1-1-2007

Image manipulation: Photoshop as a data-measurement tool

Tracilee Rose Hoffman
University of Nevada, Las Vegas

IMAGE MANIPULATION: PHOTOSHOP AS A DATA-MEASUREMENT TOOL

by

Tracilee Rose Hoffman

Bachelor of Arts
University of Nevada, Las Vegas
2001

A thesis submitted in partial fulfillment
of the requirements for the

Master of Arts in Journalism and Media Studies
Department of Journalism and Media Studies
Greenspun College of Urban Affairs

Graduate College
University of Nevada, Las Vegas
May 2008

INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

ProQuest LLC
789 E. Eisenhower Parkway
PO Box 1346
Ann Arbor, MI 48106-1346

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

Thesis Approval

The Graduate College
University of Nevada, Las Vegas

April 24, 2008

The Thesis prepared by

Tracilee Rose Hoffman

Entitled

IMAGE MANIPULATION: PHOTOSHOP AS A DATA-MEASUREMENT TOOL

is approved in partial fulfillment of the requirements for the degree of

Master of Arts Journalism and Media Studies

Examination Committee Chair

Dean of the Graduate College

Examination Committee Member

Examination Committee Member

Graduate College Faculty Representative

1017-53

ABSTRACT

Image Manipulation: Photoshop as a Data-Measurement Tool

by

Tracilee Rose Hoffman

Dr. Lawrence Mullen, Thesis Committee Chair
Associate Professor of Journalism and Media Studies
University of Nevada, Las Vegas

Researchers believe that image manipulation threatens photography's perceived objectivity of capturing moments in history. Current research exists that is aimed at determining whether images have been subjected to methods of manipulation. While this research is thorough in its approaches to detection, it lacks methods that would facilitate the measurement of those manipulations.

This study uses Photoshop to measure the qualitative changes in images. The aesthetic dimensions set forth by Gillian Rose (2007) such as content, color, spatial organization, and light can be isolated, manipulated, and ultimately measured.

This research is aimed at facilitating additional questions regarding what constitutes image manipulation, the extent of image manipulation using the methods described herein, and how image manipulation may affect the viewer. It also hopes to show that widely accepted practices of image modification need to be revisited as technologies continue to update at an unprecedented rate.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

I would like to thank my committee members: Dr. Mullen, Dr. Larson, Dr. Traudt and Dr. Hausbeck as well as the UNLV Journalism and Media Studies Department.

I would also like to thank Randy Becker for giving me my first copy of Photoshop and for being one of my greatest advocates; Emely Vega for supporting me in the very beginning; and Karissa Bagley whom I befriended on my first day of graduate school and have relied on for emotional and academic advice ever since. Also, a very special thanks to Rosa Mikeal Martey for being my friend and mentor when I needed it the most.

My family was also a great support. My brother Matthew and his family, Bobbi, Trace and Emma, were understanding and supportive while I spent countless hours writing my thesis. I will also never forget my late grandmother Lena Del Vecchio sitting next to me and making me laugh while I studied every night.

I would like to especially thank my partner Elizabeth Mileti who inspired me to begin Graduate school and who stood by my side while I completed it. Your friendship and love were my anchor during this stressful time in my life.

Finally, none of this would be possible without the unconditional support and love I receive from my parents Greg Hoffman and Roxann Del Vecchio. They are my greatest inspirations and I would not be who I am today without their influence.

I express my love to all who have helped me reach this goal. I did it only with your guidance.

CHAPTER 1

INTRODUCTION

Background

Photography has long been thought of as an objective art form that leaves behind all pre-conceptions about a situation and simply records what is happening in that place at that time. Many researchers believe that image manipulation threatens photography's perceived objectivity of simply capturing a moment in history (Gavard, 1999; Ritchin, 1990; Tirohl, 2000). As photography continues to be transformed by technology and questions of its ability to objectively represent the world have been raised, it has become increasingly important to evaluate how images are looked at, interpreted and understood.

The concept of photographic image manipulation has been examined extensively through both practice (actually manipulating images) and research (the study of manipulating images) with focused attention on the techniques of manipulation after the image has been recorded. Photographic image manipulation began in the darkroom but with quickly evolving technology in the latter half of the twentieth-century, the restrictive environment of the darkroom soon gave way to the desktop computer. The sophistication of personal and professional computing tools such as Adobe's ® Photoshop has made image manipulation easy and accessible.

The post-production manipulation of still photographic images began nearly at the same time of photography's birth in 1839 (Brugioni, 1999). While the first uses of

manipulation were aimed at beautifying subjects, manipulation methods quickly diversified. Photography began to take over the task of illustrating history and events. At the same time, image manipulation allowed for a wider interpretive process of recording history (Brugioni, 1999).

Oscar Rejlander and John Edwin Mayall were two of the first photographers to manipulate images in the darkroom. They pioneered many practices by illustrating scenes that could not be captured by cameras. Mayall's allegorical photo, *The Lord's Prayer* was created by merging ten daguerreotypes, the earliest form of photographic images, together in the darkroom (Brugioni, 1999). This method of merging images, called compositing, was just one of the many techniques of image manipulation that early photographic artists used to change the nature of the pictures that they captured with a camera.

Although much has changed in nearly every facet of photography from the 19th Century to the present, many of the same manipulation techniques that originated in the darkroom are still used today. Techniques such as compositing (merging prints), burning and dodging (selectively lightening and darkening of areas of an image), and tinting (adding or modifying the colors within an image) are now executed using computer software. In fact, the terminology utilized to describe many of the above listed techniques and additional photo manipulation techniques (to be further explained in chapter 2) have also remained consistent over time and through media types.

Significance of Study

A primary issue in the study of the process and consequences of manipulating photographic images is the inability of consumers and professionals alike to visually determine if images have been manipulated, how they have been manipulated, and to what extent they have been manipulated. In recent years, researchers, most notably Hany Farid, have devised ways of determining if images have been tampered with by applying mathematical analyses to various structures found within digital images. Essentially, his methods make it possible to determine if something from the original photo has been changed. His method, however, cannot decipher how, or how much an image has been changed. The current project builds on Farid's work and incorporates theories of image appearance and impact to identify tools and terminology that can be applied to images to compare specific attributes of photographs, including changes in content, color, spatial organization, and light.

Theoretical Background

Current research on image manipulation has identified a clear need for tools that can measure and explore image manipulation (Becker, 1991; Irby, 2004; Lowery, 2003; Martin, 1991). In particular, many of the analyses of image manipulation are holistic, qualitative and subjective in nature (Brugioni, 1999). Qualitative tools provide a rich approach to examine the cultural contexts and meaning images can express, but additional quantitative tools are needed in order to provide a systematic method to identify precisely what changes have been made to a photograph, how they were manipulated, and to what degree.

In order for this to be accomplished, image characteristics or dimensions need to be clearly defined within a theoretical framework. This project draws on theories from art criticism (Rose, 2007) to suggest four primary dimensions for analysis: content, color, spatial organization and light. Gillian Rose identifies these categories as the main characteristics of an image that affects perception, interpretation, and the development of meaning. She explains that images "catch the gazes of spectators and affect them in some way, and they do so through how they look" (p. 35). The additional dimension of expressive content will not be addressed due to its entirely subjective nature. The strength of this study is its ability to objectively, numerically and methodically outline changes in each of the aesthetic components of images listed using Photoshop as a measurement tool. Expressive content as defined by Rose (2007) is an "elusive aspect [with]...uncertain methodological status" (p.48). She cites Taylor (1957) as saying that expressive content is "the combined effect of subject matter and visual form" (p.43-44). Despite the lack of cohesiveness among visual culture critics to agree with the significance of expressive content, Rose argues that it is the culmination of all other aesthetic components and always necessary to consider. The consideration of expressive content may be better conducted in additional research after the first four elements have been fully fleshed out.

Like visual perception theories, this approach focuses on the *reception* of images to explore the impact of manipulation, and explores the ways in which specific elements are interpreted and processed. It also draws on theories of image production to understand how changes are made to images. This project does not address the more cultural implications and frameworks communicated in images, although it acknowledges to

importance of such approaches. Instead, by offering a quantitative method for image analysis, this project contributes a systematic set of tools and terminology that can enhance cultural and critical studies of image and their meanings.

This Study's Purpose

This project aims to do two things: 1) propose four visual characteristics of images as key dimensions for research on image manipulation; and 2) identify and describe a computer-based tool, Adobe® Photoshop, that can be used to measure and numerically quantify these visual characteristics. The computer-based tool outlined in this project is applied to two different images from mainstream news media in order to examine how changes to the four key visual characteristics can affect the meaning and impact of an image.

Four Visual Characteristics: Content, Color, Spatial Organization, and Light

The four characteristics proposed for analysis are drawn from Rose's (2007) compositional interpretation and were formerly studied almost exclusively with qualitative approaches. Rose's method examines each of these independent visual elements in order to identify the meaning and impact of an image: content, color, spatial organization, and light. The strength of Rose's approach for the current project is that it provides a clear language of image composition that can be used to examine specific changes made to a photograph and identify potential consequences of those changes. She notes that compositional analysis "offers a detailed vocabulary for expressing the appearance of an image" (2007, p. 35). The current project translates Rose's qualitative system of image analysis into a quantitative, systematic method of measuring these four

dimensions that employs the very tool most often used to change images: the image editing software Adobe® Photoshop. By applying systematic tools to investigations of image manipulation, this approach allows researchers to identify what specific changes are made to an image and to what degree

Identifying Image Changes: Adobe® Photoshop as a Measurement Tool

Adobe® Photoshop has been at the forefront of image post-production among both professional and casual photographers since its introduction in the early 1990s. Its recent versions offer sophisticated tools not only for making changes to image characteristics such as color, light, and content, but also for identifying the values of those characteristics in a given image. For example, tools for adjusting the dynamic range of an image (the distance between its lightest and darkest potions) include the color sampler tool that can indicate average levels of red, green, and blue in portions of an image as well as the density in that same sample. Such measures can be compared across different images to identify the exact extent to which that image has undergone change.

This project will apply the histogram and other tools available in the commercial versions of Photoshop to identify a system of quantitative image analysis that can measure and compare values along the four key dimensions of image content outlined above: content, color, spatial organization, and light. The approach offered here is not capable of identifying characteristics such as content with the richness of a qualitative approach. Instead, it is offered as a starting point and a set of terms with which researchers can systematically identify and name changes to photographic images.

Conclusions

This research is aimed at facilitating additional questions regarding what constitutes image manipulation, how far it may go using the methods described later and how it may affect the viewer. It also hopes to show that widely accepted practices of image modification need to be revisited as technologies continue to update at an unprecedented rate.

Through the use of Photoshop as a data measurement tool, the degrees of these seemingly uncontroversial manipulations as well as others will be objectively and numerically documented. Future research should be completed that discusses the implications of the manipulation of aesthetic elements in an image.

While photography has been used for many things since its invention such as portraiture, advertising, and landscapes to name a few, it is the news image that the current research is most concerned with. Indeed, other areas of photography will be touched upon and images used to strengthen this case, however, it is two images that will act as central case studies for this research. Brian Walski's image taken while on assignment for the *Los Angeles Times* that ran with a story entitled; *Panic and Human Shields in Basra* and was later found to be a composite of two separate images will be analyzed. Additionally, a photograph taken on March 11, 2004 by photographer Pablo Torres Guerrero will also be studied. Guerrero's image was originally taken for the Spanish newspaper, *El Pais,* but was subsequently printed in numerous other international magazines and newspapers. Many of the publications chose different methods to obscure, remove, crop out or cover up a portion of the image that contained a

mutilated body part from the explosion. The different methods used and reasons for their use will be examined throughout this paper

Determining whether manipulation had occurred is not a necessary component of this research. In fact, one of the strengths of the method is its ability to systematically measure changes between an image that is known to have been manipulated and its original. This however is also the weakness of the method. In order for the method is to be successfully applied to an image, that image must have been identified as manipulated and its original must be available. It is here that this study builds on the work of Hany Farid.

This study recognizes the importance and power of images on the visual consumer. The visual language of image manipulation is an organic one, which is to say that it must be looked at as an integral element of a whole. That whole is encompassed in aesthetic interpretative analysis based on a Gillian Rose's (2007) compositional interpretation, image comparative analyses using Photoshop in a new way to collect data and ultimately a conclusion and discussion of the possible implications of manipulating news images.

As image capture, post-production, printing and distribution all continue to change rapidly at the hands of emerging technologies; there is no more important time to study the implications of these great shifts and their effect on the larger concept of images as communication.

CHAPTER 2

IMAGE CREATION AND MANIPULATION: AN OVERVIEW

For this study about image manipulation, the literature review is divided into three sections. The first of this three chapter literature review is focused on providing an historical overview of early photographic milestones as well as examples of some of the methods of photographic image manipulation. The second chapter is a discussion of the role of images in expressing reality with a focus on news images and an overview of the four main dimensions of image content this study will measure. Finally, the third chapter discusses the detection of image manipulation and the methods previously used as well as the current groundbreaking research being completed by computer scientists. This chapter concludes by identifying tools and analytical perspectives still needed to enable a systematic, quantifiable measurement of image manipulations.

Early Photographic Milestones

Photography's first recorded image was reportedly taken by French lithographer Joseph Nicéphore Niépce (1765-1833) in 1827. Newhall (1982) noted that capturing the image required an exposure of more than eight hours onto a polished pewter plate coated with light-sensitive bitumen of Judea, a type of asphalt originally used by etchers. This plate was placed into a camera obscura, which is one of the earliest devices used to

project images onto light sensitive materials. This technique created the now-famous exposure of Niépce's French country estate.

A camera obscura, meaning "dark room," was nothing more than the phenomenon of an inverted image being cast upon something as a result of light passing through the pinhole of a wall or other light occluding device (Gavard, 1999). The idea of camera obscuras was recognized by intellectuals, artists and scientists alike as far back as the fifth century B.C. in Europe. Obscuras were also noted in Chinese writing during that same time period (Gavard, 1999). Newhall explains that Giovanni Battista della Porta mentions the use of a camera obscura as an aid to draftsmen in his 1558 book, *Magia naturalis, sive de miraculis rerun naturalium* (*Natural Magic*). Fifteen years later, a professor at the University of Padua, Daniel Barbaro "showed that a more brilliant image could be produced by substituting a lens for the pinhole (Newhall, 1982, p.9)."

The idea of using a lens was innovative, however it was not until Niépce assembled the pewter plate that the images projected by this camera obscura could be affixed with any permanence. Niépce called his invention a "Heliograph," meaning "sun drawing" but it remained a rudimentary means of reproduction until he partnered with a Parisian scene painter, Louis Jacques Mandé Daguerre (1787-1851). Daguerre had also been experimenting with camera obscuras in 1829 (Gavard, 1999).

Niépce died merely four years into the pairs' partnership, leaving Daguerre to build upon their combined research. Although there can be no single person credited with the invention of photography, it may well have been Louis Jacques Mandé Daguerre who launched the art of photography. Using light sensitive silver iodide placed on the surface of a highly polished silver plated sheet of copper, the first Daguerreotype, as this first

photograph is known, was created in 1837 (Newhall, 1982). The detail and tonal range capabilities of this new media revolutionized photography. In fact, Newhall (1982) states that:

> Ever the showman, [Daguerre] brought his invention for the public in a way which so excited their interest that photography may be said to have been born on that Monday afternoon in August, 1839, when the French government announced to the crowds that filled the palace of the Institute of Paris, and to the world at large, the secret process of the daguerreotype. (p. 9)

Despite the revolutionary nature of the daguerreotype, it did have limitations. Keeler (1984) explains that "the daguerreotype is a unique image and therefore can be reproduced only by photographing the original" (p. 11). Photography at that point was a glass-negative process that yielded single, positive images that were not able to be mass-produced.

This limitation of mass production changed in 1841 when Englishman William Henry Fox Talbot invented the calotype, which is the Greek work for "beautiful picture"(Newhall, 1982). Talbot, a scientist, mathematician, botanist, linguist, and classical scholar began to experiment in the fall of 1833 with paper made light sensitive (Newhall, 1983). After many attempts throughout the following years, Talbot's experiments yielded something new: both a negative and a positive print.

The negative that was produced allowed for an endless number of prints to be made. In 1843, Talbot created the first photofinishing laboratory in Reading, England. His laboratory produced prints of mostly architecture and still-life's by the thousands. These

images became an inaugural book of photographs or calotypes, *The Pencil of Nature* (Newhall, 1982).

Overall, each of these three influential men: Niépce, Daguerre, and Talbot, contributed to the field of photography in ways that are still important today. However, it was not just their inventions that shaped the field; it may also have been their professions prior to their involvement in the photography craft that left an indelible mark. The idea of photographic objectivity, a concept that will be discussed later in this chapter, was established, possibly in part from the status of these three leading individuals as scientists and inventors.

It was the scientific nature of the development of the photographic process that attracted scholars and inventors to the craft. The public was introduced to photography by scientists, whose inventions showed representations of the world through the seemingly "unimpeachable honesty [of] the confluence of naturally occurring optical, chemical and mechanical processes" (Schwartz, 2003, p. 28) that was photography. In fact, "It is the technology itself that many consider the guarantee of an accurate transcription of reality" (Gavard, 1999, p. 10).

Indeed, it was this immediate perception of objectivity and the "truth-telling promise of a photograph" (Gefter, 2006, p. 50) that led to the introduction of the camera to the battlefield and eventually all aspects of news journalism. Early in the nineteenth century, newspaper publishers discovered that circulation could be increased by including illustrations with written reports (Schwartz, 2003). Furthermore, "the evidentiary status attributed to the image as part of the larger attempt to assert the non-partisan, objective view offered by the fourth estate," helped solidify newspapers as "consumable objects

that transcended specific political, social or cultural affiliations" (Schwartz, 1999, p.27-28, 2003).

Newhall (1982) argued that photography offered the opportunity for recording history in the making with seemingly infinite detail and reproducible to nearly limitless numbers. These attributes of the medium quickly overtook the battle painters of the time as public opinion began to align with the early opinion of the London *Times* when it said of war photographers that, "whatever he represents from the field must be real" (Newhall, 1982, p. 88).

Englishman Roger Fenton was the first photographer to extensively cover the battlefield. Commissioned to photograph the Crimean war in 1855, Fenton arrived at Balaklava with four horses, a "photographic van, five cameras, 700 glass plates, chemicals, and tools" (Newhall, 1982, p. 85). Fenton's calotypes were reproduced in the *Illustrated London News* and although the mechanical restrictions of the camera limited his images to essentially still life's of battles that had taken place, Newhall asserts that the public "recognized in them the virtue of the camera as a faithful witness" (1982, p.85).

It was assurances of the accurate representation of events through photographs that helped shift public desire for documentary imagery from hand-drawn illustrations to the photographic news image. Further, Schwartz (2003) asserts that it was the early ethical lapses of sketch artists that helped photographers such as Fenton enter the news business. Schwartz (2003) claims that alert readers noticed recurring image elements within sketches due to artists reusing stock pictures to save time in the field. Ironically, the detection of recurring image elements within photographs has proven to also be a way of

determining photographic image manipulation; this will be discussed in greater detail later in the literature review.

Not long after Fenton introduced the public to photographic news images of the Crimean battlefields, Mathew Brady began to document the events of the American Civil War. He left the comfort of his Pennsylvania Avenue and New York City daguerreotype studios shortly after the onset of the war. In1861 he set out with a team of photographers and assistants to document battlefields, ships, individuals, groups and regiments (Panzer, 1997). Brady had established himself by that time as a portrait photographer of political leaders and important personalities, but his "sense of photographic documentation impelled him to undertake the recording of the Civil War," (Newhall, 1982, p.88). Newhall (1982) explains that Brady "had always shown his interest in history in the publication of *The Gallery of Illustrious Americans"* (p. 88).

Much like Fenton, Brady was limited by the cumbersome gear that was required of photographers in that day. He constructed traveling photographic buggies to house his equipment and function as makeshift chemical darkrooms. His presence was common on the battlefields and soldiers referred to the photographic contraptions as the, "What-is-it?" wagon and affectionately called Brady, "that grand picture maker" (Newhall, 1982, p.89). Despite the difficulty with which these images were created, Brady managed to photograph the first battle of Bull Run, Antietam, Gettysburg, Petersburg, City Point, and many others throughout the war. Between Brady and his crew of photographers, "there were over seven thousand negatives when peace was declared; the majority of them are now preserved in the National Archives of the United States and in the Library of Congress" (Newhall, 1982, p.89). Brady's photography "contributed to the changed

understanding of American heroes and history" (Panzer, 1997, p. 110). The technical innovations of photography's forefathers helped shaped what would come to be known as the history of the Civil and Crimean Wars. It would be through further innovations that photography would become an accessible and manageable documentary tool whose role would be inseparable from historical events.

