THE VISUAL APPEARANCE OF SKIN IN MOTION PICTURE

AND HOW TO SHAPE IT IN POST-PRODUCTION

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by

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ABSTRACT

People are usually the central point of every scene in motion pictures. As we are constantly surrounded by people, we are extremely familiar with skin tones and very sensitive to even the slightest inconsistencies. In addition, regularly changing technology and the increasing possibilities in color grading have made it a difficult task to achieve proper skin tones.

During film production, skin passes through many stages and different scenarios will need different decisions and adjustments. In order to gain a deeper understanding of how the visual appearance of skin is created, reproduced and shaped, this paper explores the different influences on skin which contribute to its final look.

KURZFASSUNG

Der Mensch ist für gewöhnlich der Kern eines jeden Bildes innerhalb einer Filmszene. Da wir tagtäglich von Menschen umgeben und mit deren Hauttönen vertraut sind, reagieren wir schon auf die kleinsten Veränderungen der Haut extrem sensibel. Durch die sich ständig erneuernden Technologien und die steigenden Möglichkeiten in der Farbkorrektur, ist es eine komplexe und diffizile Aufgabe geworden, angemessene Hauttöne zu erreichen.

Die Haut durchläuft während der Filmproduktion unterschiedlich viele Stufen, die je nach Szene oder Stil des Filmes verschiedene Entscheidungen und Anpassungen verlangen. Um ein besseres Verständnis dafür zu bekommen, wie das visuelle Erscheinungsbild der Haut entsteht, abgebildet und verformt wird, werden in dieser Arbeit die verschiedenen Einflüsse auf die Haut erforscht, welche am Ende zu einem finalen Gesamtbild beitragen.

CONTENTS

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1 INTRODUCTION

In this day and age, our world consists for the most part of digitized media. We are no longer bound to going to the cinema or sitting in front of our TV to watch a movie, documentary, series or whatever we want to see. We are overwhelmed by countless videos on social media, be it Facebook, Instagram or even paid on-demand-services like Netflix. This is the time when more videos than ever are being produced and color grading isn't reserved for big productions anymore. Technology is constantly progressing and the amount of possibilities given in post-production is overwhelming. Everyone wants a high-quality look, not only for cinema or TV but even for web content, and the need for talent in color work is growing.

Back in the 1980s, the only way to become a colorist was to start working as a tape assistant at a post house or television station and work your way up to finally color correct analog film, which often brought all kinds of issues. With the transition from analog to digital in the 1990s, many of these issues went away and colorists started getting noticed, especially for their outstanding color work on music videos. Back then, a color grading suite cost more than a million dollars and needed a lot of tech support. Although this craft still needs technical knowledge and artistic skill, color grading is luckily much more accessible today. (Hussey in Van Hurkman, 2013).

I stumbled upon the craft of color grading during my studies at the Media University Stuttgart. Since this discovery, I have been reading books and articles, watching countless tutorials on YouTube and practicing on many student projects to develop my skills. Amongst everything that I've been able to read about color grading, there was definitely one major theme which popped up everywhere: skin tones.

> *"Any colorist will tell you that half the job is grading skin tone."*
> - **VAN HURKMAN** (2013, Chapter 8)

Although it was a reoccuring issue, I couldn't find many sources that would go deeper into the craft of grading skin tones. It appeared as a secret artistry you would exclusively learn by experience. While that may be certainly true on one side, I still wanted to find out more about skin tones in order to become a better colorist.

What makes skin tones look good to us? How is skin being affected in motion pictures? Is skin related to storytelling? Why is it sometimes so difficult to fix skin in digital post-production and how can we shape it to our needs and desires?

With all those possibilities for tweaking images digitally, there's also a huge chance to get stuck by overdoing things and not knowing when to stop. Moreover, nowadays a colorist is more frequently confronted with poorly shot imagery, which most of the time is a result of limited budget, time, equipment or sometimes a simple lack of knowledge and preparation. *"We'll fix it in the post"* is a common phrase in the film industry. Sure, there are many things that can be fixed later on, but is it rational?

Looking out for a good recipe for natural skin tones, it turns out that it's a very subjective topic mostly depending on personal taste, which makes it difficult to handle entirely scientifically.

