theory application, not motion imagery. Furthermore, phenomenological studies, such as this, seem to

advance toward grounded theory to seek emergent themes. Because commanders' experiences are the basis of this study, the grounded theory approach (Glaser and Strauss, 1967; Glaser, 1978, 1998) is used to understand the data. The premise of grounded theory lies in constant comparison of the emerging data. It is a dynamic research process. As data are collected, comparisons are made to other data collected and emerging theories. During this process, additional, relevant literature is reviewed to assess findings (Dick, 2000).

CHAPTER 2

REVIEW OF THE LITERATURE

This literature review provided the framework for interview questions, but did not serve to provide a solid basis for determining any *a priori* hypotheses involving commanders' experiences.

Air Force commanders are in the midst of what one researcher calls our current communication culture, the "technoculture revolution" (Robins, 1996). This revolution merges image technologies with visual culture. Global media, surveillance systems, and virtual environments are commonplace in U.S. Air Force training scenarios and real combat situations. Image technologies are the mode of communication in these environments. The author posits that Air Force commanders' decision-making process is hampered by the reduction or lack of real-time motion imagery in the field. This problem is due to the reduced force of trained military visual communicators (Kozaryn, 2000) and lack of war planning to include the existing communicators in forward deployed locations (Strub, personal communication, May, 2000).

Commercial media companies provide a substantial amount of imagery during conflicts when they have access to particular missions. The effect of news media war coverage is highly researched (Dobkin, 1992; Robinson, 2000; Thussu, 2000).

The media footage may or may not become available to the Air Force after the media outlets' immediate needs are met (broadcasting edited footage real-time or live-to-tape for editing at a later date). Depending on the media outlets' beliefs about what is suitable viewing for the American public, most of the "disturbing" images are screened out (Robins, 1996). Use of this screened footage and the time delay can render these acquisitions useless for the commanders' decision-making process.

Ideally, visual communication-trained men and women armed with motion imagery equipment to gather intelligence, survey the environment, and document contingencies can be the eyes and ears of the commander. Bower (1988) identified the need to study the human factors of military decision-making and new technology inputs. He warned that the research communities were not studying the evolving phenomenon to understand why commanders make certain decisions; why some decisions are successful, and why some fail.

The existing research focuses largely on the technology and specific infrastructure needs of motion imagery as a communication mode (Barry, 1997; Davies, 1990). Emphasis is placed on how to deliver the imagery, physical protection of the bits and bytes, and use of motion imagery in future wartime scenario plans (Murphy et al., 1996). Unfortunately, these qualitative studies do not explore how a commander might use motion imagery in the heat of a conflict. A gap exists despite the vast use of motion imagery in today's culture. Scholars have ignored the effects of its use on human perceptions in the decision-making

process. To begin exploring how a commander might perceive motion imagery's effectiveness, qualitative methods such as this study can lead the way.

The Decision-Making Process

Understanding the commanders' decision-making processes involved a review of the existing literature on the field of decision-making itself. This field borrows from the social and behavioral sciences, including management studies, political science, history, sociology and psychology (Janis, 1989). The large amount of systematic research and case studies on the decision-making process from the 1950's to the early 1990's primarily focused on the decision steps themselves: identification of a problem, choices, risks, and outcomes (Mullen, 1991). Elaborations of these steps were explored, such as the Vigilant Problem-Solving Approach to decision-making (Janis, 1989). This approach evolved from the author's study of U.S. policymakers in making quality, crucial decisions. But overall, these approaches do not vary from the basic steps mentioned above.

Various rules have been formulated for making the best possible decision in the form of a solvable problem, given expected probabilities and risks. In 1989, Janis observed the Dominance Rule functions as a choice eliminator to leave the dominant choice as the solution. The Maximin Rule attempts to guarantee that the worst possible outcome will not occur. Encompassing all rules is the basis of the Theory of Hyperchoice. Decision-makers pick their own rules based on subjective personal preferences.

Theories to improve decision-making that build upon basic logic are varied, as well. Normative Decision Theory encompasses bodies of research that tell a person what he or she *ought* or *should* do (Mullen, 1991). Another body of research describes how people *actually do* make decisions regardless of what they *ought* or *should* do (Mullen, 1991).

Also, the Gestalt Theory of Perception (Kohler, 1929; Sternberg & Davidson, 1995) explains the phenomenon of insight that occurs when a decision-maker literally looks at a problem situation in a new way. When visual communication is used to describe a situation, insightful problem solving involves the person going beyond past personal experiences to overcome possibly misleading textual influences to formulate a novel approach to the problem.

Finally, decision-making research constitutes a wide range of aspects including: causes and statistical probabilities (Mullen, 1991), multiple objectives and multiple criteria (Haimes & Chankong, 1985; Ringquest, 1992; Sternberg & Frensch, 1991), insights (Sternberg & Davidson, 1995), moral issues particular to the military community (Hartle, 1989), organizational perspectives (Burleson, Levine, & Samter, 1984; Janis, 1989; March & Weissinger-Baylon, 1986; O'Connor, 1997; Smith & Hayne, 1997), and use of computer-mediated interactions compared to face-to-face inputs (Condon & Cech, 1996). However, in this large field no scholarly attention has been directed towards the effect of motion imagery on the decision-making process.