In 1888, George Eastman, founding member of the Eastman Kodak Company, released the No. 1 Kodak camera (Peres, 2007, p. 310). Peres (2007) explains that "the Kodak camera was a light, portable instrument that could be easily carried and hand-held during operation" (p. 310). In addition to its size and weight, the camera was inexpensive and pre-loaded with enough roll-film to take 100 pictures. Once all of the film had been exposed, the user simply sent the entire camera back to Kodak's headquarters in Rochester, NY, and for a small fee, the pictures were printed, the camera was reloaded with another roll of film and everything was sent back to the user (Peres, 2007). Eastman's Kodak camera allowed photographers to more easily capture moments without all of the cumbersome gear.

At the same time, the innovation of the focal plane shutter allowed for a 1/1000 of a second exposure to be taken (Peres, 2007). This was particularly relevant to photojournalists who used this extremely fast shutter speed to stop and capture the action in the frame. These advances not only revolutionized photography by making it accessible both in price and function, but it also helped usher in a new era of the documentary photograph. The invention of the first one-shot color camera was in 1892. Then, in 1915 the color film Kodachrome was invented (Peres, 2007) and is still commercially available today in different formulations. The introduction of Polaroid, or

instant film, in 1972 as well as rapidly advancing telephoto lenses and cameras culminated in ultra-portable, fast and inexpensive photographic gear.

It was in the 1990's that consumers were first introduced to digital cameras, and by 2007, digital capture had eclipsed analog imagery in almost all areas of photography (Frey, 2007). The influence of the digital camera on analog photography was felt strongly in 2004 when Kodak announced that it would cease sales of its "reloadable 35mm film cameras in the United States, Canada and Western Europe" (Peres, 2007, p.13).

The years between the introduction of roll film and the digital camera were marked with many milestones but none as ground-breaking as the digitization of photographic images. The computer manipulation of images would not be possible without images first being digitized. *The Focal Encyclopedia of Photography* (2007) describes a digital image as, "an image that is represented by discrete numerical values organized in a two-dimensional array" (p. 429). This process allowed for a dramatic increase in the flexibility, adjustability, and storage of images.

The digitization of the image first began with scanning existing negatives and prints into a computer using a digital scanning device. A scanner is "a peripheral device that allows for the conversion of flat art, photographic prints, and transparencies into digital data that can be accessed by photographic imaging software" (Peres, 2007, p. 434). Scanning traditional photographic media was no longer necessary upon the introduction of the digital camera which captures images on a light sensitive digital sensor instead of a sheet of film.

Beginning with Roger Fenton, that single photographer covering the events of the Crimean War in 1855, the camera, in all of its many models and functionalities has been the constant recorder of history. Photography has been the faithful observer of events happening in far off places, the witness to atrocities, and the storyteller of victories and defeats, both past and present. Gefter (2006) suggests that "a photograph comes as close as we get to witnessing an authentic moment with our own eyes while not actually being there" (p. 50). It is this unique relationship with the world and the tradition of photography as "faithful witness" that has propelled photography to the forefront of documentary journalism. Does photography deserve this lofty title of "truth-teller?" (Gefter, 2006, p. 50). Or is there simply "a myth of photographic truth?" (Gavard, 1999, p. 2).

Methods of Photographic Image Manipulation: A Brief Overview

Often in literature regarding image manipulation, the photographer's role before and during the action of recording a picture is stripped from the creation equation. Image manipulation literature often ignores the subjectivity of the original creator of this intellectual property thereby removing the art from the process. In fact, it is the argument of Barthes (1977) that viewers "never encounter a literal image in a pure state" (p. 42).

> Any discussion of 'manipulated' photography must begin with the recognition that photography itself is an inherent manipulation-a manipulation of light, a process with many steps and stages, all subject to the biases and interpretations of the photographer, printer, editor, or viewer. (Wheeler, 2002, p. 3)

Despite this argument, Schwartz (2003) claims that the prevalently held view of photography by the public is that "because machines make photographs, logic suggested, photography is free of the bias resulting from human intervention" (p. 28). Humans creating the images, however, do intervene. In fact, Schwartz (2003) goes on to say that, "the photographer's 'hand' has never been absent from the image-making process" (p. 30). Although this view of human subjectivity is certainly an important one, post-production manipulation – changes made to an image after it has been taken – has been the subject of controversy and ethical debate almost since the beginning of photography itself.

The image-making process has evolved dramatically over time from the earliest days of daguerreotypes to the current digital workflow of the craft. One thing that has remained consistent throughout the advancement of photography has been the desire to change or manipulate the images created. Edwin Martin (1991) argues that "to manipulate a photograph, consequently, is often thought to be altering it, tampering with it, changing it from its natural, truthful state" (p. 157).

The practice of manipulating still images began almost as soon as the act of recording those images was invented. However, it was the introduction of the image processing software, Adobe® Photoshop 1.0 in 1990 that would mark a new era in photography and image manipulation. Peres and Barnett (2007) describe some of Photoshop's abilities as:

> Color, density, and contrast can be altered or adjusted, and special effects such as image inversion can be executed in milliseconds. Sophisticated editing tools allow for cutting and pasting segments of images together and can be done so precisely it can't be detected. (p. 299)

Although there are numerous techniques for changing the elements of an image, literature reveals that they can be classified into three distinct categories of manipulation of analog (film) or digital images: 1) the addition, subtraction, or change of position or scale of content within an image, 2) an intentional change in the density or exposure of part or all of an image, and 3) an intentional change in color in part or all of an image (Brugioni, 1999; Reaves, 1987; Vernon, 1997; Wheeler, 2002). For the purposes of this study, content is identified according to Wheeler's (2002) definition as "subject matter, not merely the foremost object or person in a photo but details as well...large or small, important or relatively unimportant, if it existed at the scene and was captured on film [or digital sensor], it is content" (p. 93).

Although the two images that will be used in this study to examine *Photoshop's* functionality as a data measurement tool were captured and manipulated digitally, many of the methods of manipulation are the same in the analog darkroom as in the digital environment. One of Photoshop's strengths is that it builds upon the techniques of the traditional darkroom, even keeping the same terminology to describe many of the tools and functions. Evans (2007) notes that, "there are many important links between traditional photography and digital imaging. Grain size, contrast, burning and dodging, cropping, and masking all have equivalents in both worlds" (p. 444).

The tools that can be used to achieve the following functions in both the darkroom and the computer are innumerable. Although the principles of manipulation remain the same, the tools used to achieve it may extend beyond what is outlined in the following pages. The following sections are not intended to be a comprehensive listing of each of the available tools, simply an explanation of function.

Image Content and Manipulation

Brugioni (1999) explains that the earliest uses of the camera were imitation, and that "photographers tried to use the camera in the same way that the artist used a brush" (p. 26). As photography began to take over the task of recording history from painting, some of the first image manipulations were aimed at re-creating biblical or literary scenes by combining several images together in the darkroom (Brugioni, 1999). Other changes to images were, like paintings, intended to capture the vision and perspective of the photographer over the limitations of the camera's technology.

The techniques that can be used to change images in both the darkroom and the computer are innumerable. Although the principles of manipulation remain the same, the techniques used to achieve manipulation have changed throughout photography's history. In order to identify the main types of image manipulation for this study, some general techniques are outlined below. The following list is not intended to be a comprehensive discussion of all possible manipulation techniques, rather this list is an illustration of some primary areas used in image post-production.

Staging Photographs

As previously discussed, the technical limitations of cameras available to Mathew Brady and his team of photographers often forced them to photograph the scene once all of the battlefield action had subsided. It was found that Timothy H. O'Sullivan and Alexander Gardner who worked as photographers for Brady, re-arranged bodies on the battlefield for dramatic effect (Brugioni, 1999). This type of staged photography is often included when discussing manipulated imagery (Brugioni, 1999; Newhall, 1982; Wheeler 2002).

Examples of staged imagery, which was often done as a result of the technical limitations of the camera, can be found as early as 1857 with Oscar Rejlander's *Street Urchins Tossing Chestnuts*. In Rejlander's photograph, an airborne chestnut is in fact hung by an unseen thread in order to overcome slow camera shutters. The image was created to surprise and shock an audience that had yet to see "stopped" action. Until this time, most photographs were posed portraits recorded successfully on film. A contemporary audience would not find the technical act of stopping action to be image manipulation, simply an available function of modern cameras. Yet, because it was accomplished deceptively with fishing line in Rejlander's photograph, it was understandably, deemed a manipulated image. The merits of this image being termed "manipulated" rest on creating a visual scenario that was implausible at the time of creation because of the camera's technical limitations.

Blending Images

According to Martin (1991), the process of blending multiple negatives in the darkroom to create a single final print began in the 1850's by Oscar Rejlander. Often referred to as a composite or photo montage, it is defined by Brugioni (1999) as "the merging of two of more negatives to create a new image" (p. 27). The allegorical *The Two Ways of Life (*see Figure 1), was created by Rejlander in the darkroom by combining some 30 separate negatives into one composite print (Peres, 2007). It is regarded as the first artistic photomontage created (Brugioni, 1999).

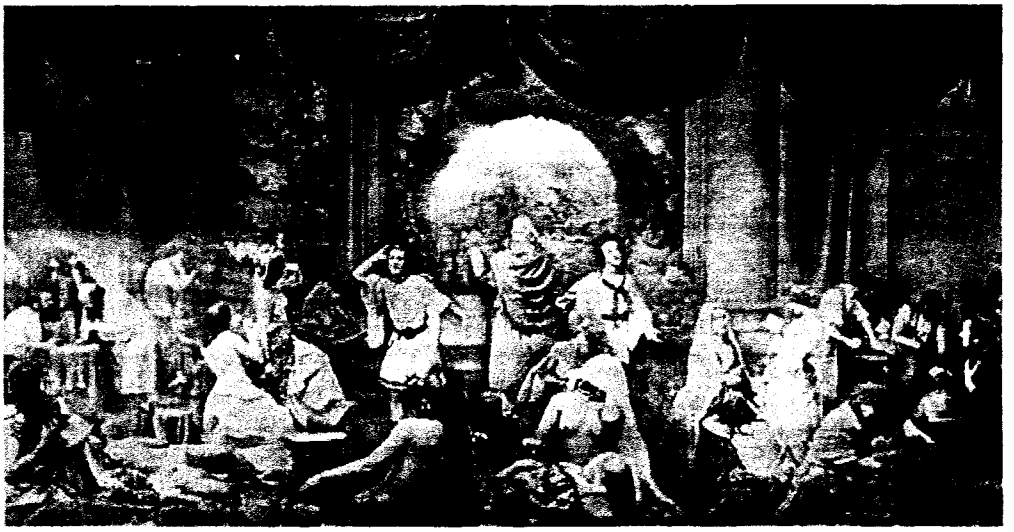

Figure 1. Oscar Rejlander, *The Two Ways of Life,* 1857.

In 1994, Adobe® released Photoshop version 3.0 with a significant and familiar capability of blending photographs. The layering function in Photoshop works in exactly the same way that darkroom technicians like Rejlander combined negatives in the darkroom to create image composites. By using a computer, however, this method of manipulation now took only seconds. Photo layering has remained an important function in the Photoshop program since its first introduction.

Another way of layering information into a single image can occur at the time that the photograph is taken. In 1862, when a photograph of two British balloonists making a record-breaking ascension to 37,000 feet was technically impossible to take, the image was faked. Photographers Henry Negretti and Joseph Warren Zambra created the news image by "using an aerial backdrop, superimposed the images of the balloonists in their basket and painted in the superstructure of the balloon" (Brugioni, 1999, p.30).

Photographers later discovered how to make multiple exposures on a single piece of film while it was still in the camera (Martin, 1991). These "double exposures," may have

begun to blur the idea that a negative was a natural-state image that recorded a singular event. Whereas individuals may have understood that a print could in fact embody more than one negative, a double exposure on a single sheet of film possibly helped change the concept of an original-state negative because the manipulation is manifested on the actual negative as it is produced in the camera. Using these techniques, elements from any picture, with varying degrees of believability, may be combined with elements of any other picture to create a completely new image that never existed, or occurred.

Brugioni (1999) explains that a double exposure "results from making either an intentional or accidental second camera exposure, which produces a negative with two images" (p. 157). (see Figure 2)

Figure 2. Greg Hoffman, *Las Vegas Lights,* 1996.

Hicks (1973) notes that *Life* magazine's policy once allowed for multiple exposures on a single sheet of film, but not multiple negatives used on single print. Martin (1991) explains this differentiation as:

> Two subjects in different locations could appear together in the magazine if a single piece of undeveloped film was used to record them both in separate locations or at separate times. But separate pieces of film could not be used to make a combination print. (p.161)

Photographers capitalized on this technique when producing "spirit photographs" for individuals who had lost loved ones. The photographer, sometimes working with a spiritualist, would make double exposures of the sitter alongside a picture of their deceased loved ones (Brugioni, 1999).

Adding or Removing Content.

The removal of image elements also established itself as a powerful method of image manipulation from the earliest days of photography. Schwartz (2003) cites a 1939 text titled *Pictorial Journalism* when describing early methods of retouching, "retouching is done on the glossy print with water-soluble black or white paint or with mixtures of the two to give the various gray shades. The paint is applied with an ordinary camel's-hair paintbrush or with an airbrush," (Vitray, Mills & Ellard, 1939). The digital equivalent of re-touching is often but not exclusively associated with Photoshop's clone stamp tool which is "the function by which an exact duplicate of an image or part of an image is made" (Peres, 2007, p. 428).

Although initially used to remove blemishes and wrinkles in portraiture, re-touching methods were quickly applied to include the complete removal of individuals and objects from images, particularly images of political figures and events. Most notable of early retouched images were those produced in Stalinist Russia. During Stalin's reign (1929-1953), state censored and falsified photography was used to glorify the regime (King,

1997). During the Great Purges of the 1930's, Stalin's secret police eradicated his political opponents while teams of photographic re-touchers similarly removed their presence from all pictorial representation (King). (see Figure 3)

Figure 3. Joseph Stalin and Nikolai Yezhov. Yezhov was killed in 1940 and later edited out of state images.

Reconfiguring Content

The reconfiguration of image elements has also proven to be a widely used method of manipulation. Thomas Wheeler (2002) exposed two versions of a photograph taken of George Bush and Margaret Thatcher as they casually walked through a garden several feet apart from one another as they spoke. The manipulated version of the image shows the two political leaders standing much closer, almost appearing to be whispering to one another. The text asks, "what does the altered version suggest about the conversation-and perhaps the relationship-between the former heads of state?" (p. 36).

The February 1982 cover of *National Geographic* showed a dusk image of the Great Pyramids of Giza taken by photographer Gordon Gahen (see Figure 4). The publication later admitted that the pyramids had been placed closer together using compositing

methods so that they could fit within the famous yellow-framed cover art of the magazine.

This manipulation essentially appeared to change the subject's position at the time that the photograph was taken. It may have been argued that the same photo was possible had the photographer simply moved his physical position to the left or right a few steps. Thereby opening up the argument that if the photographer had just known what was really important then he could have taken a better or more useable picture.

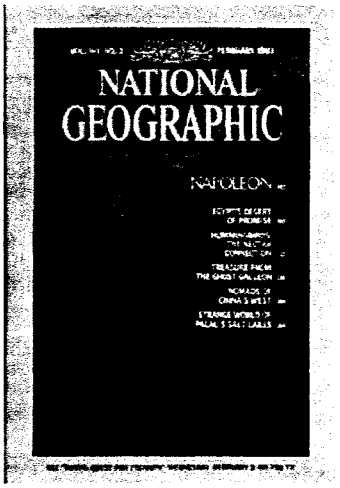

Figure 4. National Geographic, Volume 161, Number 2.

Cropping

Although historically seen as a benign image modifier, cropping is a powerful manipulation technique. Cope (2001) defines cropping as the ability "to trim or mask an image so that is fits a given area, or to discard unwanted portions of an image" (p.229). Cropping is an image manipulation that can occur both within the camera and later in the darkroom. The mere exclusion of elements of an image changes not only the image itself

but potentially the message that it sends. Cropping has the power to mislead the viewer through hiding additional image context (Wheeler, 2002).

Changes to Image Density and Exposure

Richard Zakia (2007) explains that the exposure range of an entire photograph can be adjusted using changes in development times. However, localized changes in the density of specific areas can be modified using a photographic dark room technique called, dodging and burning. "Dodging (selective shading) and burning (increasing density with extra exposure) are employed to improve a photo's contrast, to enhance clarity, and so on" (Wheeler, 2002, p. 96). Lambrecht (2007) explains that "subjective print quality is predominantly influenced by print exposure and contrast, which is rarely limited to overall adjustments, but often requires local optimization including laborious dodging and burning techniques" (p. 674). Peter Cope (2001) defines burn as "giving additional exposure to regions of an enlarged print to make those regions darker on the finished print" (p. 200). Dodging is the direct counterpart to the function and term: burn. Cope (2001) describes it as "a method of obtaining lighter areas in a photographic print by the selective use of masking (hiding relevant areas from light)" (p.202).

Although often used to correct areas of poor or inconsistent exposure, dodging and burning is also used to increase the aesthetic appeal of images. An example of this technique occurred in the 1997 *Newsweek* magazine cover. In *Newsweek*, Kenny and Bobbi McCaughey were photographed for a story on the birth of their septuplets. Dodging techniques were used to lighten the teeth of Bobbi McCaughey prior to the publication of the magazine.

The ramifications of dodging and burning may be much more serious if used to re-enforce cultural stereotypes or situational perceptions, as was the case with O.J. Simpson's police mug shot in June of 1994. Both *Time* and *Newsweek* decided to run the photograph of Simpson on their respective covers but only *Newsweek* did so without manipulation. *Time* magazine used burning techniques to substantially darken Simpson's face making him appear darker and more sinister (Vernon, 1997). (see Figure 5)

Figure 5. O.J. Simpson's Mugshot. Burning and dodging by *Time* magazine.

Changes to Color

The reasonable modification of color in an image with the purpose of more faithfully reproducing the original scene photographed is referred to as color correction (Wheeler, 2002). There are numerous technical reasons that images may be recorded with variation from how the photographer originally saw the scenario including: "temperatures and chemistry of the development process, exposure times, [and] the type of paper" (Wheeler, 2002, p.97). Wheeler (2002) goes on to explain that going beyond minor adjustments of color in an image for these purposes is not acceptable in journalistic images.

His disdain for color manipulation is supported by Dondis (1973) who suggests that color contains powerful associative meaning. Photographic color correction is a procedure that is "very much dependent on human interaction and judgment" (Peres, 2007, p. 398). Therefore, when an individual takes the methods of color correction and applies them in a way that changes the very nature of the scene, it may fall within Wheeler's definition of unacceptability in journalistic images as stated above.

An example of color manipulation occurred when 36 Swiss tourists were killed by six gunmen at the Temple of Queen Hatshepsut in Luxor Egypt. The tabloid *Blick* ran a manipulated image to accompany the story (see Figure 6). The tabloid changed the color of the water that was flowing from the steps of the temple to red possibly to infer blood.

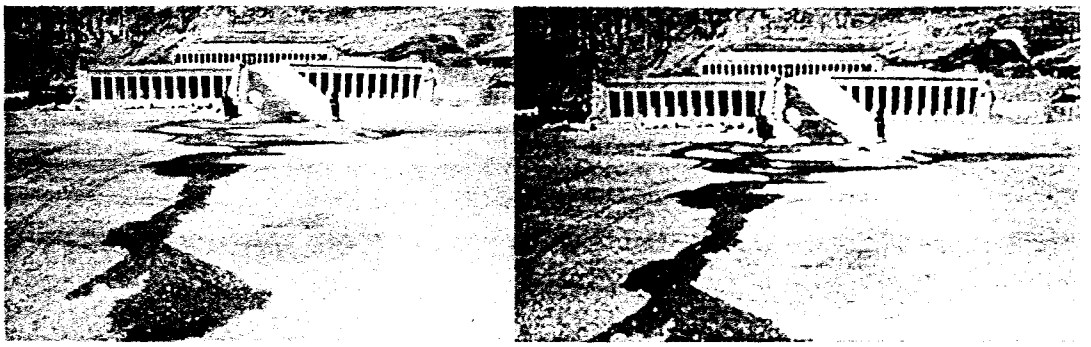

Figure 6. Temple of Queen Hatshepsut in Luxor Egypt. Shown on the left is the original image and on the right, the image as manipulated by Swiss tabloid *Blick*

In another example of color manipulation and its unacceptability, photographer Patrick Schneider lost his job at the *Charlotte Observer* after he manipulated the colors in an image of a firefighter that the newspaper published in 2006. The image was described in a letter from Editor Rick Thames that was posted on the newspapers website www.charlotte.com on Friday, July 28, 2006. The letter stated that the photograph

originally had a "brownish-gray" sky that was manipulated to become a "deep red." He goes on to explain that the *Observer's* photo policy states that; "No colors will be altered from the original scene photographed" ("Observer Photographer", 2003).