1.1 TALKING TO EXPERTS

As I was especially interested in getting an insight to what is being done at present in the industry, I reached out to as many professionals as possible to receive some answers. During my research, I realized that it was reasonable not only to contact colorists but also directors of photography (DP), gaffers, VFX as well as makeup artists. It was reassuring to find that especially the colorists were very interested in discussing this topic.

> *"You can really learn a lot from engaging with skin tones, which are the central point of the frame. When I heard about your thesis, the first thing that came to my mind was, that this is a really exciting topic which moves everyone in this industry."*
> - **STEFFEN PAUL** (personal communication)

The interviews were done in the form of a questionnaire either in writing () via e-mail or other platforms, phone () or video call (). It was very beneficial getting in touch with professionals as this allowed me to gain much more detailed information and a variety of opinions, thoughts and techniques for real-life application.

All interviews were carried out in July and August 2017. For fluidity of reading I will reference interviews only as "pc", referring to *personal communication*.

OVERVIEW OF CITED PARTICIPANTS

The below table shows the cited participants and some details of their work (and relevance to this thesis).

ADAM INGLIS *Senior Colorist*	Freelance London, UK	Planet Earth II (2016), Mr. Turner (2014), Dredd (2012), Sherlock Holmes (2009), Resident Evil (2004) etc.
ALEKSANDR VERKHOLIAK *Colorist*	Freelance Moscow, Russia	Eclipse (2017), Gemini (2017), Several features, TV series and commercials
ANDREAS BRÜCKL, CSI *Senior Colorist*	FutureWorks Mumbai, India	Commercials for L'Oréal, Puma, Google, Vodafone, Audi, Nestlé, Mavi Jeans etc.
ANDY MINUTH, CSI *Senior Colorist*	1000Volt Istanbul, Turkey	Berg II (2016), Big Game (2014); several commercials for Vodafone, Nescafé, Coca Cola, Danone etc.
ASA SHOUL *Senior Colorist*	Molinare London, UK	Baby Driver (2017), Ex Machina (2014), The American (2010) etc.
BJÖRN SUSEN *Gaffer*	Freelance Berlin, Germany	Dark (2017), Who Am I (2014), The Reader (2008), Goethe (2010) etc.
BLAKE JONES, CSI *Senior Colorist*	Freelance Munich, Germany	A Nightmare on Elm Street (1984), Poltergeist (1982), 2001: Space Odyssey (1968)
DAVID MULLEN, ASC *Director of Photography*	Freelance, Los Angeles, USA	Jennifer's Body (2009), Northfork (2003), Twin Falls Idaho (1999) etc.
FLORIAN 'UTSI' MARTIN *Senior Colorist*	ARRI Munich, Germany	Independence Day (2016), Die Wilden Kerle 7 (2016), Türkisch für Anfänger (2012) etc.
JOSH PETOK, CSI *Colorist*	Endemol Shine Group Los Angeles, USA	Fear Factor (MTV), Hunted (CBS), Superhuman (Fox) etc.
KATH RAISCH *Colorist*	Company 3 New York, USA	Commercials for Adidas, Nike, Kith/Coca Cola etc.; various short films and music videos

KEVIN SHAW, CSI *Senior Colorist / CEO*	Finalcolor UK	Streetdance 3D (2010), Transfer (2010); commercials for Jaguar, Nivea, Volvo; music videos for George Michael, Tina Turner etc.
KITTY KRATSCHKE *Makeup Artist*	Freelance, Berlin, Germany	Tschick (2016), Who Am I (2014), North Face (2008) etc.
LUKAS TIELKE *Director of Photography*	Peoplegrapher Düsseldorf, Germany	Commercials for Mercedes, BMW, VW, Ford, Vaude, Falke, Penny, Sennheiser, Fielmann etc.
MATT OSBORNE *Colorist*	The Mill Los Angeles, USA	Commercials for Jaguar, LG, H&M, Sky; Music videos for Tove Lo, Beyoncé etc.
NIK SUMMERER *Director of Photography*	Freelance Berlin, Germany	Who Am I (2014), Dark (2017), Under the Sun (2006) etc.
PARKER JARVIE *Senior Assistant Colorist*	Company 3 Chicago, USA	Commercials for GMC, Lindeblad Piano, several short films and music videos
ROB BESSETTE, CSI *Senior Colorist*	Finish Post Boston, USA	Commercials for Adidas, Bose, Reebok, Coca Cola, Toyota, Puma, Subway etc.
SEAN COLEMAN *Senior Colorist*	Company 3 Los Angeles, USA	Paper Towns (2015); Commercials for Nike, Old Spice, Audi, KFC; music videos for Flying Lotus, Justin Timberlake etc.
STEFFEN PAUL *Colorist*	ARRI Berlin, Germany	Dark (2017), Gut zu Vögeln (2016), Who Am I (2014), Cloud Atlas (2012)
STEVE HULLFISH, CSI *Creative Director*	Verascope Pictures, Naperville, USA	Author of *The Art and Technique of Digital Color Correction* (2013)