Decision-Making and the Air Force's Wisdom Warfare

Wisdom warfare is defined as a decision-making architecture involving all aspects of information inputs developed during the last few decades, such as computer-based imagery and open source communications (Murphy et al., 1996). It is based on the U.S. Air Force's commonly used model of decision-making known as the OODA loop (observe, orient, decide, and act). Colonel John R. Boyd developed this model from his research on why American fighter pilots continually won "dog fights" (air-to-air combat) against their adversaries, even though the adversaries' jet fighters were superior to American jets. Colonel Boyd deduced that American pilots had better visual perspective in the cockpit to observe the adversary's position, orient to engage, decide on the action, then engage. The key factor was the time gained in being able to make the visual contact earlier than the adversary. The ability to observe is paramount (Bateman, 2001). The subsequent components in the loop (orient, decide, and engage) may seek feedback from the observation component at any time. Figure 1 on the following page shows how the four components of the OODA loop are related to one another.

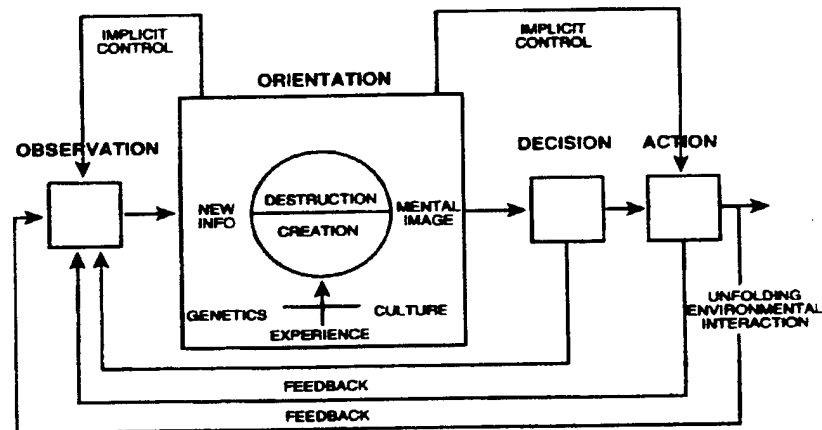


Figure 1. Boyd's OODA Loop

Fadok's (2001, p. 366) depiction of the four major elements of the OODA loop graphically shows this process. The wisdom process is an elaboration of the OODA loop. It relies on a flow from the observable phenomena through data collection, data processing, information analysis, intelligence correlation, prior knowledge, and finally wisdom support. This process makes use of judgment, experience, creativity, and intuition (Murphy et al., 1996). The focus of this study is on the first step: observing the phenomena or event and how effective motion imagery plays a part in that first step.

Motion Imagery as the Communication Mode

Much of the research linking motion imagery and the decision-making process focuses on the physiological aspects of visual inputs: how we process information using video (Barry, 1997). Additional research explores the choice between the uses of one-dimensional information (print) and two- and three-

dimensional information (video) (Pfau, Holbert, Zubric, Pasha, & Lin, 2000; Davies, 1990). Pfau et al. compared communication modes of print and video in terms of resistance to messages and inoculation. Results confirmed earlier studies that print emphasizes content of messages but video also includes the role and influence of sources of messages. Davies (1990) studied the effect of the "telling image" effectiveness in the science career fields. He argued the value of research is raised when the author tells information on an audio track or experimenters perform tasks on film versus having an audience read through pages and pages of journal writing.

Haynes (1988) pointed out in his study of the phenomenology of media that electronic communication (video) is a synthesis of our oral and written heritage. He posited video does this in two ways: the mediated qualities of its messages and the dialectical sense. Video is becoming widely accessible to provide ordinary users a vehicle to compress or extend time and space. No longer do we have to rely on the written word as the primary transmitter of knowledge in our electronic world.

Davies (1990) recognized that pictures or images as the means of communication progressively overshadowed words and numbers. Motion imagery of weather systems moving across the globe, surgical procedures using advanced, microscopic video cameras, and the transmission of digitized satellite imagery of adversarial countries are prime examples of this shift in balance between words and imagery. With this shift comes power to affect decisions.

Motion imagery's power to impact the decision-making process requires research to evaluate its role and influence.

Power of Motion Imagery during Conflicts

Various sources of motion imagery are available to commanders, such as global media reports (CNN, etc), intelligence source reporting (classified satellite imagery and unmanned aerial vehicle footage), and Combat Camera operations. The latter source is not widely known. Combat Camera is a military organization that provides decision-makers with direct imagery capability to support operational and planning requirements for situational awareness, information warfare, mission assessment, and legal documentation during crises. A joint center in the Pentagon serves as the central reception and distribution point for sharing resources. No scholarly research exists to explore the effectiveness of this organization's contribution, nor does intelligence source reporting on the decision-making process.

This is not the case for global media reports. Conflicts during the last decade received constant media coverage. Varied forms of communication documenting the conflicts entered our daily lifestyles: print, radio, and television. However, the most memorable aspect of this coverage was the live footage of deployed missiles, battle damage assessment video, and daily briefings from military commanders and national security advisors. Recent research indicated this motion imagery played a major role in making decisions, formed policy, and had international implications (Sharkey, 2001; Thussu, 2000). Stech (1994) posited

that real-time video on the battlefield in the Gulf War created a CNN war. Images broadcast daily bypassed the entire apparatus of the State Department by television's ability to carry information directly and immediately to top leaders. State Department reports were still important, but they did not reach top leaders in time for decisions to be made.

Images of conflict force viewers to react emotionally and forcefully. With this new power of persuasion in a CNN war, national leaders need to communicate the goals of policies and the objectives of military operations clearly and simply. In turn, once the commitment is made to send troops, even enemies know why and how we do what we must by the images of CNN wars.