Although these explained types of manipulations are possible in the analog darkroom and using other techniques, it was with the introduction of digital photography and computer-aided image manipulation that these methods have become faster, easier and seemingly undetectable. Vernon (1997) cites Potter (1995) when she argues that the qualitative differences between traditional photographic manipulation techniques and their digital counterpart are three-fold: 1) the extent of manipulation possible, 2) the ease and speed with which images can be altered, and 3) the virtually imperceptible nature of the alterations by digital scanning (p. 14). These three things underscore that although image manipulation has been a common act from the earliest days of photography, the advances of digital imaging and technology has made the critical review of image manipulation more important than ever.

The consequences of image manipulation with a lack of regard for ethical considerations are significant. A thorough understanding of the diverse sampling of tools that comprise the visual language of image manipulation helps to contextualize these implications. As is the case with most things, a positive tool and advancement in any industry can always be used in a negative way. Only through education and understanding is it possible to make those determinations.

CHAPTER 3

IMPORTANCE AND ROLE OF THE PHOTOGRAPHIC IMAGE

"Truth-telling is the promise of a photograph—as if fact itself resides in the optical precision with which the medium reflects our native perception"

-Philip Gefter, 2006

Background

Photography's role in society from its inception to the present day has grown to encompass nearly every facet of life. Vernon (1997) explains that photography's uses, functions, and applications are relevant to many areas including history, art, and law. Ritchin (1990) agrees that photography is omnipresent in its ability to inform every facet of human existence. Unlike text, photographs are of a singular language with an unlimited potential audience (Sontag, 2003).

The rising prevalence of image manipulation carries with it new ethical dilemmas for these varied and encompassing applications of photography. Indeed, Marchessault and Wasson (1998) explain that the questions raised today as a result of the different possible forms of images are far more complex than forty years ago. The researchers discuss the connection between images and reality and state, "the central question is no longer whether or not photographic images mediate reality...but how they mediate reality" (Marchessault & Wasson, 1998, p. 17). This chapter outlines the social role of images, focusing specifically on news images and how they are linked to social perceptions of

reality. It then discusses theories of visual literacy and reading images. This chapter then concludes by identifying a theory of image interpretation elaborated by Gillian Rose (2007) and suggests that her approach offers an effective system by which image content can be classified and analyzed to determine the type and extent of manipulation present in an image.

The Social Role of News Images

Perceptions of the world are produced, maintained and transformed by journalism and photography which are explicitly linked to objectivity (Tirohl, 2000). It is this link - photography's unique relationship with perceptions of reality, objectivity, and its evidentiary status - that makes the documentary news image the concern of this paper. Sontag (2003) asserts that photographs have contradictory features: the inherent presumption of objectivity versus the very real point of view of the photographer creating an image. The image is recorded by a machine that is held and directed by a person.

Despite these incongruencies, Jussim (1989) suggests that "photography...is the only visual medium we know that provides us with a record of something that was actually there, in front of the camera" (p. 49). Sontag (1977) further explains that "photographs really are experience captured...photographs furnish evidence" (p. 5). Sontag contends that, "a photograph passes for incontrovertible proof that a given thing has happened. The picture may distort; but there is always a presumption that something exists, or did exist, which is like what's in the picture" (p. 5). Thus, Sontag suggests that although images may be distorted or manipulated, the actual object, person or event that was photographed is still judged by the picture. Photographs are connected to our

understanding of what is *real* or *true*. Sontag explains that "photographic images now provide most of the knowledge people have about the look of the past and the reach of the present" (p.12). Photographic representations of the world serve as the memory, history and potentially the moral compass of individuals and society.

As a type of news image, documentary images are described by Newhall (1982) as having an implicit authenticity that gives them a particular value as evidence or proof. In his estimation, documentary images are just that, documents of the world. Rothstein (1986) explains that the term documentary "describes a style and an approach...that convey[s] the deep respect for the truth and the desire to create active interpretations of the world in which we live" (p. *xix*). Rothstein's (1986) outline of the six qualities that create the documentary approach to photography include among others; "the revelation of truth through the proof and evidence of the camera" and "the production of honest photographs that are useful, functional, and serve the purpose of education and information" (p. 18).

Integral to documentary photography's socially functional role is the publication and distribution of imagery. Photojournalists are described by Rothstein (1979) as "observers of people and events who report what is happening in photographs; interpreters of facts and occurrences who write with a camera; skilled communicators whose images are transmitted visually via the printed page" (p. 15). Therefore, photojournalists capture moments. These images often affect the way viewers of the images interpret or understand the world.

It was the invention of the halftone plate in the 1880's that made the printing of images and words together on the same page possible. This halftone plate enabled the

mass production of images and text in newspapers and magazines by a rotary press at a rate of thousands of impressions an hour helping to usher in the term *photojournalist* (Newhall, 1982). This change of mass production in the use and context of images brought with it a whole new understanding of the role of images in modern society.

Photography as a function of social reform grew to be a powerful tool used by some of the most notable photographers of the twentieth century. Leading the way in creating images that had a social impact was Danish-born newspaper reporter Jacob Riis. Riis's images of poverty-stricken immigrants in New York's slums during the 1880's helped coerce city officials to clean up overcrowded tenements and build a park on what once stood one of the worst slums in all of New York City.

Yochelson (2001) noted that Riis was frustrated that his written words had little effect. It wasn't long after making this observation that Riis saw an advertisement introducing magnesium flash powder enabling the illumination of dark environments for photographs. He began to record images in the alleys, schools, and hovels where immigrants lived and worked. His photographs culminated in several influential books and lectures that remain a relevant narrative on the earliest days of immigration in the United States.

In addition, Lewis W. Hine once said "If I could tell the story in words, I wouldn't need to lug a camera," and created images that helped influence Congress to reform child labor laws. Dorthea Lange's images taken for the Farm Security Administration were used to persuade legislators to aid poverty-stricken Americans after the Depression (Stepan, 2006, Foreword). Numerous photographs taken during the Vietnam War including Ron Haberle's coverage of the massacre by U.S. soldiers in the village of My

Lai helped to galvanize an anti-war movement that directly affected the role of the United States in that conflict (Sontag, 2003). With Vietnam, journalists became specialized tourists, bringing the atrocities of war into living rooms across the world (Sontag).

Photography's role as a social commentator through presentation and dissemination of documentary news images has been pivotal in numerous aspects. Recent research has shown that images attract individuals to the news (Mendelson & Thorson, 2003; Zillman, Knobloch & Yu, 2001) and that they spend more time viewing news stories that illustrate human suffering (Zillman et al., 2001). This phenomenon becomes even more salient when considering McComb's and Shaw's (1972) breakthrough research on the agenda-setting function of mass media which concludes that media can shape what the public thinks at that time.

Memorable photographic images have become a constituent part of society's collective memory and belief systems (Sontag, 2003; Gavard, 1999). Unlike individual memories, which die with each person, society's collective memory is one that does not just reminisce, it invokes or stipulates, argues Sontag (2003). Sontag (2003) goes on to say that these collective memories, created largely with the help of photographs, create ideologies complete with common ideas of significance and predictable thoughts and feelings that whole societies may substantiate with a shared archive of visual images.

This important and influential role photography has played of creating ideologies and affecting cultures since its inception has been threatened by image manipulation (Becker, 1991; Gavard, 1999). Although photography has enjoyed a truth-telling status unlike any other artistic medium before it, the craft has always had a subjective nature to its function (Martin, 1991). As we have seen, image manipulation has played a critical role in

photographic history, yet it is through the digitization of the image that its malleability has been most apparent and troublesome (Gavard, 1999; Ritchin, 1990). Tirohl (2000) says that "news journalism produces, maintains and transforms our perceptions of the world" (p.338) and the reputation of the press image remains dependent upon the audience's perception of the photographic still as a witness (Tirohl, 2000). Therefore, studying the role of manipulation within the important context of documentary news images and their representation of society ought to be a social and intellectual imperative.

Ethical Guidelines and the Evolving Newsroom

As newsrooms have become nearly entirely digital environments, the debate regarding what constitutes image manipulation as well as what is journalistically acceptable has grown to a near fever-pitch. The Society of Professional Journalist's (SPJ) code of ethics states that journalists should "never distort the contents of news photos or video. Image enhancement for technical clarity is always permissible" (www.spj.org). The National Press Photographers Association's (NPPA) code of ethics states that "editing should maintain the integrity of the photographic images' content and context. Do not manipulate images...in any way that can mislead viewers or misrepresent subjects" (www.nppa.org). NPPA also states that photojournalists should "respect the integrity of the photographic moment" (www.nppa.org).

These somewhat ambiguous ethical guidelines with regards to image manipulation have led many photographers and researchers to carry the standards of manipulations acceptability from the analog to the digital. In other words, what was once acceptable to change about a photograph in the darkroom became acceptable to change on the

computer (Becker, 1991; Martin, 1991; Ritchin, 1990; Tirohl, 2000). These manipulation tools include: cropping, burning and dodging, converting color images to black and white and increasing contrast to name a few.

However, there is no longer a darkroom. The composition of the newsroom has changed dramatically since the introduction of digital imaging. Tirohl's (2000) research indicates that from 1994 to 1999, the percentage of images being produced on fully digital equipment rose 100 percent. Lowrey (2003) credits these changes in the newsroom as contributing to the likelihood that images may be manipulated, because, as Becker (1991) puts it, "technological innovation affects the structure of decision making" (p.395). The elimination of the darkroom removed the photographer's influence over image editing and selection, giving more control to the newsroom staff (Becker, 1991). A component of Lowrey's (2003) research focused on identifying newsroom norms based partly on the occupational subgroups within various newsroom staffs. He found that "members of different occupational subgroups share differing sets of norms, practices and values that give meaning to their work. Various sets of norms conflict and coalesce as subgroups seek recognition and influence in the newsroom" (Lowrey, 2003).

In addition to the ethical guidelines set forth by SPJ and NPPA, individual newspapers maintain codes of ethics for their staff journalists. As the journalistic landscape continues to change at the hands of technology, these codes come under continual scrutiny. Becker (1991) suggests that:

> No other journalists face the same degree of change in the tools they use for gathering, processing, selecting, editing and distributing news...this has meant that photojournalists are repeatedly challenged to adjust their work strategies to

technological change, while remaining true to existing standards of ethical practice. (p. 383)

One such case illustrates how revisiting ethical guidelines is a necessary component of contemporary journalism. Prior to *Charlotte Observer* photographer Patrick Schneider being fired in 2006 for his color manipulation of an image of a firefighter, he was reprimanded for similar changes made to news images. Schneider received a three-day suspension in August of 2003 for using burning and dodging techniques, increasing color saturation and cropping three images that were published in the *Observer.* The images also won Pictures of the Year (POY) in the North Carolina Press Photographers Association (NCPPA) awards which were later rescinded (www.pdn.com).

At the time of the initial suspension Schneider argued that "unfortunately, the rules for how much a background can be darkened in order to improve a picture's visual impact have never been clear. I now know what the rules are for the *Observer* and the N.C. Press Photographers Association" ("Observer Photographer," p.5B). Schneider argues that "in two of the pictures, I used a darkening technique that photographers throughout the profession have used for decades, and continue to use at many reputable newspapers today" ("Observer Photographer," p.5B). Jennie Buckner, editor of the *Observer* agreed that she did not think that it was the explicit intention of Schneider to deceive the audience. Even though the techniques that Schneider used on the computer would have been available to him in the darkroom, Buckner still argues that "this was all so new that we had to establish standards and defend our paper's credibility" (Irby, 2003c).

Indeed, the *Observer's* ethical guidelines were updated in the aftermath of Schneider's images. Irby (2003a) outlines what seems to be "photo correction/editing guidelines" written specifically in response to Schneider's manipulations. Guidelines included that "no colors will be altered from the original scene photographed. This includes excessive changes in density and saturation levels" (¶ 2) and "backgrounds cannot be eliminated ("burned down") or aggressively toned under any circumstance" (¶ 3).

This case clearly demonstrates that despite the acceptability of similar methods of manipulation available to both analog and digital photographers, ethical guidelines are still a continually evolving aspect of photography. Additional information will be provided in the following chapter regarding ethics specific to the images used in this study. It is argued by this paper that changes in image production resulting from technological advances have encouraged researchers to reconsider how images may be looked at and interpreted by visual consumers. What was once dismissed as an innocuous image modification may now be regarded as an emotion-eliciting manipulation.

Justifications

A variety of justifications are used by editors and newsroom staffs when their publications are exposed as having used manipulated images. Often the argument that the scene or event could have happened is used. Examples of this being used as a justification include the *National Geographic* cover image and Brian Walski's composited image of a soldier in Iraq taken for the *Los Angeles Times*. The pyramids on the cover of *National Geographic* could have appeared closer had the photographer stood

a few steps to the right and the Iraqi man in the photo published in the *Los Angeles Times could* have been looking in the direction of the British soldier at the time that the shutter was snapped; therefore, goes the justification, it isn't manipulation if the image is changed to represent real possibilities.

Another justification often used and especially applicable to this study's selected cases is the notion that manipulation was necessary in order to protect the emotions of its readers. This justification, discussed further in later chapters, makes the argument that news images can often be too shocking and therefore should not be shown. Television producers and print editors make daily decisions regarding what the public's knowledge should be about events happening in the world as depicted by media (Sontag, 2003). These decisions are repressive when cast by institutions as judgments regarding taste (Sontag, 2003). However, sometimes, the best or most representative image from an event contains elements that may offend some viewer's sensibilities, such as the removal of gruesome body parts or blood. Further, as Sontag (2003) argues, "photographs of an atrocity may give rise to opposing responses. A call for peace. A cry for revenge" (p.13). Therefore, differing responses from news outlets may also be the result of a desire to encourage outrage and action; it may be a pre-emptive strike of justification measures for the response by the victim.

Whereas these sensitive images may have been previously rejected altogether, editors are now finding a myriad of ways to deal with potentially offensive image elements using Photoshop. Journalists have long considered notifying readers about manipulations made to images through labeling them as a part of the photo credit. Beginning as early as the 1920's, the tabloid *New York Graphic* labeled their famously composited images

Composographs (Stepno, 1997). Some more current examples of proposed labels for manipulated images include: photo-illustration, photo-montage, computer-generated image and digital enhancement, to name a few (Tirohl, 2000; Ritchin, 1990; Wheeler, 2002). Despite this ongoing dialogue there has not been a consensus reached within either the photographic nor journalism communities for the labeling of photographs. Moreover, regardless of any designations of image manipulation, viewers have expectations about pictures.

Gefter (2006) argues that "the viewer's expectation about a picture's veracity is largely determined by the context in which the image appears. A picture published in a newspaper is believed to be fact; an advertising image is understood to be fiction" (p. 50). In fact, Messaris (1994) claims that in order for a viewer to make a judgment of intentionality all there may need to be is a disclosure of the label such as "photojournalism" or "advertisement" (p.138). Martin (1991) uses a book entitled A Day in the Life of America as an illustration of the dual roles that photography can play within presentational context. This book used a manipulated image on its cover, yet did not allow any of the images within to be manipulated. The editors justified this decision by explaining that the cover serves the purpose of being an advertisement and that readers could understand the difference between this image, intended to draw in potential readers and the contents of the text which served a more documentary purpose.

This difference in the presentational context was tied to the viewers' perceptions of artistic versus informative. The cover is viewed as a working advertisement and therefore there is an artistic allowance, whereas the contents are intended to be informational and

therefore must not be deceptive in any way. Martin (1991) notes that, "art, the reasoning is, may be manipulated, information may not" (p.160).

Visual Literacy

If images have the socially important roles described above, including mediating how the world is represented and ultimately understood, it is important to know how viewers understand images. Although the education currently dedicated to written text is not extended to pictorial representation (Tirohl, 2000), the importance of visual literacy has not escaped researchers.

Paul Messaris (1994) discusses four distinct aspects of visual literacy and their implicit role in the comprehension of visual media in his text, *Visual Literacy: Image, Mind and Reality*. Messaris (1994) describes visual literacy as the "greater experience in the workings of visual media coupled with a heightened conscious awareness of those workings" (p.2). Within his discussion he also addresses the need to teach visual literacy as a means not only to interpret the message of the image, but also to help provide a basis for understanding whether or not the message has been manipulated. The four aspects of visual literacy Messaris (1994) discusses are: "visual literacy as a pre-requisite for the comprehension of visual media, general cognitive consequences of visual literacy, awareness of visual manipulation, and aesthetic appreciation" (p. 3).

The first aspect of visual literacy is its use as a pre-requisite for the comprehension of visual media. Messaris makes a notable distinction between mediated images and the *real world*, going on to say that past research has shown that individuals must have prior experience with visual media in order to successfully interpret visual media. Only

through a familiarity of visual conventions acquired through cumulative exposure can a visual consumer truly evaluate mediated images. Dondis (1973) says that the abilities to see and visualize are accepted as natural functions and that, "seeing is a direct experience and the use of visual data to report information is the closest we can get to the true nature of reality" (p. 2).

Building upon this idea, Messaris (1994) claims that visual literacy can lead to increased cognitive advancements in other areas of intellectual tasks. He suggests that the "general cognitive consequences of visual literacy...may lead to a general enhancement of cognitive abilities" (Messaris, 1994, p. 3). Marchessault and Wasson (1998) argue that as visual images continue to be undetectably altered, they grow further removed from their contexts and referents and are ultimately more difficult to be interpreted. Baudrillard's (1988) related concept of simulacrum states that there is no great divide between real and fake. Much like Marchessault and Wasson's (1998) argument, Baudrillard claims that images have a detachment from the *real* world.

Once the ability to evaluate images based on prior experience and general levels of cognition have been raised through increased visual literacy, the viewer may be more aware of potential visual manipulations. Messaris (1994) states that because of the viewer's increased understanding of how images create and maintain meaning visually, he or she is then less likely to be fooled by abuses of the process. Tirohl (2000) adds that "a consciousness of the problems which might be encountered as a product of evolving technologies is necessary if viewers are to be expected to intelligently engage with the news they consume" (p. 338).

Messaris explains that "finally, awareness of the ways in which visual media give rise to meaning and elicit viewers' responses can also be seen as providing a basis for informed aesthetic appreciation" (p. 2). The concept of aesthetic appreciation and its interface with visual literacy becomes pivotal in the coming chapters as it relates to Gillian Rose's (2007) aesthetic dimensions of visual images providing a basis for the interpretation of the images selected for this study.

Messaris (1994) goes on to explain that unlike English literacy, visual literacy is not taught in schools despite our highly visual culture and dependence on the visual for how we understand our surroundings and who we are. Martin Jay (1993) describes the notion of cultural dependence on the visual from our own western views as *ocularcentrism*. The lack of formalized education and understanding of visual literacy, places many individuals in a position of being inadequately equipped to make educated hypotheses regarding image manipulation.

Reading Images

Kress and Van Leeuwen (1996) regard the act of being visually literate a matter of survival. Their research takes a social semiotic approach to interpreting images created in a western society through a classification system that includes three meta-functions termed: *ideational*, *interpersonal* and *textual*. Kress and Van Leeuwen (1996) suggest that the *ideational* meta-function is related to the ways that semiotic systems refer to objects in the outside world; *interpersonal* meta-function is concerned with relations between sender and receiver; and the *textual* meta-function refers to the composition of the image. The text aims to delineate a visual grammar, yet because of semiology's reliance on culturally-dependant signs, the generalizability of their language is only

narrowly applicable. For example, images specifically Western in context and in their creation would be understood differently among Western, as opposed to non-Western, viewers.

The strength of Kress and Van Leeuwen's (1996) approach is its use of the semiotic tools of signs and symbols in image analysis. This approach acknowledges the culturally embedded properties of images and their interpretation, while providing nominal "grammars" of meaning capable of being analyzed. Semiology, according to Lester (2006b) is "a collection of signs that are linked together in some way by the viewer" (¶. 16). Kress and van Leeuwen's (1996) research argues that all details, even those excluded, as well as the manner of execution of the visual can have ideological implications. This supposition encourages research that not only identifies these details or dimensions (Kress and van Leeuwen, 1996; Rose, 2007; Zettl, 2005), but as this research sets out to do, measure them.