1.2 TARGET AUDIENCE

This paper is for all individuals who are involved in the film industry and who are already familiar with workflows of working on a film set and in post-production. As it is my intention to write this paper from the point of view of a colorist, this includes especially those who are interested in amplifying their knowledge of color grading. However, it could also be useful for directors and directors of photography in order to gain a deeper understanding of skin tones and how to control them by making creative as well as technical decisions.

The reader should have a basic knowledge of filmmaking, digital cinematography, color grading, digital intermediate workflow, and color theory as well as basic physics (light, optics).

1.3 STRUCTURE

This paper consists of 4 main parts.

After a short introduction in Chapter 2 to the craft of a colorist, the paper predominantely starts with Chapter 3 explaining the general background for skin color; how it is created by the biological structure as well as perceived and altered by the human brain. It addresses the cultural diversity of skin colors as well as individual preferences around the world.

Chapter 4 puts skin into context with storytelling. It demonstrates how creative choices by different departments on set can influence the skin and how it interacts with the overall look of the film.

Technical issues to properly reproduce skin tones are explained in Chapter 5. Recommendations are given to achieve a good starting point for tweaking skin tones in post-production.

The last chapter gives an overview of the various possibilties to shape skin in post-production. The techniques explained in the last chapter are not step-by-step-guides but should give an idea of how to deal with skin in different scenarios.

2 BEING A COLORIST

While *color correction* describes the process of making technical corrections to neutralize the picture, *color grading* refers to creating a stylistic look, *"relative to the narrative and artistic needs of a program"*, as Alexis Van Hurkman (2013, Introduction) describes. According to Van Hurkman, the craft of a colorist consists of a combination of the following steps:

1 | correcting errors of color and exposure
2 | balancing shots in a scene to match
3 | making key elements look right
4 | creating style
5 | creating depth
6 | adhering quality control standards

Digital high-end material is hardly ever distributed straight out of the camera. It is necessary to correct the picture to a neutral state by choosing appropriate exposure and contrast ratio as well as getting rid of unintended color casts. This is a first step towards matching shots in a scene to avoid inconsistencies in color and contrast that might distract the audience from following the story. Furthermore, an eye should be kept on key elements which are supposed to attract the viewer's attention. While in a commercial a key element is clearly the product that's being sold, in narratives or documentaries it's mostly skin tones. When it comes to the artistic part, creative grading allows the colorist to influence the audience's perception by enhancing or creating depth, mood and visual style that serves the story. Before the final output the program must be quality controlled and checked for compliance with the delivery format e.g. cinema, broadcast or web (Van Hurkman, 2013, Introduction).

For an introduction to color grading, I would highly recommend reading either Alexis Van Hurkman's *Color Correction Handbook* or Steve Hullfish's *Art And Technique of Digital Color Correction*.

However, this chapter is about being a colorist, and it's important to mention another important skill aside from the technical and creative: communicating with the client. In a color grading session, the client may be the producer, director, cinematographer, agency representative or even all of them together.

> *"It wasn't so much techniques or tools that helped me communicate more with my clients, but I actually started listening. I would actually not say a damn word, but I would tell people, 'Before we get started, tell me in 20 words or less what today's theme is going to be.' I'd rather let them spill their guts for 20 words or 20 minutes and then turn around and deliver the goods, because then I have a good idea about what their perception is and what their ambitions are for the session."*
>
> - **BOB FESTA, CSI** (Colorist, as cited Hullfish, 2013, Chapter 11)

Colorist Robbie Carman C.S.I (2017) recently published an article about the importance of client communication. He suggests for the colorist to watch the project before starting and to get familiar with the client's past work and creative tendencies. After all, the colorist is working for the client and it is part of the job to interpret what they want and give it to them. In the words of colorist Scott Klein (2016), "*it's always a healthy interplay between the cinematographer, the colorist and the creatives. It's a team sport and it's important to remain open*" (para. 17).