Imagery edited by media practitioners for global audiences form the reality of the conflict (Robins, 1996). There is much debate on how the imagery is interpreted in relation to real or alleged actions, such as the Kosovo conflict between Serbian and Albanian atrocities (Sharkey, 2001; Thussu, 2000) and the Gulf War (Robins, 1996). Thussu (2000) studied the role CNN played during NATO's bombing in Yugoslavia. The author suggested the bombing was covered uncritically and was presented as a humanitarian intervention even though NATO set a precedent by intervening as a peace-enforcing organization. Robinson (2000) noted the power of the media's imagery did not drive policy in Somalia in 1992 but, instead, followed policymaker's decisions. However, Bosnia in 1995 and Kosovo in 1999 seemed to show contradictory evidence. Robinson concluded motion imagery used in media reports affected the national

decision to protect Bosnia's Gorazde "safe area" and to deploy air power intervention in Kosovo.

The largest differentiation between the various sources is their missions. Global media imagery strives to compete for market share and is driven by monetary goals. Also, broadcast time is a limiting factor in the amount of imagery, and the majority of footage is edited for public consumption. As for intelligence source reporting, satellite imagery is provided by national and international organizations specifically for national strategy. These organizations normally do not have competition and are technically focused to increase "spy" capabilities.

Combat Camera units are combat-trained, military units whose mission is to provide commanders with imagery support for operational and planning requirements (Protz, 1999). These units are a dedicated source for imagery. Availability, length, and content of the imagery is limited by the commanders' themselves. However, limited numbers of personnel make Combat Camera less of a presence than the vast number of multiple media reporters. Regardless of the scope of power, motion imagery has an effect on deciding what choices are made in the course of national objectives and mission accomplishment.

The goal of this study is to explore the complexities of the human element in the decision-making process in relation to motion imagery's contribution. How commanders perceive this mode of communication will advance the literature for tomorrow's leaders. The aim of this research is based on centuries-old guidance

from a Chinese warrior, Sun Tzu: "Know your enemy and know yourself; in a hundred battles you will never be in peril." (Sun Tzu, 500 B.C./1963, p. 84.)

Research Questions

The phenomenological perspective used in this study examined the following questions:

RQ 1) How does motion imagery affect a commander's ability to observe the battle space?

RQ 2) How do commanders perceive motion imagery as an element of insight in making decisions?

RQ 3) How does the source of the motion imagery influence the perceived credibility of the imagery?

CHAPTER 3

METHODOLOGY

Method of Inquiry

This study focused on Air Force commanders' experiences with motion imagery. Approximately one-hour, naturalistic interviews and electronic mail correspondence were the instruments of data collection.

Theoretical Sampling Method

The subjects were active duty Air Force commanders who have been or are commanders while using motion media imagery in their decision-making process. They were between the ages of 30-60 due to the command eligibility age requirements of the military services based on date of commissioning and promotion. Numerous agencies were contacted to locate commanders available for survey purposes. The Joint Combat Camera, Department of Defense customer database at the Pentagon, Washington, D. C. released customer contacts. This unit in the Pentagon provides daily imagery briefings to the Joint Chiefs of Staff and serves as a focal point for field commanders to access current and historical imagery. Additional sources included the Armed Forces Information Service, National War College, Airlift Material Command, Pacific Air Command, Joint Chiefs of Staff, 1st Combat Camera Squadron, Central

Command, Theater Battle Assessment office and various Air Force bases. An interview was conducted in March, 2002. Also, the interviewed participant provided two additional commanders' videotaped interviews that were conducted in Saudi Arabia during Operation Desert Storm. The videotaped interviews addressed the research questions in this study and were used for data exploration.

Settings and Access

Possible voluntary participants were contacted by telephone to determine their exposure to motion imagery and duty descriptions in the capacity of a commander (Creswell, 1998). Upon final selection and the participant's oral agreement to be interviewed, the method of interview was determined and arranged. Also, the interview questions and informed consent form were emailed to the participant for review before the interview.

The participant agreed to a face-to-face audiotaped interview that lasted approximately two hours. Additional data were sent to me by computer-mediated-communication (email). See Appendix A for a list of open-ended questions.

A statement of informed consent was discussed with, and signed by, the subject. The participant was given a copy of the informed consent to keep. At the end of the interview, time was allowed to discuss the interview and the participant asked questions about the study. The participant was also offered a copy of the results of the study, which will be made available after May 30, 2002.

Excerpts from the face-to-face interview and videotaped interviews were used in this study. However, any identifying information was altered to protect the subjects' identities. The audiotapes, printed emails, researcher notes, and the informed consent form of the subject are kept in a locked filing cabinet to which only I have access. The videotape supplied by the participant was rerecorded to an audiotape.. Both audiotapes were transcribed, validated by a second reader, and then promptly erased. After printing any emails, the emails were promptly deleted from my email program. Transcriptions and informed consent forms will be kept in the same locked filing cabinet for three years and then shredded.

Data Collection

Guided questions for an in-depth interview provided the primary source of data. A semi-structured interview was used to avoid imposing the ideas and experiences of the researcher's previous affiliation with Combat Camera operations (Carhart, 1998). Broad and open questions were used to maximize the richness of data and allow interviewees to express their personal experiences with motion imagery. Also, the transcribed videotaped interviews provided triangulation for data analysis.

Various commanders who were contacted for this study but could not participate due to not using motion imagery during their command provided a secondary source of data. These data included an unpublished research paper and current newspaper, journal and trade articles to further triangulate the data

acquired from the interview responses. Data collected from the commanders demonstrated experience with many forms of motion imagery: media reports, intelligence sources, and Combat Camera footage.