Other studies have focused on creating a more explicit syntactic breakdown of visual elements. The concept of syntax is defined by Kress and van Leeuwen (1996) as "grammatical construction," has historically been most commonly applied to words and grammar. In fact, as Paul Lester (2006a) asserts, "linguistic theorists categorically assert that since pictures are presentational and not discursive, they have no formal grammar" (¶. 3). He further contends that based upon this reasoning, "without grammar, images cannot be considered a language. Without a language, pictures cannot be read" (Lester, 2006a, p. 6)

Of the problems associated with images not being considered a language, Lester notes two issues of importance: "images do not have common elements similar to a written

language's alphabet and images have no recognized syntax" (2006a, p. 4). He suggests that many researchers have attempted to create a kind of visual alphabet including French semiotician, Fernande Saint-Martin (1990) and Irving Biederman (1987). Although Saint-Martin's and Biederman's theories help to organize and clarify visual elements, there are still limitations in determining a finite set of these elements primarily because their proposed schemes can never fully describe the immeasurable elements contained within an image (Lester, 2006b).

The great divide in words and images at least analytically speaking is that of the objective versus the subjective. Whereas letters objectively represent sounds which make up words, aesthetic elements such as color and light elicit emotions based on a host of variables including experience, background and cultural upbringing.

Dimensions of Seeing Images

Gillian Rose (2007) takes a more holistic approach to the study of visual images with her methodology of compositional interpretation. This interpretative method is a nuanced notion stemming in part from researcher Irit Rogoff. Rogoff (1998) discusses the applicable term, "the good eye" (p. 17) as being a way of seeing and describing paintings. Rogoff (1998) claims that "the good eye" is not necessarily an explicit methodology, but merely a guideline from which to help gain an understanding of a visual event. Developing "the good eye" requires some contextual information in order to better comprehend an image. The contextual information surrounding the images selected for this study is outlined in the next chapter.

Rose (2007) explains that aesthetic elements of images affect their spectators in some way. It is important to note that her research doesn't necessarily aim to outline the ways

in which these elements affect viewers, it simply "offers a detailed vocabulary for expressing the appearance of an image" (Rose, 2007, p. 35). It looks at images for "what they are, rather than for...what they do or how they were or are used" (p. 36). Rose admits that this is a weakness in the method, one shared by the present study. She quotes Whitely (1999) to note that compositional interpretation should be "undertaken seriously and then...conjoined to other types of analysis so that the visual scrutiny of what can literally be seen can be studied in relation to reception, meaning and content"(Whitely, 1999 in Rose, p. 39).

Rose (2007) describes compositional interpretation as a schematic device that looks at the aesthetic components of an image. She notes that the idea of composition refers to all of the elements in combination because few of these components are entirely distinct from one another (Rose). She identifies five main dimensions of image content that affect the appearance of an image: content, color, spatial organization, light and expressive content (Rose). These five dimensions offer a clear framework within which the manipulation of images can be identified and measured. These five dimensions are intended as tools to explore "what images are", and therefore serve as an effective vocabulary for the present project. In addition, four of these five dimensions correspond with measurable aspects of images. The current study draws on these four dimensions, or components, to develop a taxonomy of image content.

Content

Rose (2007) explains that the initial approach to content may seem oversimplified. She asks "what does the image actually show?" (p. 40). Additional questions to be answered include: What are the contents of the image, what elements make up the

structure of the image? Of course, the opposite question should also be asked; what does the image *not* show, what is excluded?

Kuh (1951) explains that individuals often "think of space as an enclosed area marked off by boundaries" (p. 54). Photographic image boundaries are enclosed first by the frame of the camera and then later by frames imposed by the darkroom technician. These later frames are endlessly malleable, allowing for the apparent re-grouping of image elements.

Ritchin (1990) illustrates how image content can be greatly modified by using the traditional method of cropping by discussing an image of Senator Edward Kennedy. A photograph was taken of Senator Kennedy exiting a gala event in 1979 and published in the *Washington Star*. The uncropped photograph included four individuals; (from left to right) an unidentified man, a young, attractive woman, Senator Kennedy, and Monsignor Francis J. Lally of the Catholic Conference. The first edition of the newspaper cropped all but Senator Kennedy and the woman, implying that they left the event together which is particularly troublesome for Kennedy whose marriage fidelity had been under scrutiny for some time. The second edition of the newspaper showed only Kennedy in the photograph. Finally, the third edition of the newspaper presented Kennedy alongside Monsignor Lally who was Kennedy's guest at the event. The content of these three different permutations of the same image can be powerful modifiers of the audience's perception of the events at hand.

Fahmy (2007) performed a content analysis of 43 newspapers from 30 different countries to illustrate differences in the photographic framing of images taken of the toppling of Saddam Hussein's statue at Paradise Square in Baghdad, Iraq. Fahmy (2007),

citing research from Aday, Cluveiurus, and Livingston (2005) noted that most of the images shown in U.S. media were cropped tightly or photographed at close range, making it appear as if the toppling of the statue was cheered on by a large crowd of Iraqi civilians. A thorough review of the content of other images taken on that day revealed a mostly empty square, with only about 200 supporters. The research concluded that public opinion played a role in the selection of images to be used in various regions based on that countries support or opposition to the war in Iraq. Therefore, image content may not only have the power to reinforce political attitudes but it may also be steered by pre-existing public opinion.

In addition, in Zettl's (2005) discussion of fundamental media aesthetics, he refers to content as the idea. In his estimation, content is what begins everything. Zettl argues that a good idea, or the content, is not all that is necessary for it to be regarded as effective within the realm of mass communication. With all content there is a molding process that he calls encoding. Encoding is a formalist approach to applied media aesthetics that requires production knowledge which includes the remaining three dimensions in Rose's (2007) compositional interpretation: color, spatial organization, and light. These aesthetic functions modify the content.

Included here is the component of occlusion. Messaris (1994) describes occlusion as an image element that allows the viewers to gain a better understanding of depth understanding. He defines occlusion as "the blockage of the view of part of one object by another object" (Messaris, 1994, p. 12). For the purposes of this study, occlusion takes the form of text overlay that hides a significant element of an image. Therefore,

within the confines of this research, occlusion is utilized as a function of image manipulation.

Color

Zettl (2005) explains that color is a property of light and has three main attributes: hue, saturation and brightness. Dondis (1973) suggests that hue, saturation and brightness are the primary variations of color, which can be defined and measured. Rose's (2007) description of the dimensions states that; "hue represents the actual colors in a painting...saturation refers to the purity of a color in relation to its appearance in the color spectrum [and] value refers to the lightness or darkness [brightness] of a color" (p. 41). Rose (2007) further explains that color can be used to stress elements within an image. Citing Kress and van Leeuwen (1996), Rose (2007) notes that a combination of these elements, hue, saturation, and brightness, affects how realistic audiences will perceive the image to be.

Hue is the result of the interaction of three basic building blocks; yellow, red and blue (Dondis, 1973). Subtle changes in the percentages of these three colors affect the rendition of the color. Whereas a change in brightness or saturation renders variations of that same color, a change in the hue effectively changes the nature of the color itself.

Saturation, another variant of color is described by Dondis (1973) as "relative purity of color...uncomplicated and overstated...the more intense or saturated the coloration of a visual object or event, the more highly charged it is with expression and emotion" (p.51). Saturation is specifically the amount of white, gray, or black mixed into the hue, thereby rendering the hue less or more saturated (Zettl, 2005). A normal saturation of colors provides information about the event depicted in the image (Zettl). Desaturating

or removing the saturation of colors, Zettl argues, renders the scene "more low definition and so more accessible emotionally" (2005, p. 55). A total desaturation or conversion of the existing color image to black and white involves the elimination of color altogether, thereby further lowering the scene definition and allowing an even further emotionally accessible visual image (Zettl).

Brightness is achromatic. Dondis (1973) states that, "brightness...is relative from light to dark...tonal gradations" (p.51). Brightness affects the tonality of the image, which in turn offers viewers depth cues (Messaris, 1994). It should be noted that tonality is not dependant on the existence of color.

Color is one of the most important features in an image. "Color is, in fact, loaded with information and one of the most pervasive visual experiences we all have in common" (Dondis, 1973, p. 50). Color maintains powerful associative, symbolic, emotional, and informational meanings (Arnheim, 1974; Dondis, 1973; Gombrich, 2000; Messaris, 1994; Rose, 2007; Zettl, 2005). Zettl (2005) says that color helps viewers understand more about the event depicted than would be possible in the absence of color. Color informs, therefore the removal of color in part or all of an image, it may be argued, could be used as a means to hide or make less important a specific element or elements contained therein.

The impact of the color red, with all of its associative and symbolic meanings, is important to the viewer's relationship with the documentary news image. Dondis (1973) claims that red "means something...even where it does not have any environmental connection...[it] means danger [among numerous others]" (p. 50). In fact, just the inclusion of red blood within the pages of a newspaper versus a desaturated black and

white, albeit tonally correct, image of the same scene becomes so incredibly important to the telling of that story and the emotional implications so great that newspapers such as the *Washington Post* postponed the use of this tool for 122 years. The *Washington Post* may very well have denied using color images in order to maintain a kind of visual objectivity in the face of all of this powerful associative meaning.

Spatial Organization

Rose (2007) organizes the potentially broad definition of spatial organization into two aspects for consideration; "the organization of space 'within' an image and the way the spatial organization of an image offers a particular viewing position to its spectator" (p. 42). Kepes (1995) says that "spatial organization is the vital factor in an optical message" (p. 46).

The organization of space within an image includes the idea of proximity or the physical relationship of image elements to one another, which is argued by Kepes (1995) to be one of the simplest conditions of organization. Ritchin (1990) concludes that as a result of image manipulation's influence, "elements within a photograph can no longer be assumed to have occupied proximate space" (p. 17).

In addition to the importance of the physical relationship of image elements to one another is the perceived interaction that those elements may have. "One of the strongest forces operating within the screen are directional forces that lead our eyes from one point to another within, or even outside of, the picture field...called vectors" (Zettl, 2005). Zettl goes on to explain that index vectors help guide the viewers vision in specific directions. Photographers may achieve this by placing their subjects in positions that "create converging index vectors [that] point toward each other" (p. 123) thus clearly

directing the viewers gaze. In a related concept, Rose (2005) references Bal (1991) and Kress and van Leeuwen (1996) when discussing focalizers, which is the organization of looks and gazes in an image.

Rose (2007) agrees with Holly (1996) when she concludes that it is "the positioning of the viewer that is most important when thinking about how visual images have their own effects" (p. 46). Holly calls this positioning the logic of figuration, which includes point of view and scale. Included within the concept of "the spatial organization of an image [as it] offers a particular viewing position to its spectator" (Rose, p. 42) is the term, paraproxemics, borrowed from Meyrowitz (1986) by Messaris (1994). The paraproxemics principle states that there is a "real-world association between physical closeness and psychological intimacy" (Messaris, p. 32; Kress and van Leeuwen, 1996). Although a perception of visual closeness may be created by using a tele-photo lens that renders a close-up of the subject, it can also be achieved by increasing the scale of the subject using image manipulation techniques. This principle relates to one of the final two components of this study's designation of image manipulation methods within the first category: the addition, subtraction, or change of position or scale of content within an image.

Dondis (1973) says that "scale can be established not only through the relative size of visual clues, but also through relationships to the field or the environment" (p. 56). Another important factor of scale is its juxtaposition to other elements in the image, particularly humans, as they offer a common standard for object-size, scale comparisons (Dondis, 1973; Zettl, 2005). Additionally, viewers often judge the size of objects in the frame by the amount of screen space the object takes up (Zettl).

The adjustment of scale often affects another component discussed by Rose (2007): perspective. Rose (2007) explains that "perspective...provides a means of representing three-dimensional space on a two-dimensional surface" (p. 44). Kress and van Leeuwen (1996) explain that perspective helps to establish relations among the subject and viewer. Therefore, a viewer's perceived point of view can be altered through a shift in the image's perspective (Rose). For example, Rose explains that a low point of view may suggest that the viewer should approach the image as if they were a child, possibly giving reverence to elements of an image placed above the eye level of the viewer. Zettl (2005) agrees that there are angles that may intensify events or establish power for individuals and that the use of these angles helps to reveal "the underlying feelings of a person in a particular situation" (p. 215). Zettl clarifies the difference between a viewpoint and a point of view; "viewpoint simply refers to what that camera is looking at and from where. Point of view, on the other hand, means that the camera takes on a bias of looking: it no longer describes...but comments on the event" (p. 205).

Rose (2007) concludes her discussion of the importance of spatial organization by arguing that "the spatial organization of an image is not innocent. It has effects. It can produce a specific relation between image and spectator" (p. 47). It should be noted that spatial organization allows for many variables to be addressed, not all of which are included here. However, all of the variables that comprise Rose's definition of spatial organization are included here.

Light

Rose (2007) posits that light is related to colors and space. In fact, Zettl (2005) says that lighting is directly related to spatial organization because it "reveals the basic shape

of an object and where it is located relative to its environment" (p. 26). In addition to lighting affecting space, differing types of light used to illuminate a subject may also affect that subject's color saturation as well as the value of its hues (Rose). Rose says that "the illusion that geometrical perspective realistically represents three-dimensional space can be enhanced or called into question by the use of light sources" (p. 48). Zettl agrees with Rose and adds that "the basic purpose of lighting is to manipulate and articulate the perception of our environment...it can also establish a context for our experiences...[and] tell us how we should feel about a certain event" (p. 20).

An important component of light is contrast. Contrast can be controlled with filters at the time that photographs are created or with darkroom and digital techniques after the image has been recorded. Dondis (1973) explains that "in its elemental visual state, light is tonal, reaching from brightness (or lightness) to darkness in a series of steps which can be described as having very subtle graduations" (p. 86). Contrast plays a pivotal role in visual literacy as it allows, in its most polarized functions, there to be a complete presence or absence of light (Dondis).

Rose (2007) concludes her discussion of the role of compositional interpretation by emphasizing that the application of this methodology is central to a viewer's understanding of new images through the description their visual impact. Her analysis notes the methodology's dependence on a more explicit semiological approach to help the viewer more fully grasp the broader cultural meanings inferred by the aforementioned aesthetic image elements. Rose notes that despite this shortcoming, compositional interpretation does "begin to say something about an image's possible effects on a spectator" (p. 57).

Expressive Content

Expressive content as defined by Rose (2007) is an "elusive aspect [with]...uncertain methodological status" (p.48). Rose cites Taylor (1957) as saying that expressive content is "the combined effect of subject matter and visual form" (p.48). Despite the lack of cohesiveness among visual culture critics to agree with the significance of expressive content, Rose argues that it is the culmination of all other aesthetic components and necessary to think about when analyzing an image. The consideration of expressive content may be better conducted in additional research after the first four elements have been fully examined.

Content, color, spatial organization, and light are key dimensions of "what images are" (Rose, 2007, p. 36). Drawing on Rose's notion of compositional interpretation to establish a working vocabulary of image components, images can be analyzed and measured for levels, types, and styles of manipulation with a systematic and consistent framework, allowing researchers to compare and contrast manipulations across images and cases.

CHAPTER 4

EXISTING RESEARCH

As the methods used to manipulate images have advanced at startling rates, the ability for individuals to detect those fundamental changes has decreased. Technological innovations in the software and hardware of the new digital darkrooms such as Photoshop have made manipulations increasingly subtle, sophisticated, and difficult to identify without careful comparisons with non-manipulated versions of those same images. As previously discussed, there are innumerable ways in which images can be manipulated. For the purpose of this study, those changes have been classified into three distinct areas of manipulation: 1) the addition, subtraction, or change of position or scale of content within an image, 2) an intentional change in the density or exposure of part or all of an image, and 3) an intentional change in color in part or all of an image (Brugioni, 1999; Reaves, 1987; Vernon, 1997; Wheeler, 2002).

Manipulations and changes to images have been analyzed from a variety of perspectives with a range of techniques throughout the past century. Early techniques of image analysis were largely qualitative examinations of easily detected changes, but recent developments in computer science have allowed researchers to detect changes that have been made to images that are virtually undetectable to the human eye. All of these techniques provide tools that researchers use to explore the nature and impact of manipulated images, especially within the realm of news images.

Image Forgeries and Manipulation: Qualitative Approaches to Image Analysis

Early examinations of image forgeries and manipulations generally focused on substantial changes to the content of an image, and were often limited to detection of changes clearly visible to the naked eye. Early analytical techniques were almost entirely qualitative examinations of images, and they often necessitated reference to the original, non-manipulated image to confirm what changes had taken place.

Brugioni (1999) outlines some of the methods researchers developed to help reveal image forgeries. He states that experts often look at components of images that may be helpful in determining if manipulation has taken place. These components include: shape, size, tone, texture, pattern, shadow, site, scale and association. Among the methods of detection that Brugioni discusses are analyses of: date-time-shadow sun angle, parallax, depth of field, photogrammetric, microscopic, vanishing point, and halation. Some of these methods, including early techniques of photogrammetric analysis, have served as foundations for software that performs these detections more accurately and more quickly than ever before.

These methods and other qualitative measures are often employed when attempting the authentication of questionable images. The Department of Defense (DOD) employed extensive means to determine the authenticity of an image purported to show three American pilots missing for more than twenty years after their planes crashed in various parts of Southeast Asia. The apparently well-fed men were holding a sign that read a date current to when the photo was released in the early 1990's. The DOD sent a ten-person team to Thailand to uncover the circumstances in which the image was made. In

addition to this physical investigation, they also employed interpretation and analysis of every visual element that could be clues including: their haircuts and mustaches (decidedly of Russian or Eastern European background), the handwriting on the sign (which was compared to other known manipulated images containing handwritten signs), and even the buttons on the men's coats (later determined to be distinctly Russian) (Brugioni, 1999). This image, after exhaustive qualitative research, was eventually determined to have been manipulated. However, the methods employed to make this determination are not feasible to be used in the number of scenarios. Potentially manipulated images need to be accessible more quickly and accurately and in more cost efficient ways as we will explore further in this chapter.

Computer-Assisted Detection: Quantitative Analysis of Manipulated Images

Leading the way in quantifiable image manipulation detection is Hany Farid, a computer science researcher and professor at Dartmouth University who began the Image Science Group. The group's research "focuses on topics in digital forensics, image analysis, computer vision, and human perception" (Farid, n.d.) Farid and his colleagues outline mathematical and technological methods of detecting image forgeries and changes made through a variety of techniques of manipulation. Due to the increased need for services in the digital image forensics arena, Farid formed Ma'at Consulting which offers "consulting and expert witness services in the analysis of digital media," specializing in digital forensic analysis (Farid, n.d.).

Research resulting in new ways of detecting image manipulation through the use of complex mathematical algorithms culminated in Farid's innovative software package

unlike anything ever created, called Q-IF. The tools in Q-IF can be used for detecting some forms of digital tampering in images. These forensic tools function independently from Photoshop as a standalone program and were developed with grant money and additional resources from, among others: the National Science Foundation, Department of Homeland Security, United States Air Force, National Institute of Justice, Microsoft Corporation, and Adobe® Systems Incorporated (Farid, n.d.). The Q-IF software, along with specific analytical methods performs the complicated task of detecting image manipulation created through various modes of compositing. In particular, this software is best for determining the addition, subtraction, position change, or changes to scale of content within an image. Whether the individual manipulating the image did so in the analog darkroom or in the computer, there are a few tell-tale signs of image tampering that can be identified by unaided human eyes, previous detection methods and through the research and software of computer scientists.

Inconsistent Lighting

Lighting inconsistencies within the image may signal the blending or compositing of images from different sources. Brugioni (1999) explains that "shadows of objects are present in most photos, and they must fall in the same direction and be consistent in relative size and shape with the object photographed" (p. 69). He goes on to explain that a "detailed analysis of the direction of the light and shadows being cast are key elements in the detection of a fake photo" (p. 69). In his work on image forensics, Micah Johnson (2007) asserts that, "when creating a digital composite of, for example, two people standing side-by-side, it is often difficult to match the lighting conditions from the

individual photographs. Therefore, lighting inconsistencies can be a useful tool for revealing traces of digital tampering," (p. 6).

In an official White House photograph, *Senator Prescott Bush and His Family—Three Generations,* on display in the George Bush Presidential Library, evidence of photo tampering is clearly visible to the human eye due to inconsistent lighting. A trained eye can easily note that the light is striking President Bush and his family from their left while the rest of the family is lit from the right. However, inconsistent lighting is not the only means by which this image was determined to be a fake. Brugioni (1999) goes on to explain that the crop lines from the two images that were placed together are also visible as well as inconsistent scaling of the portion of the image that was combined with the original image. Although these changes are more difficult to notice, they can be seen with careful observation of the image.