In some cases, the colorist will find themselves in a situation making assumptions on how something was originally intended to look or they have to come up with alternatives if the image doesn't fit as intended (Van Hurkman, 2013, Introduction). Communicating with the client or especially the cinematographer will help to get it right and focus on the creative part. This is very essential for grading skin tones as they often depend on the client's vision.

3 WHAT MAKES SKIN LOOK LIKE SKIN?

Skin is the outermost tissue of the human body which makes us very sensitive to its appearance. Understanding the biological structure of skin gives us an idea of how skin color is created, but being aware of the human visual perception will show us that there are clearly more factors that influence how we experience skin tones.

> *"Skin also has aesthetic relevance. The desire to have beautiful and healthy looking skin has been a centuries-old quest for humans."*
> - **IGARASHI, NISHINO & NAYAR** (2007, p.3)

This chapter explores the reasons for the unique look of skin and calls attention to cross-cultural diversity and beauty ideals around the world.

3.1 THE NATURE OF HUMAN SKIN

Not only is skin the largest organ of the human body, it is also one of the most complex ones. Genetic and environmental factors both create the familiar look and feel of skin which provides us with important information about an individual's age, health, condition, and origin. Its essential functions, for example protecting the body from damage, bacteria, or ultraviolet light, tend to vary among population according to age, gender, and race. With the help of incident light, optical effects are created by the surface of the skin. While lipids result in a glossy look due to reflection, hairs and wrinkles cause a more matte effect due to scattering. Additionally, a number of nerve fibers and nerve endings *"enable it to act as a sensory organ"* (Igarashi et al., 2007, p.4).

In order to understand the appearance of skin, it is a good idea to get a sense of its main structural and biophysical characteristics. To stay relevant to our purposes, this section will only focus on components that have a noticeable impact on appearance.

> *"Skin is translucent, and our complexions are actually a combination of color absorption, light scattering, and reflection from several different layers of skin."*
> - **VAN HURKMAN** (2013, Chapter 8)

Skin can be divided into two main regions, the epidermis and the dermis.

The epidermis is the upper layer and therefore the visual layer. Its thickness varies depending on the part of the body. Besides protecting those parts, it also creates new skin cells and produces melanin, which is a pigment that adds color to the skin. The amount of melanin produced is genetically predisposed and the reason why skin color can be any shade from pale to dark. Basically, the more melanin is created, the darker the skin. There are two different types of melanin: the red/yellow pheomelanin and a brown/black eumelanin, which is most common, but most individuals synthesize a mixture of both types (Agache & Humbert, 2011).

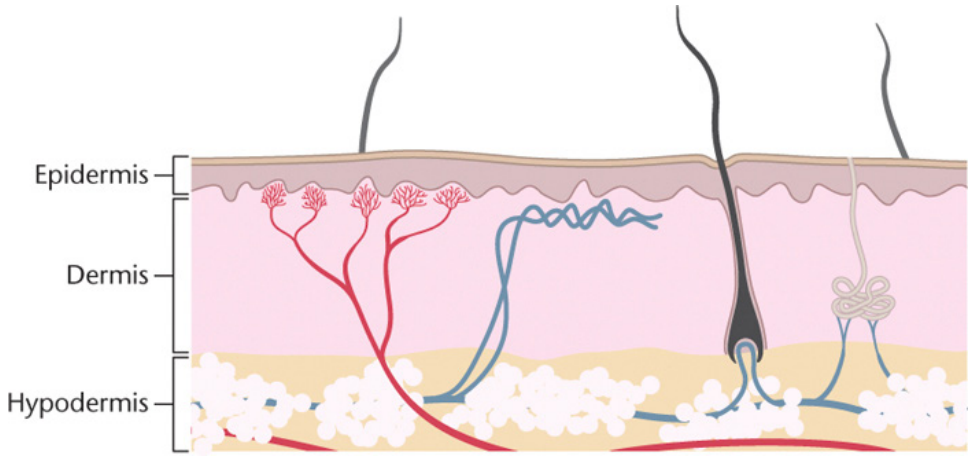

FIGURE 1: *The layers of human skin.*

The lower layer, the dermis, is responsible for a significant red hue in the skin due to the hemoglobin which is circulating in the veins. The amount of red can vary depending on physical exercise or stimulation of the nervous system (Jablonski, 2006). Moreover, bluish-white connective tissue can emphasize a pale,