Expectations

Phenomenology does not utilize *a priori* hypotheses. Nonetheless, I expected the outcome of this research to produce a set of categories that described the variation or similarities of using motion imagery as a tool for commanders' decision-making process. Leaders of tomorrow (Air Force in the Year 2025, 1996) will need information in a form that is timely, reliable, relevant, and tailored to the war fighter's information needs (Murphy et al., 1996). Studying current leaders' experiences with motion imagery from a phenomenological perspective can provide rich insight for those leaders of tomorrow in our "technocultural revolution."

Method Of Analysis

Interview tapes were transcribed to computer text files. A second reader validated a random 30% of the transcribed tapes resulting in no errors. Key-word notes during the interviews were taken to determine categories of thought, core categories that appear central to the experience, if any, and comparisons between the results and the transcripts or email (Dick, 2000). In grounded theory studies, data analysis and the later stages of data reduction operate iteratively.

Coding is a process of simultaneously reducing the data by dividing it into units of analysis and coding each unit. These categories or units of analysis were determined by emerging themes and constant comparative methods (Charmaz, 2000; Glaser, 1998). There were five techniques used to develop data comparisons: commander to commander; same commander but different points in time of command; incident to incident; incident to category; category to category. Also, this study employed Strauss and Corbin's (1990) method of open coding to search for general categories, axial coding to search for relationships between categories, and selective coding to describe the central phenomenon.

Additionally, the documents were analyzed and interpreted using a qualitative software package, N5 (Non-numerical Unstructured Data Indexing Searching and Theorizing). The software analyzed rich-text formats, such as email documents and word processing formats. It provided integrated, editable coding in the form of nodes. As concepts were developed, the nodes were formed into tree nodes to show relationships to each other. Researcher memos were also coded, linked, and searched to further understand emergent themes.

As themes emerged, additional memos were written to add to the theoretical sampling of commanders' experiences to saturate the nodes. This occurred because the data overlapped. As interviews were analyzed, emerging themes were explored in subsequent interviews to confirm or disconfirm the previous findings. Additionally, relevant literature was reviewed to further this validation process. As the nodes were sorted into a coherent substantive-level theory, the results were written in narrative form. The goal in this process was to bring the

lived experience to the reader to show how motion imagery affects the decision-making process.

Validity and Reliability

Use of an outside coder provided verification of transcribed data, coded categories, and emergent themes. Strauss and Corbin (1990, pp. 209-210) developed criteria to judge the quality of this type of study as to whether the structural descriptions are well grounded and well supported. I used these criteria as a backdrop in writing the narrative.

Also, Glaser (1998) provided two criteria for judging the adequacy of the emerging theory: that it fits the situation and makes sense in the context of the experience; and that it works. The assumption of grounded theory methodology declares the theory is in the data. Coding reveals its components; memoing provides the relationship links. Sorting these relationships develops the theory. An additional reviewer ensured this process was intact.

Computerized Setting

After transcribed interviews were checked for accuracy by a second reader, the files were converted to computer rich text files and imported into N5. The data set consisted of 660 text units (individual lines of computerized text). Key-word memo notes and the interview questions were also imported. Questions were labeled Q01-10. The key words noted during the first session of analysis laid the foundation for first level tree nodes to begin coding: Imagery types,

Credibility, Orientation, Effectiveness and Implications. These nodes correlated with the research questions. Orientation referred to the first question: How does motion imagery affect a commander's ability to observe the battle space? Effectiveness referred to the second question: How do commanders perceive motion imagery as an element of insight in making decisions? Imagery types and Credibility referred to the last question: How does the source of the motion imagery influence the perceived credibility of the imagery? The Implications node categorized specific remarks made during interviews.

An attributes table was created to break down the data further about the commanders: Rank, War, and Age. This table made it possible to compare and contrast data within the tree nodes. For example, participant responses with a rank of general could be compared to colonels. As interviews were imported into the software, the attribute table expanded to include Imagery Provider as this attribute differentiated commanders' experiences with the imagery. Some served a dual role: provider of the imagery in one command and receiver in other commands. The attribute table remained a fluid component as data were analyzed. Figure 2 depicts a vertical representation of several nodes.

(2)	/Docsdata
(2 1)	/Docsdata/Rank
(2 1 1)	/Docsdata/Rank/Brig General
(2 1 2)	/Docsdata/Rank/Lt General
(2 1 3)	/Docsdata/Rank/Colonel
(2 2)	/Docsdata/War
(2 2 1)	/Docsdata/War/Multiple Wars
(2 2 2)	/Docsdata/War/Saudi Arabia

(3)	/Imagery
(3 1)	/Imagery/Film
(3 2)	/Imagery/Video
(3 3)	/Imagery/Digital
(3 4)	/Imagery/Commercial
(3 5)	/Imagery/Still Photo
(3 6)	/Imagery/Predator

Figure 2
Partial node tree report as a result of key-word notes and initial analysis

The left column represents the numerical hierarchy in the tree. (2 2 2) node is a 'child' – Saudi Arabia of the 'parent' - War in the attributes table filename Docsdata. Appendix B depicts a graphical representation of the tree node hierarchy.

Coding

Dey (1999) suggested researchers think in terms of data coded to "category strings" rather than to "stand alone" categories. Data may fit in more than one "stand alone" category and need to be explored in relationship to strings, as was found to be the case in this study. Orientation seemed to be connected to Effectiveness and, in turn, connected to Implications. This category string allowed for a more holistic approach in exploring relationships between coded data.