Unlike the composite photograph of the Bush family, inconsistencies can often be nearly imperceptible to the human eye. Building on the research of Sinha (2000) as well as Ostrovsky, Cavanaugh and Sinha (2005), Farid's Q-IF program offers a function that aids in the determination of the illuminant direction (Farid, 2007, (in press)). After the software makes some "initial simplifying assumptions about the light and the surface being illuminated [using Lambertian principles]" it can then, "mathematically express how much light a surface should receive as a function of its position relative to the light" (p.3).

During the 2004 presidential campaign, a composite image was circulated of democratic nominee John Kerry sharing a stage with well-known anti-war activist Jane Fonda (Johnson & Farid, 2005; Farid, 2007, (in press)). The image is a remarkably well

crafted composite, with few visual clues pointing to manipulation. Despite this, Johnson and Farid were able to apply tools from the field of computer vision to determine evidence of inconsistencies in light directions in the image of Kerry and Fonda at 123° and 86° respectively (Johnson & Farid, 2005).

Johnson and Farid (2007) developed another way of determining illuminant direction by using specular highlights found on the eyes of individuals photographed. They explain that "specular highlights that appear on the eye are a powerful cue as to the shape, color and location of the light source(s)" (Johnson and Farid, 2007, p.11). Previous research conducted by Nishino and Nayar (2004) describes a technique that can create a map of the lighting environment of photographs based in part on the reflections or spectral highlights in a subject's eyes. Johnson and Farid (2007) continued this research by developing a method for aligning the 3-D direction of a light source and the position of the spectral highlight in the eyes of photographic subjects. They argue that using this technique can help researchers detect if the individuals in the photograph may have been composited together (Johnson & Farid, 2007).

Scale and Perspective

Scale and perspective play an important part in determining if a new portion of an image has been added to an existing one. When two images are composited, one of those images often needs to be re-sized or rotated in order to better fool the viewer into thinking that those image elements existed together in that place, at that time.

Scale and perspective play an important role in the audience's reception of an image. Brugioni (1999) explains that "scale involves the relative size of one known object or part of an object compared to another. Perspective is the spatial relationship of objects as they

would appear to the eye" (p. 71-72). Zettl (2005) argues that "we judge the size of objects when they appear as screen images by these major perceptual cues: knowledge of object, relation to screen area, environment and scale, and reference to a person" (p. 94). Therefore re-sizing and/or rotating an image is a powerful form of changing ones perception using image manipulation.

Elements within any image can be measured, and when those measurements register as inconsistent with the scale of surrounding contextual elements, it may be a sign of an image composite (Brugioni, 1999). Soviet images of various military weaponry and machines were manipulated in such a way. They were then distributed in an effort to intimidate their political rivals. Jet fighters, missiles, and destroyers were enlarged in relation to other image elements and screen area.

Photogrammetric analysis involves the measurement and comparison of elements within an image in an effort to uncover scale inconsistencies. This method was previously employed by forensic image specialists using little more than rulers and calculators. It has since served as the foundation for studies that employ "projective geometry [to make] metric measurements on planar surfaces from a single image" (Johnson & Farid, 2006b, p.1). The work of computer science researchers such as Hartley and Zisserman (2004) as well as Liebowitz and Zisserman (1998) helped Johnson and Farid (2006b) develop computer generated methods of measuring and comparing image elements.

The introduction of additional image elements not only allows for the possibility of those elements to be improperly scaled, it also introduces new pixels that may be located

more easily because of the scaling or rotating that may occur. Noah Shachtman (2002) explains Farid and Popescu's (2005) methods of exposing scaling or rotating:

> Take a picture that is 10 pixels by 10 pixels, for a total of 100. Stretch it to 10 by 20 pixels, and image-editing software like Adobe® Photoshop will assign the picture's original pixels to every other slot in the new picture. That leaves 100 pixels "blank," or without values. Image-editing software fills in the gaps by examining what their neighbors look like, and then applying an average. To oversimplify, if pixel A is blue, and pixel C is red, the blank pixel B will become purple. (¶ 8)

This method of manipulation detection argues that by re-sizing or rotating portions of an image, statistical correlations can be detected in the image using the Q-IF software. These correlations can best be detected in high-quality, uncompressed TIFF images; there are significant limitations when analyzing JPEGs or other file formats (Farid & Popescu, 2005). Since most digital cameras utilize the JPEG (joint photographic experts group) file format which compresses the file, enabling a faster download and transfer, and not the TIFF (tagged image file format) which is an uncompressed digital file format, this method of testing correlations using TIFFs has functional limitations.

Recurring Artifacts

Another way images have been identified as manipulated is through the discovery of recurring artifacts, or elements of the image content. Recurring artifacts are usually a result of a sloppy use of the copying tools in Photoshop such as the clone stamp or healing brush. The clone stamp duplicates the pixels from a source point into a destination point. The source point need not be in the image that contains the destination

point. In other words, in Photoshop you may have two separate images open at the same time and select the source point from one image while transferring it to the other. The clone stamp is often the fundamental tool used by newcomers when they first begin to add or remove elements within an image (Cope, 2001).

The healing brush, on the other hand, is an intelligent paintbrush similar to the clone stamp tool in that it uses pixel data from one location and places it into another. The difference between the clone stamp and the healing brush is that when that new pixel data is pasted with the healing brush, Photoshop analyzes the surrounding pixels for texture, color, and luminosity or density. Once the new data is pasted, Photoshop merges the texture from the sample area into the color and luminosity or density of the destination area in a 10-12-pixel spread, resulting in a smoother seam blended into the target area's content. With this healing brush tool, the crop lines visible in the Bush family photo would not have been as easily detected by the naked eye.

Although few people may know *how* Photoshop can blend insertions, remove blemishes, and change content in this way, most are aware that such changes can be made. These tools quite literally have the ability to eradicate whole areas of images or add elements of images that did not previously exist. In certain contexts, especially news, such manipulation takes on significant ethical problems as we have already discussed.

In August of 2006, The Reuters news agency released a photograph taken by Beirut-based freelance photojournalist Adnan Hajj. Hajj's image was of an Israeli air strike on the suburbs of Beirut. The photograph was alleged to have been a fake by Charles Johnson on his political blog, Little Green Footballs. Johnson was tipped off to the fake largely due to the recurring patterns in the smoke by graphic designer, Mike Thorson

(www.nytimes.com). "Photo editors said that such patterns, which result from using Photoshop's cloning tool, are one of a few indications of deliberate digital manipulation" (www.nytimes.com). Reuters later made available to the public the original image and the manipulated version. This manipulated image was ultimately responsible for Reuters severing its ties with and purging the archived photographic files of Hajj (*Washington Post*, Blogger Takes Aim, p. C01).

Although the previous example was detected by sight alone, many uses of the clone stamp or healing brush may go unnoticed. The research of Fridrich, Soukal and Lukáš (2003) addresses the issue of copy-move forgeries by focusing on the "detection of a special type of digital forgery – the copy-move attack in which a part of an image is copied and pasted somewhere else in the image with the intent to cove an important image feature" (p. 1). At the same time, Popescu and Farid (2004, 2005a) discuss the detection of duplicated image regions often as a result of poorly executed copy-move manipulations. This research ultimately led to the inclusion of methods of detection based on recurring artifacts in Farid's Q-IF software.

The use of Photoshop as a manipulation detection tool was implemented in 2002 at the *Journal of Cell Biology*. In an effort to detect if scientific images that were included in submitted papers were tampered with, the *Journal* began examining all submitted images using Photoshop (Cook, 2006). The tests that were performed on the images included extreme magnification to aid in the detection of recurring artifacts and the increase of contrast to better detect if the background was inconsistent (Cook, 2006). With the rapidly advancing ability of Photoshop to manipulate images, these analytic methods alone remain insufficient. For example, Donald Kennedy, editor of the journal

Science argued that he did not believe that those methods would have helped uncover the manipulated images associated with Hwang Woo Suk's ground breaking article on human cloning published in *Science* in 2005 (Cook, 2006). In the article, Suk used manipulated images to help illustrate a procedure cloning human embryos and extracting their stem cells, thereby giving hope to finding cures for numerous ailments as well as securing further funding for his research. His changes to the image violated the magazines ethical guidelines and prompted the respected magazine to print a retraction.

Unfortunately, Farid's research only successfully addresses one of the three distinct areas of manipulation: the addition, subtraction, or change of position or scale of content within an image. His team's methods are currently unable to address whether or not there was also an intentional change in the density or exposure of part or all of an image, or an intentional change in color to part or all of an image. As long as those changes were made with the colors and density existing in the original image and not imported into the image from other digital files, Farid's research and team could not detect the manipulation.

Although Farid's (2006) research cannot consistently identify changes to density or color, he has developed a way of determining if the image was opened in Photoshop or another image editing software. Farid explains:

> Most digital cameras export images in the JPEG file format. This lossy compression scheme employs a quantization table that controls the amount of compression achieved. Different cameras typically employ different tables. A comparison of an image's quantization scheme to a database of known cameras affords a simple technique for confirming or denying an image's source.

> Similarly, comparison to a database of photo-editing software can be used in a forensic setting to determine if an image was edited after its original recording. (p. 1).

The importance of knowing merely whether or not images have been opened in photo editing software is a growing concern. Some editing software including Adobe's ® newest variation of Photoshop called Lightroom makes automatic and global changes to concepts such as color and exposure without any input from the user. Therefore, knowing if the image has been viewed in these programs is often tantamount to knowing if they have had their exposure and or color balance *optimized.*

The body of research generated from the field of computer science includes numerous other methods of manipulation detection through bispectral analysis (Farid, 1999), the analysis of the color filter array of interpolated images (Popescu & Farid, 2005), chromatic aberration analysis (Johnson & Farid, 2006a), and the use of metric measurements on a plane from a single image which is a derivative of photogrammerty (Johnson & Farid, 2006b). The strength of these approaches is that they can detect manipulations in an image without comparing it to the original. However, this research is primarily concerned with the detection of image manipulation; this computer science research remains limited in its capacity to measure specific levels of difference. Additionally, the types of manipulations that this research can detect best are associated most commonly with compositing, or the addition, subtraction, or change of position or scale of content within an image. Although these fundamental tools are invaluable in the area of digital image forensics, there is a need to develop additional tools to be able to

measure the manipulated elements of content, color, spatial organization, and light as set forth by Rose (2007).

As can be noted in existing research (Arnheim, 1974; Dondis, 1973; Zettl, 2005), the aesthetic principles of content, color, spatial organization, and light play important roles in shaping the perception of visual consumers. The first step towards qualifying the effects of these manipulations is the measurement of them. This thesis introduces the use of Photoshop as an image content measurement device. Using tools in the Photoshop CS3 platform, each of Rose's principles can be measured, documented and compared.

It should be mentioned that although it is not the intention of this method to initially detect *if* manipulations are present in images, this may occur. In fact, it is a limitation of this method that the original and manipulated image be present for measurement. However, if an image was previously identified as manipulated because one of the aforementioned things was present, such as a lighting inconsistency or recurring artifacts, and this proposed method of measurement is used to analyze the images in their totality, other changes in color, or light may be identified. Therefore it is not intended as a method of detection, its purpose is strictly measurement.

CHAPTER 5

METHODS

It is the contention of this paper that meaning is gained not only through the existence of each of the image dimensions outlined by Rose (2007) but also as a result of the qualitative changes images undergo through the use of image manipulation techniques. Therefore, the methods developed by this paper intend to fill an important gap in research associated with understanding image reception and meaning. This research takes into account technology's role in the manipulation of still images and after identifying Rose's four aesthetic dimensions, it applies a set of techniques to measure the qualitative changes made to images. This method of measurement uses tools available in the software program Photoshop. This measurement method also seeks to accomplish two goals: 1) increase the understanding of the visual language of image manipulation; and 2) add to the body of knowledge regarding an image prior to its further evaluation with a method such as semiology which offers a more culturally interpretative analysis. These first steps of identification and measurement are necessary to aid future research that may be able to make greater generalizations regarding the effects of image manipulation.

The methodology discussed in this paper utilizes Photoshop in a unique way in order to better understand content of photographs. Interestingly, Photoshop is the software used to make qualitative changes to images; Photoshop is used in this study to measure and quantify the changes. The aesthetic dimensions set forth by Rose (2007) - content,

color, spatial organization, and light - will be isolated and measured using techniques designed specifically for this study. The additional dimension of expressive content, which Rose also discusses within compositional interpretation, will not be addressed. Expressive content as defined by Rose is an "elusive aspect [with]...uncertain methodological status" (p.48). Rose cites Taylor (1957) as saying that expressive content is "the combined effect of subject matter and visual form" (p.48). Despite the lack of cohesiveness among visual culture critics to agree with the significance of expressive content, Rose argues that it is the culmination of all other aesthetic components and necessary to think about when analyzing an image. The consideration of expressive content may be better conducted in additional research after the first four elements have been fully examined.

One of the strengths of this study is its ability to objectively, numerically and methodically outline changes in each of the aesthetic components of images listed above using Photoshop as a measurement tool. The measurement of elements that can be thought of as subjective such as color or light, will add a degree of objectivity to their interpretation as it focuses on the *changes* that they undergo as a result of image manipulation.

This qualitative methodology also places an emphasis on the genesis and context of each image. Therefore, additional information regarding the background of each of the two selected images will be given. This contextual image information is referred to as connoisseurship by Rose (2007). It aims to provide valuable insight for the reader into the potential motivations and implications of its publication and distribution. When

taking into account the origination and circumstances of each image, the audience can more fully understand its intended purpose.

The existing research section of this paper exposed various methods that researchers have developed to detect image manipulation. These methods range from simple visual critical analyses (Brugioni, 1999) to the development of sophisticated detection software (Hartley and Zisserman, 2004; Johnson and Farid, 2006b; Liebowitz and Zisserman, 1998). What was consistently missing from existing literature was an importance placed on the degree to which images were manipulated. This paper argues that degrees of manipulation are important and should be examined on their own merits.

The section of this paper dealing with documentary news images and objectivity illustrated that images are culturally and socially important and that aesthetic elements contribute to the perception and reception of images. This research may be the starting point in conducting additional research that could substantiate a claim that changes made to aesthetic elements may also contribute to changes in the perception of viewers.

Selected Cases

As previously noted, the methods of this study require that the images to be studied must be available in their original, unaltered state as well as the manipulated version that is to be analyzed. The two images selected for study were printed in both national and international publications. Additionally, the two images were determined to have been manipulated by either the photographer while on location (Brian Walski), or various members of the editorial staffs prior to publication (Pablo Torres Guerrero). The degrees

of change in Rose's (2007) dimensions will be measured through a comparative analysis of the images as facilitated by the methods discussed in this chapter.

Panic and Human Shields in Basra

Veteran photojournalist Brian Walski was on assignment in southern Iraq for the *Los Angeles Times* in 2003 when he captured images of an Iraqi man holding a child in front of a British soldier. Instead of following protocol and transmitting unaltered images to the news staff at the *Times*, Walski chose to combine two separate images on his laptop while still on location to create the photo composite that ran under the headline: *Panic and Human Shields in Basra* (see Figure 7). For the purposes of this study, the image that Walski used for the British soldier (see Figure 8) will be referred to as 'soldier' for the remainder of this paper. Additionally, the image that Walski used for the Iraqi (see Figure 9) will be referred to as 'Iraqi' for the remainder of this paper.

Figure 7. Panic and Human Shields in Basra, Composited Image, Brian Walski, 2003

Figure 8. Unaltered image used for British soldier, Brian Walski, 2003

Figure 9. Unaltered image used for Iraqi man holding child, Brian Walski, 2003

The image originally ran across three columns on the front page of the *Los Angeles Times* on Monday, March 31, 2003 and was also published across 6 columns of the front

page of the Hartford Courant that same day. The image is a composite of two separate images (see Figures 8 and 9) taken just moments from one another.

In an online interview with *Photo District News (PDN)* (Walker 2003), Walski discussed his reasons for manipulating the image and the ensuing fallout. He cited merely poor judgment in an attempt to create a more aesthetically pleasing image.

Walski explained that he had taken numerous images of that particular scene, but had none where the British soldiers face was visible while the Iraqi man holding the baby was looking at the soldier. Walski went on to explain that he was, "looking to make a picture" and had not considered the ramifications of his decision at the time, (Walker, 2003, ¶ 5). Much like the arguments used by the editors of *National Geographic* in reference to the manipulated magazine cover in 1982, Walski's justification seems to lie in the understanding that what was represented in the original image *could* have actually occurred. He did not fabricate one particular event; he simply combined images taken of occurring events in order to create, in his opinion, a more aesthetically composed image.

The image, explains Irby (2003b), was determined to be manipulated, or a composite, by a staffer of the *Hartford-Courant* because of recurring artifacts found in the background (see Figure 10). If there had not been a glaring oversight in the background, then the deceiving image may have never been discovered. Walski, a staff photographer for the *Los Angeles Times* since 1998, was fired on April 1, 2003, after admitting the photo manipulation to his editors (Walker, 2003).

Figure 10. *Panic and Human Shields in Basra,* Brian Walski, 2003. Close-up showing recurring background artifacts

Madrid Train Bombing

Pablo Torres Guerrero was employed as a staff photographer at Spanish newspaper *El Pais* while he was on assignment photographing the terrorist attack in Madrid on March 11, 2004 (see Figure 11). Guerrero captured images from just outside the Atocha train station in Madrid. The attacks left 190 morning commuters dead and nearly 2,000 injured when 13 backpacks filled with bombs were detonated.

Figure 11. Madrid Train Bombing, 2004. Original, unaltered image originally published in *El Pais* March 12, 2004, Pablo Torres Guerrero.

Reuters, whose website boasts it is "the world's largest international multimedia news agency" and has "a reputation for speed, accuracy and freedom from bias" (Reuters, N.D.) electronically distributed Guerrero's images globally. One of the images immediately stood out as being particularly powerful. *Time* magazine picture editor Mary Ann Golan recalled the picture, saying, "this was the best picture that we saw in terms of the scale and impact. You get a sense of the long focus and the - Oh my God! - how massive the impact and mayhem of the situation" (Irby, 2004, ¶ 8). The impact of the image also included some controversial content. Medical experts later identified an element located in the bottom left portion of the frame as a bloodied human femur bone (Irby, 2004). Newspapers worldwide felt that the image was important and decided to run it, yet could not include the body part, and therefore used a variety of ways to minimize or eliminate it in the image.

Reuters senior picture editor, David Viggers, explained that the agency does not condone the removal of image elements of any kind, and that they do not tolerate anything that changes the editorial context of the images they distribute on behalf of their photographers (Cozens, 2004). Reuters does stipulate, however, that they allow manipulations made on the computer that could have been accomplished in the darkroom. Coincidentally this includes all of the methods of manipulation used to obscure or remove the body part from this image, albeit at the hands of a much more talented darkroom technician than necessary in a Photoshop user.

When newspapers are confronted with graphic imagery it is often the concept of newsworthiness and immediacy that must be weighed against other values when deciding whether or not to run potentially offensive images (Day, 1991; Parsons & Smith, 1988). Day (1991) explains newsworthiness as something that "provide[s] significant information or understanding that would otherwise be lacking in the story" (p. 236). Some of the other values that both editors and producers of news images must take into account before publishing news images according to Keith et al. (2006) include, "the role played by government censorship, the tolerance of readers and viewers, questions of privacy, and the questions related to developing technology" (p. 249). Varied methods of sanitizing photographs depicting death or other gruesome details are most often employed in order to protect viewers from painful reactions (Fishman, 2003).

Due to the advances in computer-aided image manipulation, the gatekeepers of some newspapers no longer needed to completely rule out the use of the Guerrero image because of its potentially controversial content. In fact, their options for publishing the image minus its offending material were extensive.

Five (5) newspapers were selected to illustrate how different newsrooms chose to address the bloodied femur, each doing so in distinctly different ways. The individual publishers at the discretion of the editors completed these manipulations, not the photographer. Unlike Walski, Guerrero was not involved in the manipulation process and remains a working photojournalist. The manipulation methods used in respective publications include: cropping, *Los Angeles Times*; cloning, *The Daily Telegraph*; de-saturation, *The Guardian*; *Time*; neither the *Washington Post* nor *El Pais* manipulated the image in any detectable way.

The *Los Angeles Times* cropped the femur from the photograph which was in line with the methods employed by most U.S. newspapers (Keith et al., 2006). The methods used by British newspapers tended to be more conservative in nature, often selecting more advanced methods of manipulation (Cozens, 2004).