Open Coding – search for themes

Each answer to the corresponding interview question was coded to the first level tree node (Q01-10). This enabled expedient comparisons between participants. A second analysis session resulted in coding parts of answers to

other tree nodes. For example, parts of answers pertaining to Q01, Q04, Q05, and Q07 were coded to Orientation. Segments of Q04 and Q07 were coded to the node of Effectiveness.

Units of analysis were coded as paragraphs to ensure context was maintained. Further coding sessions narrowed down the data to sentence coding for deeper analysis. Spreading the code lines to review data before and after selected sentences enabled coding confirmation.

Axial Coding – interconnecting the categories for causal conditions

The primary method of axial coding was performing search/compare node queries. Also, coding on the resulting node reports enabled exploration of questions that arose. For example, comparing answers to Q07, Perceptions of Imagery, resulted in questioning the relationship to Effectiveness. How does the source of imagery (commercial, still photo, video, etc.) relate to effectiveness in decision outcomes? The majority of sources involved military personnel acquiring the imagery and seemed to retain no questions of credibility. Effectiveness of the imagery's use in the decision-making process seemed high due to swift actions after the imagery was viewed.

We're really having some serious problems with our helicopter blades, the sand's eating them up. That doesn't mean anything to them (higher headquarters). So we got a call from the Vice Chief of Staff of the United States Army. I need to be able to understand this and see this so we can solve it. (Colonel 1, 2002)

Further coding the results of crossing these themes provided an additional link to Implications. How does the perception of imagery (credible sources,

timeliness, accuracy) affect the perception of effectiveness, thus implicating distinct actions for future decisions? It seemed once a commander obtained imagery, subsequent decisions were made that otherwise might have been put off for a later date or not made at all unless directed otherwise.

...The chairman was there, they could see vaguely, but he can't, they don't, they couldn't see the whole concept. It was all at night ...but through visual we made this secret film on special operations command...and eventually out of it came special operations command. ...the four star billet and whole separate funding. (Colonel 1, 2002)

Also, data obtained from published materials focusing on motion imagery in observing the battle space during Operation Enduring Freedom were used to confirm or disconfirm categorical intuitions.

Selective Coding – building a narrative that connects the categories

Implications arose from the data as the central or core category. Analyzing axial coding between commanders, data within each commander's perspective, comparing incident-to-incident (Vietnam vs Saudi Arabia) and category-to-category suggested many implications were associated with the use or non-use of motion imagery. Specifically, all the commanders expressed gratitude of the imagery received at critical decisions during Operation Desert Storm.

...A group of people that have been more effective and more influential in the prosecution of this war than anyone will ever know. And that's the Combat Camera effort and their ability to give me real-time BDA (battle damage assessment), which no other entity in our entire government structure could provide. (General 1, 1991)

Using external data from published reports of motion imagery use validated relationships to Implications and filled in categories that needed more development. For example, Loeb (2002) reported Air Force officers figured out

how to feed streaming video from an unmanned aerial vehicle directly to AC-130 gunship computers for faster targeting. This use of imagery had major implications for the decision-maker: A credible source of imagery effectively inserted the commanders into the OODA loop within seconds.

One commander gave rich descriptions on nine distinct missions where he saw the imagery have an effect on decision-making. While describing a command on the west coast, he spoke of Combat Camera's role in Materiel Command. During this command, he was also an imagery provider.

They need you, I mean, our stuff would come back and they're not going to launch anything, not a 200 million dollar satellite until they see what's on there to figure out what the heck happened and so it was definitely integrated, well used type thing. (Colonel 1, 2002)

Negative Cases

Although the interview data did not result in negative data that opposed categories in coding, external data reflected a possible variation in the core category of Implications. Ricks (2002) gathered negative information regarding streaming video from the unmanned aerial vehicle, Predator. This information was not part of the raw data set, but did provide a test as to whether the participants' views were congruent with reported incidences in Operation Enduring Freedom. Ricks gathered information from Army officers who felt the continuous video stream from the unmanned aerial vehicles was better suited for narrow tasks such as targeting, rather than managing the battle from a remote site.

Also, management problems were discussed. Other personnel not in the direct chain of command offered suggestions to the commander and thus

hampered effective decision-making. Although this new technology paved the way to observe the battle space in real time, management issues and lack of controlled imagery does not negate the participant's data.

CHAPTER 4

RESULTS

Research Question 1

How does motion imagery affect a commander's ability to observe the battle space? *Observing the battle space using motion imagery has an increasingly positive effect on a commander's ability to make decisions.*

In retrospect, I wish we'd done more 2-seat flights where we carried the Combat Cameraman into combat. I admit I did not take into account what they could offer because you're busy doing the operational side, you're busy doing the war planning, the beddown, the feeding and care of your people.... In reality your Combat Camera is a tremendous asset....
(General 2, 1991)

Even with advanced imagery technology and delivery systems, acquisition of imagery dominated the rich text descriptions. As an imagery provider and commander, Colonel 1 expressed correlations between imagery acquisition and the relationships he formed with other units and his superior commanders. Each new command brought challenges in regard to getting the higher commander's vision of what he/she needed. In one instance, Colonel 1 literally bumped into a staff officer who was surprised to see him at a special operations demonstration. Arrangements were made to acquire the demonstration imagery and resulted in private viewings with a senior leader. However, other incidents involved, as the colonel remarked, "weird requests." Flying in aircraft during the first pass while dispersing Agent Orange, shooting imagery behind enemy lines with CIA

personnel, and flying into blacksmoke-filled skies in the Middle East to document 527 oil wells on fire were a few incidents shared with the author.

Research Question 2

How do commanders perceive motion imagery as an element of insight in making decisions? *Commanders sought out motion imagery as an element of insight to observe the complete structure of a problem through a clear canopy.* Commanders routinely sought out the footage for decision-making.

As one general stated:

...Many of the decisions, and I should say, when I say many, that's hard to quantify, but to put a number on it, 80 to 90 percent of the targeting that was done was done based on Combat Camera's effort to bring the aircraft videos to real life and present them in an organized fashion, which would enable one to make decisions because a lack of BDA from the overhead sensors and the tactical intelligence capability, and I'll be forever grateful for that ...
(General 2, 1999)

Furthermore, Gestalt's Theory of Perception of looking at a problem using visual communication in a new way could also include motion imagery. Gestalt posited that the whole, or sum, is more important than the individual parts. The theorist used the example of individual notes that compose a symphony. It is not the notes themselves that are important; it is the proximity and composition of the notes that create the music. This notion provided insight in understanding that commanders need a "clear canopy" in regard to viewing the situation as a whole, instead of focusing on the parts of the whole. In order to make a decision effectively, commanders must ensure credible, clear, and complete imagery is acquired.

The decision-making process ends when a problem is solved. Werthimer (1959/1982) used a Gestalt interpretation of problem solving: Being able to see the overall structure of the problem is the essence of successful problem-solving behavior. Motion imagery seemed to be a part of this important essence.

Research Question 3

How does the source of the motion imagery influence the perceived credibility of the imagery? *Although a commander spoke about various incidences regarding commercial sources and military sources, the limited text lines of data available for analysis did not support an answer to this research question.*

The data did not reveal source credibility in terms of the motion imagery itself, but rather source credibility in terms of the source providers' behaviors. Commercial sources were viewed warily based upon suspicious behaviors, which I discuss in the next paragraph. Military sources were assumed to be credible. This was most likely due to the fact that the military providers belong to the same community as the commanders. Furthermore, if misconduct in providing questionable imagery were to happen, the imagery source would be subjected to serious ramifications through the military structure. But as General 1 stated: "Obviously in wartime, you can't take the media behind enemy lines, and Combat Camera guys can do that."

A "clear canopy" involved credibility of the imagery source. If the source could be construed as untrustworthy, the commander could not be sure what was in

the battle space. Colonel 1 expressed his personal distrust of commercial sources during Operation Desert Storm after commercial sources broadcast imagery of Arabic plants with lettering in Arabic and English. The imagery was reported as a baby milk plant; however, no other signs in the area were written in English. Also, the commercial source inhabited a building that was identified as a military target and scheduled for attack. The commercial source members urged military commanders that no activities conducted in the building were worthy of attack. However, other intelligence sources confirmed otherwise. Commanders evaluated the accuracy of the attack when the commercial source was no longer broadcasting. These stories illustrated how commanders may not trust imagery based upon suspicious behavior.

Conversely, the commander shared incidents where the United States used these commercial sources for intelligence diversion for the enemy. Military units heavily documented heavy aircraft landing in theater. Commercial sources documented the same build-up of aircraft and troops.

We wanted Iraq to guess we had a lot more forces than we did. We gave the press much more access then. Later, when we were really putting our real forces (tanks) in place, we restricted the press as we knew they would give all our positions away to Iraq.
(Colonel 1, 2002)

CHAPTER 5

DISCUSSION

Theoretical Contribution

Motion imagery can be more than the “eyes and ears” of the commander. Using Colonel Boyd’s example of how the OODA loop study began, the pilots used the clear canopy to observe the enemy fighters better and avert danger. Just being able to see the enemy faster saved their lives. Having a “clear canopy,” that is, observing the battle space, has great implications. Averting danger, protecting resources, and accomplishing the mission set before him/her: All of these scenarios are part of a commander’s decision-making process. Ensuring commanders have a full and unobstructed view, a “clear canopy,” may be the most important tool in the commander’s toolbox.

The data analyzed seemed to begin formulating the framework for a substantive-level theory. Distinct lines are drawn between substantive-level theory and formal theory (Strauss & Corbin, 1990). Substantive-level theory is derived from the study of one particularly situated phenomenon, while formal theory emerges from a phenomenon studied under many different types of situations. The results of this study, given its limited data sources and highly focused theoretical sampling, are at the substantive level of theory. This analysis

aimed to provide a grounded roadmap to understand how motion imagery can maximize effectiveness in a commander's decision-making process.

I label this emerging theory as "Clear Canopy Theory." It provides a beginning roadmap for exploring how some commanders perceive motion imagery's effectiveness. Motion imagery enhances the ability to expedite the OODA loop by: 1) providing a clearer picture of the battle space; 2) approving or disproving mental images (previous experience, genetic heritage, and cultural traditions) commanders might have in the orientation stage by comparing imagery to the mental images; 3) validating/challenging a pending decision if subsequent imagery is obtained; 4) and offering concrete feedback after action has been taken.

Causal Conditions

Imagery should be accessible to the commander: the right commander. Management and leadership issues must be resolved as imagery is used. Lower level commanders retaining imagery at their level of command obstruct the canopy and cripple the decision-making process. Also, massive amounts of imagery, or rather unedited imagery, hamper decision-making. Too much imagery, as in the recent case of streaming video from unmanned aerial vehicles (Ricks, 2002), clutter the view as to what is most important in the moment. Distant peer commanders outside the realm of operations viewing the same footage could clutter the "clear canopy" needed for the primary commander, just

as two pilots sitting in the front seat of a cockpit could no longer effectively pilot an aircraft.