The Daily Telegraph's picture editor, Bob Bodman, defended his decision to use the cloning technique to remove the body part because he felt that it did not change the context of the image. He explained that the femur did not add anything to the photograph and that had the body part been located on the opposite side of the image, the papers staff would have simply cropped it out. He concluded that "at the end of the day we make decisions that are right for our readers, not for other journalists" (Cozens, 2004).

The Guardian's decision to de-saturate that portion of the image from red to grey was regarded by the paper's deputy editor, Paul Johnson as "not perfect by any means" but the best solution nonetheless (Cozens, 2004). Johnson explained that the photograph "encapsulated the scale of this very human tragedy" and that although it was bordering on acceptability for usage on the front page, the body part was beyond what could be shown

(Cozens, 2004). Ultimately, the decision was made to leave the content there but remove the color because it did not eradicate any specific image elements from the picture. This justification was similar to that of the *Daily Mirror's* decision to run the image in black and white.

These varied responses to manipulate the same image underline the importance of a consensus of ethical standards among news outlets particularly when dealing with images of tragedy and violence. Keith et al. (2006) found that only nine of forty-seven ethical codes of journalism in the United States addressed how to treat images of tragedy and violence. They cite Lule (1995) and Hariman and Lucaites (2003) when explaining that "photographs of tragedy and violence have power as purveyors of message, myth and memory" (Keith et al., 2006, p. 246).

The publications sampled in this study are not the only places this image appeared both in manipulated and unmanipulated versions but for purposes of length they have been selected as representative cases.

Procedures[1]

All selected images were retrieved from online sources that had the images posted at adequate resolutions for use in this study; each of the images were able to be used at least 150 pixels-per-inch (ppi). The areas studied by this research do not require high resolutions (large file sizes) for the analysis primarily because it is not a function of this research to output prints for examination and all elements of the images were clearly

[1] For a complete list of the procedures necessary to replicate this study, please contact the author directly at tracileehoffman@gmail.com

visible and measurable at 150 ppi. Therefore, using the moderately low resolution of 150 ppi was not only adequate but also allowed for a faster workflow in Photoshop.

The two original images and one manipulated image taken and created by Brian Walski for the *Los Angeles Times* story, *Panic and Human Shields in Basra* were downloaded from www.poynteronline.com. The Poynter Institute is an online resource for journalists that include job postings as well as seminars on a variety of issues including ethics and reporting.

Pablo Torres Guerrero's images of the Madrid Train Bombing were downloaded from each of the newspapers' sites that ran their version of the image. The original, unaltered image was downloaded from www.elpais.com.

Each of the images were opened in Adobe® Photoshop Creative Suite 3 (CS3) version 10.0, viewed at a magnification of 1000% in order to detect areas of the image that may have been modified. They were also investigated using some of the previously mentioned qualitative manipulation detection techniques such as; lighting inconsistencies, recurring image artifacts and inappropriate scaling.

The images were viewed on screen in the standard screen mode as selected from the floating tool palette situated by default on the leftmost portion of the Photoshop screen. All versions of Photoshop have had this viewing screen selection available and it has been located in the same floating tool palette from the program's first version through the current version, Photoshop CS3. The standard screen mode was selected because it places sliding navigation bars on the bottom and right hand side of images. When navigating these images, it was very important to ensure that no areas were left unexamined; the use of these sliding navigation bars was necessary for this.

These sliding navigation bars allow detailed examination of every image. When zoomed into images in Photoshop, clicking on each of the bars' empty space on either side of the slider advances the view to precisely the next portion of the image that fits into that screen size without missing so much as one pixel. This method of image navigation was used with both images beginning from the top left hand section of the image across to the right, down one screen quadrant, then from right to left, down another screen quadrant and back to left to right until each image had been thoroughly explored.

Grid Overlay

To aid in this process of exploring the manipulation of images, a grid overlay was created in Photoshop CS2 for use with the Walski and Guerrero images. This grid is intended to be a kind of image map for the compositional interpretation of the images by separating the image into identifiable quadrants.

A new, blank (white) document was created in Photoshop with the size specifications of 8 inches x10 inches at 150 pixels-per-inch (ppi). This size was selected because it exceeded the physical dimensions (8 inches x 10 inches) of each of the images used for this study ensuring that all files could be investigated in their entirety once they were combined with the grid file. The resolution, 150 ppi, was the most common resolution of each of the images that was downloaded, therefore necessitating the least amount of image re-sizing to be performed later.

Once the basic file was created, two pixel wide black lines were placed both horizontally as well as vertically every ¼ inch. This graph layout created identifiable quadrants for the purpose of this study. The X-axis columns were marked with the letters A-Nn, while the Y-axis rows were marked with the numbers 1-32, which created a total

of 1280 individual quadrants. This new document now contained two layers; a white background or bottom layer and an additional layer placed above the background containing all of the coordinates and quadrants for use in this study. Maintaining two layers allowed for the images to be placed between the grid overlay layer and the background for analysis.

Each of the images ppi was set to 150 prior to their placement in the grid. This was necessary in order to maintain the size of each of the images because in Photoshop when two images are combined (in this case the software program is unable to distinguish the grid as anything other than an image), both images must be of the same ppi in order for the relative measurements to remain consistent. Ppi is used as a measurement for images on-screen. The more common, dots-per-inch (dpi) is the terminology used when the image is printed using a desktop printer that creates images with thousands of dots of ink. None of the images measured 8x10 or larger, therefore not all of the 1280 quadrants were used in any of the image maps.

These image maps are used for three different purposes in this study. First, the quadrants allow for accurate descriptions of the locations of elements within images; which is particularly helpful when attempting to determine if elements have been added, removed, or changed location. In addition, the quadrants also provide an accurate measuring tool for identifying the sizes of images in order to help determine if they have been cropped. The third function of the grid is to create standardized quadrants for the sample points to placed for measuring color and light values. The maps also allow for consistent selection locations across versions of images.

Analysis of Cases

This study uses new techniques to measure the qualitative differences that images undergo as a result of digital manipulation. It uses two cases of image manipulation to illustrate how Photoshop can be used to quantitatively measure the original, unaltered images to known manipulated versions of the same images. Rose's (2007) method of compositional interpretation is used as a framework to outline the four aesthetic dimensions to be studied: content, color, spatial organization, and light. The analysis requires comparison to the original, unaltered version of each image. Part of the selection process for images to be used by this study was having access to these unaltered versions. Both of the cases presented will begin with the original, unaltered images being outlined using the methods described below and ultimately will serve as the baseline from which the other, manipulated versions of the images will be compared.

Content

Rose (2007) argues that the starting point for looking at images through her method of compositional interpretation is to study what the image actually shows – its *content.* Analyzing content is of particular importance when framing a study about image manipulation because as this paper has established, a powerful function of manipulation resides in the fundamental change of image elements. Researchers are often limited to studying image content that exist within the borders of the frame and only speculating as to what may have existed beyond the crop of the camera's boundaries. This studies method of comparative analysis offers a unique opportunity to study image content that has been removed as a result of image manipulation.

Systematic analyses of content are difficult, however. Different viewers can have different interpretations of content, not only in relation to its meaning but also in relation to its elements. The technique used in the present study provides a tool by which content can be systematically examined, although it does not contribute to understandings of that content's meaning. The focus of this study is deeply rooted in and strictly limited to quantitative measurements of change.

The approach used in this study is most powerful for examining two characteristics of image content: overall image frame content, which changes as a result of cropping and additions or removals of specific objects. It is important to note that this tool, while providing some numerical output, also depends in part on more qualitative identification of specific image elements, such as people or objects. Therefore this tool can be considered a systematization of subjcctive measures, and is not a purely quantitative set of measurements when used to examine content. In this way, it is distinct from the other three tools used in this analysis to measure color, spatial organization, and light.

In order to determine if overall image frame content has been removed or cropped in either the horizontal or vertical axis, this study uses the grid overlay described in the previous section in conjunction with the Auto-Align Layers command to examine the image. Simply identifying the image size may not always illustrate if a portion of the image was cropped because image size can easily be adjusted after cropping to match any dimensions. However, the methods of this study that standardize ppi settings, align layers based on pixel content using the Auto-Align Layers command and use the grid system do enable users to determine the number of inches that were removed through cropping.

The Auto-Align Layers command allows for a direct size comparison to take place based on the alignment of image contents. Two or more images can be selected at one time and aligned using the Auto-Align Layers command. This command matches layers based on their exact pixel content and re-sizes each file so that they are proportionately identical. Once the images have been aligned, the exact size change that the cropped image underwent can be determined in direct relation to the original, unaltered image.

Additionally, a meaningful analysis requires identifying the specific content of the image and measuring any differences across images with a description through use of the grid overlay. For example, in a photograph of a brick wall, the number of bricks displayed on the left side could be counted and compared across two images. Figure x shows the uncropped image (left), and a cropped version (right) of the same size but with slightly different content: counting the bricks would reveal fewer bricks in the cropped version.

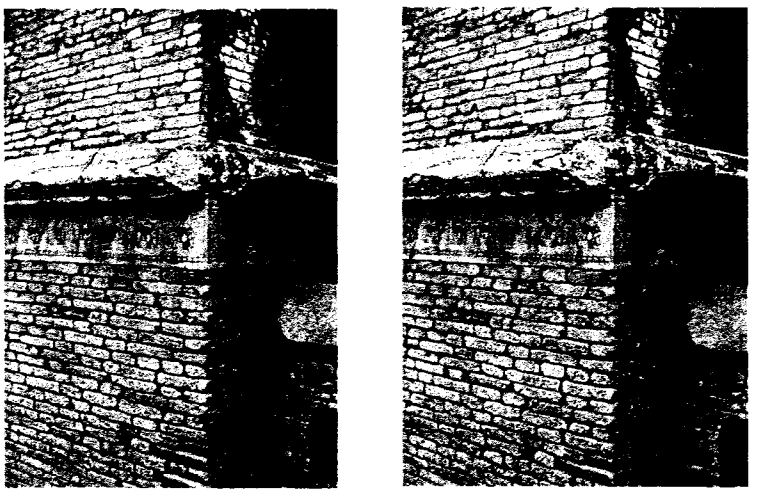

Figure 12. Content changes resulting from cropping.

In order to measure the precise amount an image is cropped and what contents were cropped, each image is placed under the graph, proportionately aligned and a quadrant-by-quadrant analysis is then used to detect the addition or removal of image elements. In the case of these photographs of a brick wall, such as analysis would require counting individual bricks. The cropping is then measured in number of grid quadrants which each equal ¼ inch, use of the measure tool, described later, also supplements the grids functionality.

This method of image analysis can also be used to examine images for recurring artifacts (such as bricks copied and pasted into portions of an image) that are often produced as a result of sloppy image compositing. Similarly, specific elements within an image can be examined by grid quadrant. For example, if a person in the background of an image is removed, a side-by-side comparison of the relevant quadrants across two images would reveal differences in their content.

As noted, conducting a content analysis on images using the grid created for this study necessitates some degree of interpretation from the researcher. The grid does not function as a measurement tool for the purposes of *detecting* cropping per se; it simply allows the researcher to systematically examine the image in order to compare where the image ends horizontally and vertically in both the original, unaltered image and the manipulated version. It also is used as a way to map out areas of images that may have had elements added or removed.

Table 1: Content Analysis

Change	Tool	Unit of Analysis	Output
Cropping	Grid	Grid quadrants	Variance in quadrant placement
Additions	Grid	Grid quadrants	Content of quadrant
Removals	Grid	Grid quadrants	Content of quadrant

Color

Rose (2007) suggests that there are three ways of describing the colors in an image: hue (actual colors), saturation (purity of color), and brightness (lightness or value). Although Photoshop does allow for the measurement of an image's hue, saturation and brightness, it is the values of red (R), green (G), and blue (B) that will be measured for the purposes of this study.

These colors correspond to additive color synthesis that occurs in light, as opposed to in pigment, for which the primary colors are red, yellow and blue. Computer monitors, as well as darkroom developing for color photography use red, green, and blue by convention. Monitors process separate signals for each color (RBG), and combine them to create the range of colors displayed by emitting the light as opposed to reflecting it. (Doughty, 2007; Pascale, 2003; Süsstrunk, Buckley and Swen, 1999)

Pascale (2003) explains that the RGB color space as used in personal computing is simply a mathematical representation of color as displayed or emitted by computer monitors. Measuring the RGB levels as opposed to other color spaces including: cyan (C), magenta (M), yellow (Y), black (K), or hue (H), saturation (S), brightness (B), of images or portions of images is important primarily because of the methods used to

produce the data of this study. Each of the images used for this study was attained, displayed and measured via electronic means and RGB is by far the most common color space used to electronically represent digital images (Pascale, 2003). Süsstrunk, Buckley and Swen (1999) explain that "when applied correctly, a standard RGB space can minimize color space conversions in an imaging workflow, improve image reproducibility, and facilitate accountability" (p. 127).

These RGB values can be measured using the *Color Sampler* tool by reading the color information palette in Photoshop CS3 which is by default "docked" in the upper right-hand corner of the toolbar. When the color sample tool is selected, it allows the user to place pinpoint "samplers" in the image. These color samplers indicate the average red, green and blue values of the selected area. Photoshop allows for seven different ways for the samples to be taken including: point, 3x3 average, and 5x5 average. The point sample measures the exact point clicked on. The 3x3, 5x5 and additional options sample an average of the color values at those dimensions from the area surrounding the selection point. Up to four samplers may be placed on an image at a single time for numerical side-by-side comparisons of color.

For the purpose of this study, a 3x3 sample area was used. This 3x3 sample size allowed for a small average of color and density to be measured. In order for that sample average to fall directly in the middle of each 0.25 inch x 0.25 inch quadrant, additional guides or lines were created on both the horizontal and vertical axis at measurements of 0.125 inch. This ensured that when referencing a specific quadrant, the per-channel color measurements were registering from the exact center of the quadrant and included the color average from that exact point as well as the eight surrounding pixels. Thus,

selecting a specific 3x3 point in, for example, a photograph of green grass, the Color Sampler will indicate a high value for the color green that reflects a high average quantity of green in the 3x3 pixel area.

This tool is a powerful and subtle one because the values for each color are extremely specific and nuanced. When the Color Sampler tool is used on an image, the info palette shows the average values for that point of the primary colors used in computer display: red (R), green (G), and blue (B). When all three color dimensions are set at 0, color is displayed as black, whereas when all three are set to the maximum 255, color is displayed as white. When one color is at its maximum (255) and the other two are set at 0, that color is displayed in its pure form. For example, a sample point set with red at 255 while blue and green are at 0, one would see a very bright, 'fire engine' red. There is no other influence of colors in that mix; it is red in its purest state. When other colors are added to a red of 255, however, the color reflects combinations of red, blue and green. Table 2a illustrates some relationships between Color Sampler tool values and displayed color as examples.

Table 2: Displayed Color by RGB Value

Displayed Color	Red Value	Green Value	Blue Value
Pure red	255	0	0
Pure green	0	255	0
Pure blue	0	0	255
Bright yellow	255	204	0
Royal purple	128	0	128
Pure white	255	255	255
Pure black	0	0	0

The Color Sampler tool, therefore, can be used to identify the values of red, green, and blue in a sampled portion of an image. These values reflect the specific color of the sampled point. Subtle changes in the value of red, for example, can be identified in changes of the value of the red dimension in the Color Sampler output. This tool is especially useful for measuring the extent of color changes that can result from adjusting the relative combinations of red, green, and blue in altered images. Table 3 provides the minimum, maximum, unit, and output for each dimension of color.

Table 3: Color Measurement

Dimension	**Photoshop Tool**	**Min**	**Max**	**Unit**	**Output**
Red	Color Sampler tool	0 (black)	255 (pure color)	Color strength	Average level of red in sampled section
Green	Color Sampler tool	0 (black)	255 (pure color)	Color strength	Average level of green in sampled section
Blue	Color Sampler tool	0 (black)	255 (pure color)	Color strength	Average level of blue in sampled section

Spatial Organization

Spatial organization is a key component of image content according to Rose (2007). Although Rose (2007) and others identify a range of aspects to spatial organization, the present study focuses on three of these aspects that allow for a wide range of analysis: size, proximity, and scale. By analyzing these three factors, other aspects of spatial organization can be interpreted including perspective, point of view, and focalizers. The

grid developed by this study will aid in determining important beginning points for these additional concepts.

In combination with the grid overlay, Photoshop's *Measure* tool can quantify precise changes in size, proximity and scale of objects in an image. When selected, the measure tool displays relevant information based on the distance travelled in the image. The information that is shown in the tool bar includes: the starting (X and Y coordinates), the horizontal (W) and vertical (H) distances traveled from the x and y axes, and the total distance (L1). The units of measurement can be changed in the *set measurement scale* dialog box found under the *analysis* drop down menu. For the purposes of this study the standard unit of measurement was inches.

The Measure tool, therefore, can be used to identify changes in the placement of specific objects, borders, points, and various aspects in an image. For example, in a photograph of two people, the Measure tool can identify the absolute number of inches they take up on the image (size), their distance from one another on the image (proximity), and their relative size in comparison to one another (scale). When comparing two photographs of people, for example, differences in the size, proximity, and scale across the two images can thus be systematically identified and analyzed. This tool is especially helpful to examine composite images, as combining two images often results in small but mis-matched differences in size or scale (Brugioni, 1999). Table 4 outlines the values, units, and output for each dimension this tool is used to examine in the present study.

Table 4: Spatial Organization

Dimension	Tool	Min	Max	Unit	Output
Size	Measure tool	0	[dimensions of image]	inches	Size of sampled element
Proximity	Measure tool	0	[dimensions of image]	inches	Distance between sampled element and other elements
Scale	Measure tool	0	[dimensions of image]	inches	Relative size of sampled element to other elements

Light

Rose (2007) suggests that lightness and darkness are important characteristics of an image because they can be used to direct the attention of viewers to its different areas. This manipulation can be accomplished by either drawing the viewer's attention to a lighter section of a photograph or hiding an area by darkening it. Brightening and darkening portions of an image are common techniques used in both the darkroom and in Photoshop among photographers and editors to improve the quality of images. These techniques aimed at aesthetic enhancement, however, may not be employed without potentially tampering with the images other qualities (Tirohl, 2000). Therefore, image manipulation by lightening and darkening areas in an image is relevant when considering their affects on viewers.

In order to measure the specific levels of lightness and darkness in an image, the present study uses the *Color Sample* tool in Photoshop. This tool is also used to measure color levels. The Color Sample tool can be used to identify levels of black in a similar way it measures color. Photoshop provides several other tools to measure the tonal range

of an image, including the histogram, which identifies the number of pixels at each color intensity level. However, histograms are difficult to read and compare, and thus they do not function well for systematic measurement. The Color Sample tool is better for the present study due to its ease of measurement and comparable attributes.

Measuring lightness and darkness in a black and white image is straightforward: the naked eye can distinguish relatively easily between different levels of black. However, measuring lightness and darkness in a color image is more complex, and often affected by individual perceptions of color. For example, is a pure blue "darker" than a pure green? It is extremely difficult to make such a judgment consistently. However, using the Color Sample tool in Photoshop provides a systematic technique for identifying levels of darkness across colors.

In the Color Sample palette, Photoshop can provide information about the darkness of a sampled portion of the image that it labels the K percent value of that portion. This information can be displayed by selecting the "Grayscale" readout option in the Info palette. Photoshop identifies the darkness of the sampled color as though it were displayed in grayscale. Thus pure red, with a red value of 255, a green value of 0, and a blue value of 0 has a K (darkness) value of 58%. Table 5 illustrates the K values of several colors as examples.

Table 5: Darkness Values (K%) by Displayed Color

Color of sample	K value	Red value	Green value	Blue value
Pure red	58%	255	0	0
Pure green	17%	0	255	0
Pure blue	89%	0	0	255
Bright yellow	4%	255	255	0
Pink	18%	255	205	255
Pure black	100%	0	0	0
Pure white	0%	255	255	255

By reading the K value output of the Color Sample tool, the Photoshop user can identify level of darkness or density in the sample regardless of specific color values. This measurement of density provides a clear and systematic way to examine darkness and lightness levels in an image, a characteristic that Rose (2007) identifies as important in an image and as distinct from color. The strength of this measurement approach is that it permits an analysis of density (light) without incorporating color values. Identifying a sample's K value interprets each color by its corresponding level of black in a uniform way, allowing a consistent analysis. Thus individual perceptions of the relationship between color and darkness or lightness do not affect the measurement of light in an image when using this tool.