Technology plays a major part in getting the imagery to the commander. Imagery use during Vietnam versus Saudi Arabia reflected the challenge of using film compared to video and digital devices. Film had to be processed for viewing and took up to a week for commanders' use. The film was not observed coming back to the commander in the field.

Duplication methods may have been a factor, also. Videotape is easily duplicated, as is sending out an electronic signal. One commander observed that even though film-processing labs were later introduced into the field, film products did not filter down to field commanders. Thus, for imagery to be effective, it must be acquired in a timely manner.

Accuracy of imagery is another condition in obtaining a "clear canopy." Both generals stressed that the imagery received enabled decision-making when other sources failed to show an accurate picture. The colonel described documenting the rubber canopy seals located between the body of the fighter jet and the canopy dome over the cockpit. The canopy seal material deteriorated much quicker in the desert. Accurate imagery of the canopy seal deterioration was needed to make further decisions on the fighter jet maintenance schedule.

Moreover, the timeliness of images is a condition that was necessary to begin the decision-making process. Satellite technology greatly reduced the delivery time from weeks in Vietnam to seconds during conflicts beginning with Operation

Desert Storm. Imagery providers also saw ways not only to assist commanders in observing the battle space, but also to improve timeliness by devising their own inventions.

Colonel 1 recalled:

...We were doing test stuff on laser guided munitions that no one had ever seen before. The first AC-130 came in, the Spectre. They didn't have all the stuff they learned to put on there. We were taking our motion picture cameras and putting it up to the scopes and working the motors to try to get them in sync to the TV. They said, hey we've got to put this stuff in there for real, not have these guys try to do this, you know, trying to figure out, I mean, we weren't scientists. We just figured this would work. So they have it automatically now.
(Colonel 1)

Consequences

Providing a "clear canopy" through effective, credible motion imagery could enhance commanders' ability to move through the OODA loop faster and possibly stave off defeat. Consequences of not using motion imagery would include latent decision-making, hampered decision-making, or ineffective decision-making. Any of those three consequences might result in loss of resources, failed mission, and perhaps ultimately loss of life.

Our commanders have got to think on their feet and I give them that credit. Some of them are going to get killed doing it. (Colonel 1, 2002)

I think that I would tell any future commander, right at the beginning he needs to plan how he's going to use Combat Camera, get it in theater right from the very start to record what went on, from the deployment on. (General 1, 1999)

Unfortunately, newer technology allowing commanders to view the battle space as it develops could prove to be disheartening, as Hendren and Daniszewski (2002) reported during Operation Enduring Freedom. As the unmanned aerial vehicle feed streamed video to remotely located commanders,

the commanding general watched helplessly as a naval member was killed and dragged off by three enemy men. This motion imagery might have been a factor in subsequent decisions. The next day of operations, the general was quoted saying: "We body –slammed them...and killed hundreds of those guys" (Hendron & Daniszewski, 2002, p. 4).

Variations

Still photography was a variant in commanders' decisions. Still photographers often deploy alongside videographers during combat missions, depending on space in the transport vehicle. Two-seater aircraft preclude the availability of both products. Commanders would have to weigh the advantages of each particular type of product. Colonel 1 remarked video had been a source of contention because of the quality of image; however, digital cinematography successfully rivaled film products in recent conflicts. Smaller, lightweight cameras and low light/infrared technology gave commanders an advantage over still photography. However, the unavailability of motion imagery can enhance the still photography role to maintain a "clear canopy." Colonel 1 recalled that still photographs taken of oil refinery equipment behind enemy lines gave decision-makers the information needed to know when Iraq would be back in the oil business. Also, a civilian oil well expert in Texas used Combat Camera acquired still images to stop the burning Kuwaiti oil fields in half the time expected. In Vietnam, still photo documentation of a Da Nang attack provided stateside

commanders evidence the flight line revetments worked. Also, many servicemen were killed in top bunks because sandbags needed to be stacked higher around barracks. Commanders used the battle damage assessment photographs to improve future base configurations.

Limitations

Unfortunately, I could not foresee the increased Air Force operations tempo for Operation Enduring Freedom and the war on terrorism during the course of this study. Consequently, only one voluntary commander was available for participation. Numerous contacts agreed to participate; however, their schedules did not permit interviews or email response time. In fact, two commanders deployed on three separate occasions outside the continental United States within this study's timeframe. Every effort was made to increase the sample size. Furthermore, since this study severely restricted the sample to commanders only, additional time granted for this study would not result in additional responses due to the current war planning and operations.

Conclusion

"Clear Canopy Theory" states that motion imagery enhances the ability to expedite the OODA loop. Motion imagery effectively gives Air Force commanders an edge for decision-making. Gestalt's perception theory (Kohler, 1929) of looking at a problem visually and Wertheimer's (1959/1982) idea of

surmising that the whole is more important than the parts gave credence to employing motion imagery as a decision-making tool. As technology progressed toward imagery where details were expertly recorded with advanced digital methods, commanders used motion imagery during Operation Desert Storm that rivaled Vietnam-era motion picture film cameras. Moreover, delivery methods of these images traverse the globe within seconds. Not using motion imagery in recent conflicts even prompted a general to advise future commanders not to repeat his mistake. The other general had realized the potential motion imagery offered and gratefully thanked those who provided the imagery as a decision tool.