Table 6: Light Measurement

Dimension	Photoshop tool	Min	Max	Unit	Output
Black	Color Sample tool	0%	100%	Level of black	Average darkness of sampled section

Summary

The four dimensions identified as central to the appearance of an image are: content, color, spatial organization, and light. These dimensions are analyzed in a consistent and systematic way using Photoshop tools and the grid overlay created for the measurement of the dimensions within this study. By measuring sampled portions of an image with the grid and Photoshop tools suggested by this study, researchers can make subtle and meaningful comparisons among images, across altered and unaltered images, and within portions of an image. These techniques are used in the current study to examine the specific changes made to the images in the two case studies selected: Pablo Torres Guerrero's photograph of the 2003 Madrid Train Bombings and Brian Walski's composite image of the British soldier and the Iraqi holding a baby. The techniques were used to create quantitative measures of changes to content, color, spatial organization, and light in these images.

CHAPTER 6

RESULTS

Panic and Human Shields in Basra

Two images were selected for use in this quantitative study about image manipulation. Brian Walski's *Panic and Human Shields in Basra* and Pablo Torres Guerrero's image of the Madrid Train Bombing were downloaded from numerous online sources. The images were then re-sized for consistency and analyzed using various tools and techniques found in Adobe® Photoshop with the help of a grid overlay created specifically for use in this study.

This chapter presents the quantitative output of the qualitative changes that were made to these two images by either the photographer (Walski) or members of the newsroom staff (Guerrero). The measurement of these two images was based on Gillian Rose's (2007) four dimensions of aesthetic image elements as set forth through her method of compositional interpretation. The measurement was conducted using unique methods developed specifically for this study which were previously discussed in the methods section of this paper. The results presented here demonstrate that these techniques can clearly identify and measure differences that images undergo as a result of manipulation.

Content

The content of the final version of *Panic and Human Shields in Basra* is composite of two other images taken by Brian Walski. Prior to being placed in a single, final image together, Walski made some qualitative changes to some of the components of each of the original images including changes reported in size, scale and proximity, which are discussed in the section on spatial organization.

As previously discussed, this image was determined to be a composite because of recurring image artifacts located in the background. An analysis of this image's content using the grid overlay in conjunction with Photoshop's ability to view images at high magnifications revealed specific areas that were duplicated, thus alerting viewers to the manipulation. Quadrant locations D15-16 contain the image of a man's face also seen in quadrants I-J14. Additionally, quadrant locations C14-15show the image of a man's head and partial body also seen in H13-14 (see Figure 13).

Color

The changes in color noted for *Panic and Human Shields in Basra* were likely do the shift in density that the image underwent as a result of image manipulation. As described in the methods section of this paper; to increase density or darken portions of an image, changes the mix of the colors red, green, and blue. Therefore, although the color changes that Walski's image exhibit are a result of modifications to density, the shifts in color are important and measured in the table below. The points selected for measurement are the same as those selected for the measurement of light. These are described in this chapters section that measures the light or density of portions of an image.

Table 7: Color changes in *Panic and Human Shields in Basra*

Quadrant	Selection Point	Color	Color Value Composite	Color Value Iraqi	Color Value Soldier	Difference
H6	1	Red	124	-	138	+14
		Green	158	-	158	-
		Blue	158	-	168	+10
J6	2	Red	102	-	140	+38
		Green	139	-	160	+21
		Blue	141	-	170	+29
T7	3	Red	123	154	-	+31
		Green	156	171	-	+15
		Blue	159	178	-	+19
V6	4	Red	93	141	-	+48
		Green	130	160	-	+30
		Blue	135	173	-	+38

Note. Non-applicable values are designated with a -.

Spatial Organization

When compositing the original, unaltered two images together (soldier and Iraqi) Walski chose to make noticeable and measurable changes in those images' size, scale and proximity. The findings reported below were determined with the use of the grid overlay in conjunction with Photoshop's measure tool as described in the methods section of this paper. All measurements reported for this section of the study are illustrated in inches.

Table 8: Baseline Measurements Recorded For Each the Images

Image	Size		Scale	Proximity (eyelines)
	Soldier	Iraqi		
Composite	5.088 in.	3.039 in.	-2.049 in. 59.7%	2.389 in. (H2 to R8)
Iraqi	4.798 in.	2.739 in.	-2.059 in. 56.8%	2.701 in. (G3 to Q7)
Soldier	4.40 in.	2.719 in.	-1.681 in. 61.8%	3.110 in. (F4 to R7)

Table 8 shows the baseline measurements that were recorded for each of the images including each of the original, unaltered images as well as the final composite. These measurements show specific dimensions of size, scale and proximity between the two main subjects (soldier and Iraqi) of Brian Walski's image, *Panic and Human Shields in Basra.*

As these findings indicate, Walski increased the overall size of the British soldier by 0.688 in. or 15.63% in the final composite. In comparison, the Iraqi in the composite was increased by only 0.309 in. or 10.98%. In regards to scale, or the relative size of one element compared with another, there is a 59.7% difference between the Iraqi and the soldier in the composite as opposed to the 56.8% and 61.8% difference between those two image elements in the two original, unaltered images respectively. Additionally, in the final composited version, Walski changed the proximity of the soldier and the Iraqi by making them closer together. The composited version has the soldier and Iraqi 2.389 in. away from one another which is a shorter distance than the two previous unaltered versions of the images which measure 2.701 in. and 3.11 in. respectively.

Table 9: Light Values Recorded For Each Image

Image	Quadrant H6 (selection point 1)	Quadrant J6 (selection point 2)	Difference	Quadrant T7 (selection point 3)	Quadrant V6 (selection point 4)	Difference
Iraqi Black Value (K%)	-	-	-	42%	46%	+4%
Soldier Black Value (K%)	48%	46%	-2%	-	-	-
Composite Black Value (K%)	47%	57%	+10%	49%	61%	+12%

Note. Non-applicable values are designated with a -.

Table 9 illustrates the differences in the black values of various selection points throughout each of the three images selected for study. Findings in the analysis of density measurements taken using the color sample tool indicate various increases in density in the selection points chosen for this study. A total of four selection points (the maximum that Photoshop allows) were placed throughout the image for the purposes of this analysis. The quadrant locations were chosen because after performing a basic visual overview of the images in each of their iterations; it appeared to the naked eye that burning and dodging techniques to increase density were used around the perimeter of each of the heads of the soldier and the Iraqi.

Therefore, based on this initial analysis, quadrant location H6 was selected because it was located within ¼ inch of the perimeter of the face of the soldier, while quadrant location J6, which measures ½ inch away from quadrant location H6 on a vertical plane

was selected for comparison. The data indicates that there was 12% increase in the density within this ½ inch measurement from the original, unaltered image of the soldier to the final composite.

Similarly, quadrant location T7 was selected for the first selection point because of its close proximity to the face of the Iraqi while selection point four was placed at quadrant location V6, which measures ½ inch away at a slightly angled plane. The difference between these two selection points indicated an 8% increase in the density between the original, unaltered image of the Iraqi and the final composite print.

Madrid Train Bombing

Content

Table 10: Cropping of Madrid Train Bombing Image, Comparison of *El Pais* and the *Los Angeles Times*

Image	**Perimeter Quadrants** (location of frame)	**Description**	**Difference**
El Pais	A1-Bb1 (Top)	Some sky, buildings, and train	-
El Pais	A20-Bb20 (Bottom)	Rocks, train tracks and debris and bloodied femur at quadrant locations: G-I15, and G16, injured individual laying down at quadrant locations: Q-R 15-16 and S-T 15-17	-
El Pais	A1-A20 (Left)	Train, debris, and boy wearing blue cap standing in quadrant locations, A6-A11	-
El Pais	Bb1-Bb20 (Right)	train, train tracks, debris, with injured passenger at quadrant locations: Y2-Y4 and X2-X4	-
Los Angeles Times	A1-X1 (Top)	Some sky, buildings, and train	-
Los Angeles Times	A15-X15 (Bottom)	Rocks, train tracks and debris	Removal of 1.28 in. injured passenger laying down and bloodied femur not included in frame
Los Angeles Times	A1-A15 (Left)	Train, debris, and boy wearing blue cap standing in quadrant locations, A6-A11	-
Los Angeles Times	X1-X15 (Right)	train, train tracks, debris	Removal of 1.02 in. injured passenger not included in frame

Note. Non-applicable values are designated with a -.

Table 10 illustrates that just over one inch was cropped from the right and bottom of the image printed in the *Los Angeles Times,* March 12, 2004. Contained within the inch that was removed are three injured individuals and the bloodied femur.

Table 11: Cloning of Madrid Train Bombing Image, Comparison of *El Pais* and the *Daily Telegraph*

Image	Quadrants	Description
El Pais	G-I 15-26 and G 16	Bloodied femur bone
Daily Telegraph	G-I 15-26 and G 16	Rocks

Table 11 illustrates that the *Daily Telegraph* used image manipulation techniques to remove the bloodied femur by placing adjacent image content over it. The most likely tool used to perform this function in Adobe® Photoshop is the clone stamp tool.

Color

Table 12 illustrates the baseline color measurements that were recorded for each of the color values of red, green and blue in the original, unaltered image of the Madrid Train Bombing as well as the manipulated version that was printed in the *Guardian*. The area of the image under question in this analysis was that of the bloodied femur bone found in quadrant locations: G15, H15, I15, and G16. Each of the four quadrant locations were measured for their mix of red, green and blue color values using the color sample tool set for a 3x3 average analysis.

Table 12: Color of Madrid Train Bombing Image, Comparison of *El Pais* and the *Guardian*

Quadrant	Selection Point	Color	Color Value *El Pais*	Color Value *Guardian*	Difference
G15	1	Red	191	171	-20
		Green	100	151	+51
		Blue	110	148	+38
H15	2	Red	239	208	-31
		Green	173	198	+25
		Blue	159	188	+29
I15	3	Red	202	202	0
		Green	85	164	+79
		Blue	86	142	+56
G16	4	Red	151	117	-34
		Green	75	96	+21
		Blue	75	88	+13

Color is a dynamic image dimension to measure. It is important to note that the way that each individual color is displayed is equally dependent upon the values of red, green and blue. For example, there is no difference in the red value of quadrant location I15 across the two images used for this study, however, there are substantial additions of the colors green (+56) and blue (+79) to that selection point, thereby rendering the appearance of the red value less vibrant. All four selection points showed a change in one or more of the colors red, green and blue including a decrease of -34 points of red in quadrant location G16 from the *Guardian* to the original, unaltered image taken and published in *El Pais*.

Spatial Organization

There was not a noticeable change in the categories of size, scale or proximity for this image. For the purposes of this study, the dimension of spatial organization is examined using Brian Walski's *Panic and Human Shields in Basra*.

Light

There was not a noticeable change in the category of light for this image. For the purposes of this study, the dimension of light is examined using Brian Walski's *Panic and Human Shields in Basra.*

Summary

Results of these analyses suggest that distinct and quantifiable changes were made to each of Rose's (2007) four dimensions of aesthetic image elements as set forth through her method of compositional interpretation over the two images selected for this study. Overall, the findings agree with previous research that delineate image manipulation as 1) the addition, subtraction, or change of position or scale of content within an image, 2) an intentional change in the density or exposure of part or all of an image, and 3) an intentional change in color in part or all of an image (Brugioni, 1999; Reaves, 1987; Vernon, 1997; Wheeler, 2002).

CHAPTER 7

DISCUSSION

This paper seeks to introduce and discuss new techniques and vocabulary used to examine images that have been manipulated. The methods developed for this study build on prior means of qualitative image analysis and theories of image reception and syntax. This paper proposes a set of quantitative techniques that provides a systematic approach to identifying specific characteristics of images that have been changed. These characteristics are based on the image analysis tools of Gillian Rose (2007) that include: content, color, spatial organization, and light. The strength of the techniques proposed in the current project is that they provide ways to clearly measure and compare subtle differences across images in order to identify how and to what extent they have been manipulated.

This technique does not propose qualitative assessments of what manipulations might *mean* to viewers, but instead provides a starting point from which such changes can be identified and measured. It is important to note that these techniques are most powerful when used to compare different versions of the same image; they are not intended as a means to determine *if* images have been manipulated.

In order to demonstrate this technique, the current study examined two images: Brian Walski's *Panic and Human Shields in Basra* and Pablo Torres Guerrero's photograph of the Madrid Train Bombing. Quantitative methods for measuring the changes that images

undergo were developed using Adobe® Photoshop. Through a careful analysis using the systematic and quantitative methods developed by this study, these images were shown to have undergone a variety of changes through image manipulation. These changes were measured along the four dimensions of content, color, spatial organization, and light. Results suggest that the techniques used to measure these dimensions results in a clear analysis of the specific changes made.

Cases

Brian Walski's image *Panic and Human Shields in Basra* created and printed in the *Los Angeles Times* in 2003 was discovered to have been manipulated because of recurring artifacts found in the background. Using the methods developed for this study, additional manipulations were discovered, measured and documented. When compositing the two images, this study determined that Walski also changed the overall sizes of the British soldier and the Iraqi as well as the relationship of those sizes (scale) to one another. Additional analysis regarding measurement found that the soldier and Iraqi were moved closer to one another in the final composite image.

It takes little more than a cursory comparison between the final composited file and the original, unaltered images to determine that the final image underwent changes to the density. Using the techniques developed for this study, those density changes were measured and documented to exist at levels reaching an increase in density of 12% (soldier) and 8% (Iraqi). When measuring color shifts from the same image locations as those measured for density, this study found there to be changes in all three dimensions of color: red, green and blue. In fact, in one such image quadrant location, V6, there was

an increase of red, green and blue measured from the original, unaltered image to the final composite print of 48 points, 30 points, and 38 points respectively.

Using the methods developed by this study allowed for a thorough analysis to be conducted of the changes that Brian Walski made to his image, *Panic and Human Shields in Basra* prior to its publication in the *Los Angeles Times.*

Pablo Torres Guerrero's image of the Madrid Train Bombing was selected for this study because of the diverse methods of manipulation that various publications used when dealing with the bloodied femur in the bottom portion of the image. The analysis performed by this study shows that cropping, de-saturation, and cloning methods were used to keep the viewer's attention away from this potentially offensive image element.

Cropping the image effectively removed several elements that may have been offensive to the viewer by the standards of the *Los Angeles Times.* As this paper has shown, cropping is often employed and rarely thought to be a function of image manipulation. However, cropping 1.28 in. from the bottom of the frame and 1.02 in. from the right of the frame removed the bloodied femur just as surely as the method of cloning did. Cloning the rocks from an adjacent portion of the image over the bloodied femur eradicated it without leaving a trace. Both methods: cropping and cloning, served to remove the image element in question. Whereas cropping has historically been regarded as an acceptable means to remove image content, cloning is often regarded as a means of manipulation. It is the contention of this paper that both of these methods often serve the same purpose and carry the same implications.

The de-saturation method of diverting the viewer's attention is of particular interest because in removing the red through adding blue and green, the publication helps to

make the argument that colors contain powerful associative meaning. In performing this manipulation, the *Guardian* acknowledges that red can be an influential device in the reception and understanding of images. Therefore, measuring the degrees of this manipulation provides some insight as to what this publication may believe to be acceptable parameters of image change.

Relevance

The development of this new method for analyzing the changes that images undergo as a result of image manipulation is intended to supplement existing theoretical frameworks and help facilitate additional research. The ability to systematically and objectively measure components of images can further research in image syntax (Dondis, 1973; Gombrich, 2000; Rose, 2007), image manipulation detection (Johnson & Farid, 2005, 2006b; Nishino & Nayar, 2004; Popescu & Farid, 2004) and the reception of images (Kress & van Leeuwen, 1996; Meyrowitz, 1986; Saint-Martin, 1990). Semiotic analyses – that is, those concerned with what images actually mean to viewers – can be strengthened with the clear identification of specific changes offered by the techniques used in the present study. This study bridges the gap between image syntax and semiology. It further develops the elements of image composition through researchers such as Rose (2007) and in doing so produces a new theoretical framework by which to analyze images. The study of changes that images undergo as a result of image manipulation may provide great insight to further studies concerned with image reception, understanding and the motivations that an increasing number of individuals have to make those manipulations.

This research could help the journalism community establish universal standards for types and degrees of image manipulation that are acceptable based on known, potential shifts in audience reception as a result of those changes. The aesthetic optimization of images is often necessary in news publications, and this study's analysis of dimensions such as color and light aim to provide a framework for identifying the boundary between image optimization and manipulation.

The National Press Photographers Association's (NPPA) code of ethics states that "photographs can...cause great harm if they are...manipulated" (NPPA, ¶ 3, 2008). The Society of Professional Journalists (SPJ) code of ethics argues that "image enhancement for technical clarity is always permissible" (SPJ, ¶ 3, 1996). The *Los Angeles Times'* ethical guidelines explains that they "do not digitally alter images beyond making *minor* adjustments for color correction [and] exposure correction...required to ensure faithful reproduction of the original image" and that "*exaggerated* use of burning, dodging, or color saturation is not permitted" (The Los Angeles Times, ¶ 38, 2005, emphasis added). Similarly, the *New York Times* argues that "adjustments of color or gray scale should be limited to those *minimally necessary* for clear and accurate reproduction; analogous to the "burning" and "dodging" that formerly took place in darkroom processing of images" (The New York Times, ¶ 17, 2000, emphasis added).

While such guidelines seem to be increasingly important in the wake of image manipulation scandals such as that surrounding Brian Walski's termination, terms such as *minor, exaggerated,* and *minimally necessary* remain vague and unquantified. The present techniques can provide, through a systematic measurement system usable by anyone with modest knowledge of Photoshop, a way to identify specific levels of change

such ethical guidelines would permit. For example, instead of "minor," guidelines could specify the number of points on the red measurement scale an image could ethically be altered, or the exact number of inches that may be cropped from an image.

Some unique and relevant factors in this research are that no extensive computer science experience is necessary and if individuals are already using Photoshop to manipulate images then the tools used by this research to measure manipulation are already available and understandable.

Limitations

Using quantitative tools to analyze qualitative areas of images has some limitations. The initial difficulty in conducting this research is that the image to be studied must be available in its original, unaltered format as well as in its manipulated state. Procuring both original and altered versions can be difficult, as once images are demonstrated to have been manipulated, websites often remove them.

First, Rose's (2007) guidelines were used by this study to identify areas of images to further investigate with the quantitative methods developed herein. Using Rose as a theoretical framework relies on the underlying assumption that Rose's four elements are indeed important. Although her work is widely cited and well developed, it is possible that these elements, especially those that are changed in subtle ways, do not actually affect understandings and meanings of images. This study does not actually consider the potential meanings associated with these qualitative changes. Rather, the method is intended to function strictly as a means of measurement that aims to facilitate additional

research leading to greater generalizations and research into the impact of image manipulation.

Second, this study's findings rely on attaining accurate numerical values associated with the four aesthetic dimensions used. The images selected for comparative analysis in this study were downloaded from different websites, which reduces the reliability in two specific areas: color and light. It is important to note that the same issues would have been encountered if the images had been scanned into a computer from the various newspapers partially because scanning software automatically optimizes color and density levels. As noted above, the source of the images used for analysis is important, and comparing, for example, a scanned image with its digital version can result in unpredictable differences in the dimensions studied, especially color and light. Additional problematic variables may occur when scanning newspapers. Newspapers sometimes fade or may discolor with age and unless attained from the newspaper publisher itself or a library, there may be damage to it that interferes with its color or density quality as a result of rain or soiling.

A third potential problem for the use of this method lies in technologies used. Individual computer monitors interpret and display colors and density differently. However, computers and monitors can go through a process called *calibration* prior to conducting these methods of measurement in order to ensure that color and density values are represented accurately. Adobe's ® help resource explains that calibrating a computer monitor's color is the process by which the monitor is brought into compliance with a universal and pre-defined standard. Theoretically, if two separate computer

monitors were calibrated using Adobe's ® Gamma calibration software and the same analyses were conducted; the results would be the same.

The computer monitor used for the analysis of these images was color calibrated using Adobe's ® Gamma calibration software that installs as a part of Adobe® Photoshop. There are other software programs available that perform similar calibration functions, however using Adobe's ® version provided an additional level of consistency to this study.

As previously discussed, Rose's (2007) fifth dimension of compositional interpretation of expressive content was not discussed. This study's goal was to add an element of objective measurement into the process of evaluating images based on their aesthetic dimensions. Compositional interpretation provided a framework of the first four elements: content, color, spatial organization, and light, which were largely supported in additional existing research (Arnheim, 1974; Dondis, 1973; Gombrich, 2000; Messaris, 1994; Zettl, 2005). Future research should explore techniques that could incorporate examinations of expressive content with quantitative measurements of image content, color, spatial organization, and light.