The data collected for this study paved the way for exploring motion imagery use in the OODA loop, concentrating on observing the battle space. Motion imagery supported the concept of a "clear canopy" for a commander to see what is around him/her and engage quickly. Furthermore, repeated use of the imagery could provide feedback for the other steps in the loop.

Orientation involved mental images the commander might have about a particular incident. Motion imagery could confirm or disconfirm those mental images. Once action is decided, further motion imagery could provide the commander with immediate feedback to alter his/her decision before action.

Finally, visual feedback after action is taken would be invaluable for subsequent decisions and analyzed for historical purposes. Motion imagery could provide the evidence that a decision was the right one or show the result of a bad one. Any further decisions might hinge on motion imagery as General 2

stated in the case of battle damage assessment video acquisition during Operation Desert Storm.

The limited data collected provided very rich descriptions of places and times motion imagery was used, but a question remained: How does the source of the motion imagery influence the perceived credibility of the imagery? Future research would be necessary to answer that question.

Future Research

A larger sample size is needed to develop or reject the "Clear Canopy Theory." Additional research exploring commanders' use of motion imagery as a decision-making tool would further enhance coding to confirm/disconfirm these preliminary findings. The grounded theory approach provided rich descriptions of how the commanders feel about using motion imagery in making critical decisions. Exploring a larger sample size would test the substantive-level theoretical contributions of "Clear Canopy Theory."

Also, future research should be mindful of how future technology affects motion imagery's availability in this digital age. Global Positioning Satellites are extensively used to transmit motion imagery. As bandwidth encroachment by civilian businesses and incidental or direct jamming of the signal occurs, how would commanders adapt to the lack of motion imagery? Also, the age of commanders for this study provided a distinct age group that did not grow up in the video age.

Given the “technoculture revolution,” as Robins (1996) aptly named our increasingly visual environment, how will future commanders rely on motion imagery to get a picture of the battle space and what amount of credibility will they attribute to the mode of communication? Future commanders will also contend with multiple source video streams as the sister services develop group troop helmet cameras. Managing these multiple sources all at once will certainly be worthy of study if reliance on visual images continues to increase in subsequent generations.

Finally, propaganda images from the United States and adversaries are parts of warfare. Determining credibility is increasingly necessary as commanders are exposed to commercial sources of imagery. How commanders determine effectiveness of all types of imagery generated during a war warrants additional study.

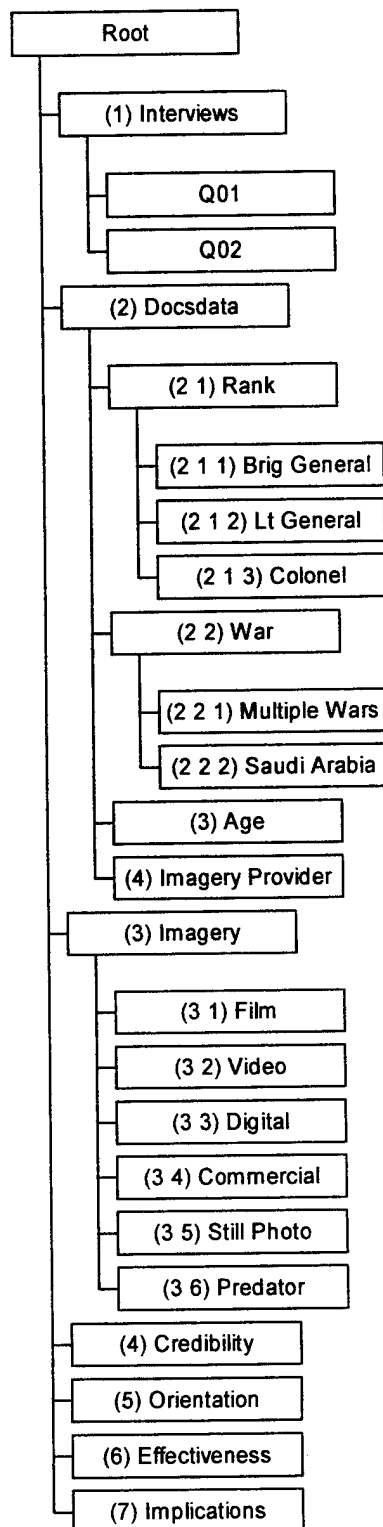
APPENDIX A

Sample of Guiding Questions for In-Depth Interviews

Questions

1. Tell me about your command duty. What are your responsibilities? What is your command structure? Is this your first command? How do you feel about commanding? Have you commanded in real-world conflicts? What was that like?
2. If you have not commanded in real-world conflicts, what experiences have you had in field exercises? What was that like?
3. How do you see yourself as an effective commander? Please give me some examples of why you think of yourself in this way. Tell me what aspects you think contribute to your effectiveness.
4. What data gathering tools do you use as a commander to make decisions? Please tell me about them. How do you see these inputs as being effective tools for you to make critical decisions?
5. Have you experienced motion imagery as a data-gathering tool? If so, what was it like to use this type of information?
6. Please give me some examples of how you acquired motion imagery.
7. What was the source of this imagery? What was your perception of its timeliness? Accuracy? Trustworthiness?
8. What did you think about imagery's usefulness compared to narrative inputs? Still photographs, if used?
9. Please tell me about a time where your expectation of the motion imagery's usefulness did not meet your standards. Why do you think this was so?
10. Please tell me about a time where you would have liked to have used motion imagery as a tool to make a decision. What did you use as an alternative? In what way did you see this alternative as being the best tool after the decision was made?

APPENDIX B

Partial graphical representation of node tree

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