Future research can also combine the techniques suggested here with semiotic studies of interpretations of the visual imagery displayed. Future semiological research may use quantitative measurements of image characteristics as a starting point, including the present techniques as building blocks to a broader analysis of not only aesthetic image elements but of what the specific changes that they undergo may mean and how they affect the audience's reception and understanding of visual imagery.

Technology is a rapidly progressing cultural force that may evolve faster than society's ability to explore and use it to its fullest potential. Software such as Adobe® Photoshop continues to offer new tools and functions at a breakneck pace to both manipulate images and measure those manipulations. These powerful tools must be continually evaluated for potential use in the unique ways that have been shown in this study in order to help further research.

APPENDIX

Figure 13. Panic and Human Shields in Basra, composite image with grid, Brian Walski, 2003

Figure 14. Unaltered image used for Iraqi man holding child with grid, Brian Walski, 2003,

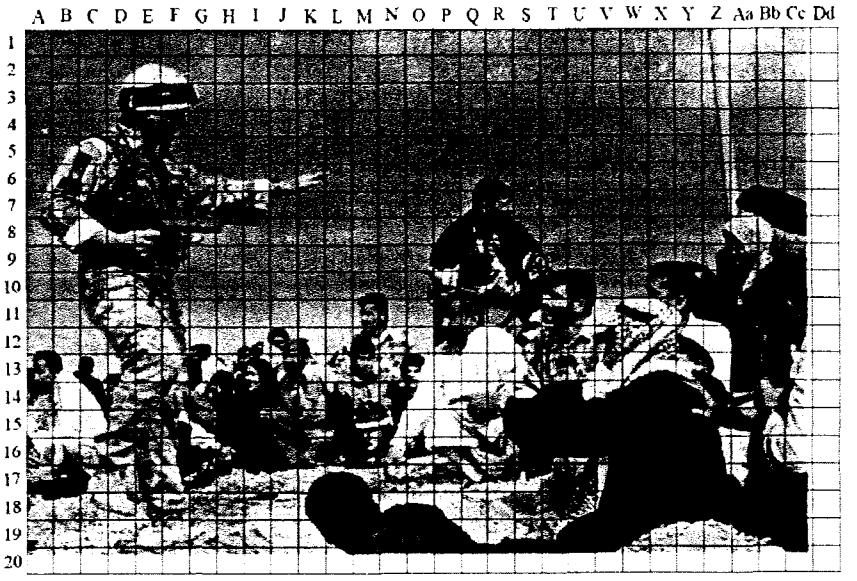

Figure 15. Unaltered image used for soldier with grid, Brian Walski, 2003,

Figure 16. Madrid Train Bombing, Original, Unaltered Image, *El Pais* with grid, Pablo Torres Guerrero, 2004

Figure 17. Madrid Train Bombing, *Los Angeles Times*, Crop with grid, Pablo Torres Guerrero, 2004

Figure 18. Madrid Train Bombing, *Daily Telegraph*, Cloning with grid, Pablo Torres Guerrero, 2004

Figure 19. Madrid Train Bombing, *Guardian* with grid, Desaturate, Pablo Torres Guerrero, 2004

REFERENCES

Aday, S., Cluverius, J., & Livingston, S. (2005). As goes the statue, so goes the war: The emergence of the victory frame in television coverage of the Iraq war. *Journal of Broadcasting and Electronic Media, 49*, 314-331.

Arnheim, R. (1974). *Art and visual perception: A psychology of the creative eye.* Berkeley: University of California Press.

Bal, M. (1991). *Reading Rembrandt: Beyond the word-image opposition.* Cambridge: Cambridge University Press.

Barnett, G., & Peres, M. R. (2007). Photography's dependance on equipment. In M. R. Peres (Ed.), *Focal encyclopedia of photography: Digital imaging, theory and applications, history, and science* (4th ed., pp. 297-300). Burlington, Massachusetts: Focal Press.

Barthes, R. (1977). *Image, Music, Text.* New York: Hill and Wang.

Baudrillard, J. (2002). *Jean Baudrillard: Selected writings.* (M. Poster, Ed., & J. Mourrain, Trans.) Stanford: Stanford University Press.

Becker, K. E. (1991). To control our image: Photojournalists and new technology. *Media, Culture and Society, 13*, 381-397.

Biederman, I. (1987). Recognition-by-components: A theory of human image understanding. *Psychological Review, 94*(2), 115-147.

Brugioni, D. A. (1999). *Photo fakery: The history and techniques of photographic deception and manipulation.* Dulles, Virginia: Brassey's.

Cook, G. (2006, January 11). Technology seen abetting manipulation of research. *The Boston Globe* . Retrieved March 15, 2008, from http://www.boston.com/news/science/articles/2006/01/11/technology_seen_abetting_manipulation_of_research/

Cope, P. (2001). *The Photoshop user's encyclopedia.* New York: Friedman/Fairfax.

Cozens, C. (2004, March 12). *Editors 'cleanup' bomb photo.* Retrieved March 26, 2008, from www.guardian.co.uk: www.guardian.co.ok/media/2004/mar/12/pressandpblishing.spain

Day, L. A. (1991). *Ethics in media communications: Cases and controversies.* Belmont, California: Wadsworth Publishing Company.

Dondis, D. A. (1973). *A primer of visual literacy.* Cambridge: MIT Press.

Doughty, M. (2007, October 14). *Two kinds of color: Color models*. Retrieved April 14, 2008, http://www.sketchpad.net/basics4.htm

Evans, M. P. (2007). Academic and pedagogical issues: The impact of digital imaging on photographic education. In M. R. Peres (Ed.), *Focal encyclopedia of photography: Digital imaging, theory and applications, history, and science* (4th ed., pp. 441-446). Burlington, Massachusetts: Focal Press.

Fahmy, S. (2007). "They took it down": Exploring determinants of visual reporting in the toppling of the saddam statue in national and international newspapers. *Mass Communication and Society, 10*(2), 143-170.

Farid, H. (2007 (in press)). *Deception: Methods, motives, contexts and consequences.* Palo Alto, California: Stanford University Press.

Farid, H. (1999). *Detecting digital forgeries using bispectral analysis.* Technical Report, Massachsetts Institute of Technology, AI Lab, Cambridge.

Farid, H. (2006). *Digital image ballistics from quantization.* Technical Report, Dartmouth College, Department of Computer Science, Hanover.

Farid, H. (n.d.). *Ma'at Consulting*. Retrieved March 4, 2008, from http://hanyfarid.org/maat/

Farid, H., & Popescu, A. C. (2005a). Exposing digital forgeries by detecting traces of re-sampling. *IEEE Transactions on Signal Processing, 53*(2), 758-767.

Farid, H., & Popescu, A. C. (2005b). Exposing digital forgeries in color filter array interpolated images. *IEEE Transactions on Signal Processing, 53*(10), 3948-3959.

Fishman, J. M. (2003). News norms and emotions: Pictures of pain and metaphors of distress. In L. Gross, J. S. Katz, & J. Ruby, *Image ethics in the digital age* (pp. 53-69). Minneapolis, Minnesota: University of Mineapolis Press.

Forceville, C. (1999). Educating the eye? Kress and van Leeuwen's reading images: The grammar of visual design. *Language and Literature, 8*(2), 163-178.

Fraser, B. (2005). *Real world camera raw with Adobe® Photoshop CS: Industrial-strength production techniques.* Berkeley: Peachpit Press.

Frey, F. S. (2007). Digital: A maturing technology. In M. R. Peres (Ed.), *Focal encyclopedia of photography: Digital imaging, theory and applications, history, and science* (4th ed., pp. 357-358). Burlington, Massachusetts: Focal Press.

Fridrich, J., Soukal, D., & Lukas, J. (2003). Detection of copy-move forgery in digital images. *Proceedings of Digital Forensic Research Workshop.* Cleveland.

Gavard, S. (1999). *Photo-graft: A critical analysis of image manipulation.* Unpublished doctoral dissertation, McGill University, Canada.

Gefter, P. (2006, Winter). Photographic icons. *Aperture 185*, 50-55.

Gombrich, E. (2000). *Art and illusion: A study in the psychology of pictorial representation* (2nd ed.). New York: Princeton University Press.

Hariman, R., & Lucaites, J. L. (2003). Public identity and the collective memory in U.S. iconic photography: The image of "accidental napalm." *Critical Studies in Media Communication, 20*(1), 35-66.

Hartley, R., & Zisserman, A. (2004). *Multiple view geometry in computer vision* (2nd ed.). Cambridge: Cambridge University Press.

Hicks, W. (1973). *Words and pictures: The literature of photography.* New York: Arno Company.

Holly, M. A. (1996). *Past looking: Historical imagination and the rhetoric of the image.* Ithaca: Cornell University Press.

Irby, K. (2004, March 29). *Beyond taste: Editing truth.* Retrieved February 26, 2008, from http://www.poynter.org/content/content_view.asp?id=63131

Irby, K. (2003a, September 25). *Charlotte Observer photo correction/editing guidelines.* Retrieved February 26, 2008, from http://www.poynter.org/content/content_view.asp?id=46958

Irby, K. (2003b, April 2). *L.A. Times photographer fired over altered photograph.* Retrieved March 20, 2008, from http://www.poynteronline.org/content/content_view.asp?id=28082

Irby, K. (2003c, September 25). *Suspended photographer focuses on ethics.* Retrieved February 26, 2008, from http://poynter.org/content/content_view.asp?id=47867

Jay, M. (1993). *Downcast eyes: The denigration of vision in twentieth-century French thought.* Berkeley, California: California University Press.

Johnson, M. K. (2007). Lighting and optical tools for image forensics. Hanover, New Hampshire: Dartmouth College.

Johnson, M. K., & Farid, H. (2005). Exposing digital forgeries by detecting inconsistencies in lighting. *ACM Multimedia and Security Workshop.* New York.

Johnson, M. K., & Farid, H. (2006a). Exposing digital forgeries through chromatic aberration. *ACM Multimedia and Security Workshop.* Geneva, Switzerland.

Johnson, M. K., & Farid, H. (2007). Exposing digital forgeries through specular highlights on the eye. *9th International Workshop on Information Hiding.* Saint Malo, France.

Johnson, M. K., & Farid, H. (2006b). *Metric measurements on a plane from a single image.* Technical Report, Dartmouth College, Department of Computer Science, Hanover, New Hampshire.

Jussim, E. (1989). *The eternal moment: Essays on the photographic image.* New York: Aperture Foundation.

Keeler, N. (1984). The calotype and aesthetics in early photography. In R. R. Brettell, R. Flukinger, N. Keeler, & S. M. Kilgore, *Paper and light: The calotype in France and Great Britain, 1839-1870* (pp. 11-46). Boston: David R. Godine.

Keith, S., Schwalbe, C. B., & Silcock, B. (2006). Images in ethics codes in an era of violence and tragedy. *Journal of Mass Media Ethics, 21*(4), 245-264.

Kepes, G. (1995). *Language of vision.* New York: Dover Publications.

King, D. (1997). *The commissar vanishes: The falsification of photographs and art in Stalin's Russia.* New York: Metropolitan Books.

Kress, G., & van Leeuwen, T. (1996). *Reading images: The grammar of visual design.* New York: Routledge.

Kuh, K. (1951). *Art has many faces: The nature of art presented visually.* New York: Harper & Brothers.

Lambrecht, R. W. (2007). From exposure to print: The essentials of silver-halide photography required for long-lasting, high-quality prints. In M. R. Peres (Ed.), *Focal encyclopedia of photography: Digital imaging, theory and applications, history, and science* (4th ed., pp. 664-692). Burlington, Massachusetts: Focal Press

Lester, P.M. (2006a). *Syntactic theory of visual communication.* Retrieved March 23, 2008, from http://commfaculty.fullerton.edu/lester/writings/viscomtheory.html

Lester, P.M. (2006b). Urban screens: The beginning of a universal visual culture. *First Monday* (4).

Liebowitz, D., & Zisserman, A. (1998). Metric rectification for perspective images of planes. *Computer Vision and Pattern Recognition*, 482-488.

Lowrey, W. (2003). Normative conflict in the newsroom: The case of digital photo manipulation. *Journal of Mass Media Ethics, 18*(2), 123-142.

Lule, J. (1995). Enduring images of war: Myth and ideology in a Newsweek cover. *Journal of Popular Culture, 29*, 199-211.

Marchessault, J., & Wasson, H. (1998). Eyewitness history: New technologies and the production of visual evidence. *Convergence, 4*(3), 17-23.

Martin, E. (1991). On photographic manipulation. *Journal of Mass Media Ethics, 6*(3), 156-163.

McCombs, M., & Shaw, D. (1972). The agenda-setting function of mass media. *Public Opinion Quarterly, 36*, 176-187.

Mendelson, A., & Thorson, E. (2003). The impact of role congruency and photo presence on the processing of news stories about Hillary Clinton. *The New Jersey Journal of Communication, 11*, 135-148.

Messaris, P. (1994). *Visual literacy: Image, mind, & reality.* Boulder, Colorado: Westview Press.

Meyrowitz, J. (1986). Television and interpersonal behavior: Codes of perception and response. In G. Gumpert, & R. Cathcart (Eds.), *Inter/media: Interpersonal communication in a media world* (3rd ed., pp. 253-272). New York: Oxford University Press.

National Press Photographers Association. (2008). *NPPA Code of Ethics*. Retrieved April 15, 2008, from http://www.nppa.org/professional_development/business_practices/ethics.html

Newhall, B. (1982). *The history of photography: 1839 to the present* (5th ed.). New York: Museum of Modern Art.

Nishino, K., & Nayar, S. K. (2004). Eyes for relighting. *ACM Transactions on Graphics, 23*(3), 704-711.

Observer photographer loses awards. (2003, August 15). *The Charlotte Observer*, pp. 1B, 5B.

Ostrovsky, Y., Cavanagh, P., & Sinha, P. (2005). Perceiving illumination inconsistencies in scenes. *Perception, 34*, 1301-1314.

Panzer, M. (1997). *Mathew Brady and the image of history.* Washington: Smithsonian Institution Press.

Parsons, P. R., & Smith, W. E. (1988). R. Budd Dwyer: A case study in newsroom decision making. *Journal of Mass Media Ethics, 3*(1), 84-94.

Pascale, D. (2003). A review of RGB color spaces: From xyY to R'G'B'. Montreal, Quebec, Canada.

PDN Online. (2003, August 21). *NCPPA strips photog's POY awards.* Retrieved February 26, 2008, from pdn online: http://www.pdnonline.com/pdn/search/article_display.jsp?vnu_content_id=1963706

Popescu, A. C., & Farid, H. (2004). *Exposing digital forgeries by detecting duplicated image regions.* Technical Report, Dartmouth College, Department of Computer Science, Hanover.

Potter, L. (1995). Altered realities: The effect of digital imaging technology on libel and right to privacy. *Hastings Communication and Entertainment Law Journal, 17*, 495-528.

Reaves, S. (1987). Digital retouching. *News Photographer, 42*(11), 23-24, 26-33.

Reuters. (n.d.). *About.* Retrieved March 20, 2008, from www.Reuters.com: http://about.reuters.com/home/

Ritchin, F. (1990). *In our own image: The coming revolution in photography, how computer technology is changing our view of the world.* New York: Aperture.

Rogoff, I. (1998). Studying visual culture. In N. Mirzoeff (Ed.), *The visual culture reader* (2nd ed., pp. 14-26). London: Routledge.

Rose, G. (2007). *Visual Methodologies: An introduction to the interpretation of visual materials* (2nd ed.). London: SAGE Publications, Ltd.

Rothstein, A. (1986). *Documentary photography.* Boston: Focal Press.

Rothstein, A. (1979). *Photojournalism* (4th ed.). Garden City, New York: American Photographic Book Publishing Company.

Saint-Martin, F. (1990). *Semiotics of visual language.* Bloomington: Indiana University Press.

Schwartz, D. (1999). Pictorial journalism: Photographs as facts. In B. Brennen, & H. Hardt (Eds.), *Pictures in the public sphere: Studies in photography, history and the press.* Champaign, Illinois: University of Illinois.

Schwartz, D. (2003). Professional oversight: Policing the credibility of photojournalism. In L. Gross, J. S. Katz, & J. Ruby, *Image ethics in the digital age* (pp. 27-51). Minneapolis : University of Minnesota Press.

Shachtman, N. (2002, July 22). *For doctored photos, a new flavor of digital truth serum.* Retrieved March 3, 2008, from http://www.cs.dartmouth.edu/farid/press/nyt04/nyt04.html

Sinha, P. (2000). Perceiving illumination inconsistencies. *Investigative Opthalmology and Visual Science, 41*(4), 1192.

Society of Professional Journalists. (1996). *Code of Ethics*. Retrieved April 14, 2008, from http://www.spj.org/ethicscode.asp

Sontag, S. (1977). *On Photography.* New York: Picador.

Sontag, S. (2003). *Regarding the pain of others.* New York: Picador.

Stepan, P. (Ed.). (2006). *Photos that changed the world: The 20th century.* Munich: Prestel Verlag.

Stepno, B. (1997). *Staged, faked and mostly naked: Photographic innovation at the Evening Graphic (1924-1932).* Paper presented at the Association for Education in Journalism and Mass Communication, Chicago.

Süsstrunk, S., Buckley, R., & Swen, S. (1999). Standard RGB color spaces. *IS&T/SID 7th Color Imaging Conference, 7*, 127-134.

Taylor, J. (1957). *Learning to look: A handbook for the visual arts.* Chicago: Chicago University Press.

The Los Angeles Times. (2005, October 17). *Code of Ethics: The Los Angeles Times.* Retrieved April 15, 2008, from http://www.asne.org/ideas/codes/losangelestimes.htm

The New York Times. (2000). *The New York Times: Guidelines on Our Integrity.* Retrieved April 14, 2008, from http://www.asne.org/index.cfm?id=408

Tirohl, B. (2000). The photo-journalist and the changing news image. *New Media and Society, 2*(3), 335-352.

Vernon, M. E. (1997). *The credibility of news photography in the digital age.* Unpublished dissertation. University of Nevada, Las Vegas.

Vitray, L., Mills, J., & Ellard, R. (1939). *Pictorial journalism.* New York: McGraw-Hill.

Walker, D. (2003, May 7). *Brian Walski discussed his doctored photo.* Retrieved March 20, 2008, from http://www.pdnonline.com/pdn/search/article_display.jsp?vnu_content_id=1000456607

Wheeler, T. H. (2002). *Phototruth or photofiction? Ethics and media imagery in the digital age.* Mahwah, New Jersey: Lawrence Erlbaum Associates.

Whitely, N. (1999). Readers of the lost art: Visuality and particularity in art criticism. In I. Heywood, & B. Sandywell (Eds.), *Interpreting visual culture: Explorations in the Hermeneutics of the visual* (pp. 99-122). London: Routledge.

Yochelson, B. (2001). *Jacob Riis.* New York: Phaidon Press Inc.

Zakia, R. (2007). Perception, evidence, truth and seeing. In M. R. Peres (Ed.), *Focal encyclopedia of photography: Digital imaging, theory and applications, history, and science* (4th ed., pp. 460-469). Burlington: Focal Press.

Zettl, H. (2005). *Sight sound motion: Applied media aesthetics* (4th ed.). Belmont, California: Thomson Wadsworth.

Zillman, D., Knobloch, S., & Yu, H. (2001). Effects of photographs on the selective reading of news reports. *Media Psychology, 3*, 301-324.

VITA

Graduate College
University of Nevada, Las Vegas

Tracilee Rose Hoffman

Home Address:
6775 Shelter Lane
Las Vegas, Nevada 89103

Degrees:
Bachelor of Arts, Communication, 2001
University of Nevada, Las Vegas

Special Honor and Awards:
Member, Lambda Pi Eta, Communication Honor Society

Presentations and Conference Papers:
2006. "Gender partner and relational uncertainty as consequences of another person's jealousy expression" The 77th Annual Convention of Western States Communication Association. Palm Springs, CA. Feb 18-21.

2007. "Image manipulation: Past methods, present implications, future progress, a synthesis using Iraq war imagery" VISCOMM: The Visual Communication Conference. Estes Park, CO. June 13-17.

2008. "Image manipulation: Past methods, present implications, future progress" William A. Kern Conference, Visual Communication: Rhetorics and Technology. Rochester, NY. April 10-13.

Thesis Title:
Image Manipulation: Photoshop as a Data-Measurement Tool

Thesis Examination Committee:
Chairperson, Dr. Lawrence Mullen, Ph. D.
Committee Member, Dr. Paul Traudt, Ph. D.
Committee Member, Dr. Gary Larson, Ph. D.
Outside Committee Member, Dr. Kate Hausbeck, Ph. D.