desaturated skin tone. Especially heavily pigmented skin is more likely to have lower saturation, as the greater amount of melanin absorbs more light, which makes it difficult for it to reach the dermis (Angelopoulou, 2001). Other blood-borne pigments, bilirubin and ß-carotene, contribute to a yellowish or olive tint of human skin, but in excessive quantity may cause a yellowness in skin and eyes due to liver disfunction (Baranoski & Krishnaswamy, 2010). Functions of the dermis are producing sweat, oil, growing hair and most important: it contains all the nerve endings that provide the sense of touch and heat. It is attached to the underlying hypodermis, the subcutaneous fat layer, which is not exactly considered part of the skin. It controls our body temperature and supplies blood vessels and nerves.

3.2 MEMORY COLOR

> *"Color perception is one of the most mysterious of our mental master strokes. There are no colours in the real world. They are ideas, sensations, and constructs of our consciousness. The perception of colours corresponds to a cognitive process which is correlated with memory."*
> **- JÜRG NÄNNI** (2008, p. 61)

It's impossible to prove that two human beings under the same conditions see the same red, green or blue. Everyone has an individual perception system and we can communicate the result of our own color perception only to a limited extent. *Color constancy* makes it possible for our brain to recognize the color of a familiar object in countless situations of illumination (Nänni, 2008). We see a white paper as white and the letters as black, whether we look at it under cool daylight or warm candle light.

According to C.J. Bartleson, *memory colors* are *"those colors that are recalled in association with familiar objects, that is, objects with which we have frequent visual experience"* (1960, p. 73). Several studies show, that we all have similar expectations of colors of certain objects. Grass is green, the sky is blue, bananas are yellow.

However, those expected colors differ from the actual, real colors, as most objects are perceived brighter and more saturated than they really are (Smet et al., 2014). In fact, people mostly prefer memory colors over the actual colorimetric color of the original scene, and certain memory colors such as skin, grass, and the sky are preferred to be produced with slightly different hues and sometimes with greater purity (Hunt, Pitt & Winter, 1974). The preferred memory color for Caucasian complexion, for example, turns out to be distinctly more yellow than photometrically measured, even though it mostly varies in luminance (Bartleson, 1960). So, there's clearly a thing called color preference.

3.3 COLOR PREFERENCE

Years of looking at each other have turned us into true experts on instinctively recognizing skin tones. Our eyes and brains are adjusted to this process, which makes us extremely sensitive to it and even insignificant variations may immediately trigger a negative response, unless the lighting conditions would explain it due to *color constancy*. Bartleson (1959) remarks:

> *"It is frequently assumed that the objective of the photographic process is to reproduce exactly the chromaticities of the original objects (...) [but] It has often been recognized that chromatic fidelity may not be necessary or even desirable."* (p.114)

As skin tones are literally the first point of reference for the audience, reproducing them pleasingly is an important factor in photographic color reproduction (Zeng, 2011). Everyone has an internal reference of natural skin tones, but there' still room for creative variation depending on the scene's dominant light source. As a colorist, being aware of viewer preferences and what the audience is expected to see is a good start for working on skin tones.

> *"Most people will say they want 'accurate' color, but what they prefer (and what clients buy) is 'pretty' color—not wild surrealism, but usually some departure from reality. In reality, the color of skin is quite varied but viewers tend to accept a much narrower range of color as 'natural' in reproduction. This is where color control becomes important."*
> - **LEE VARIS** (2010, Chapter 3)

We can use this knowledge to influence the viewer, depending on the story we want to tell. Too much yellow or green may result in someone look unintentionally sick, too much red may indicate the character being sunburned or embarrassed (Van Hurkman, 2013).

3.4 CULTURAL DIVERSITY AND ITS BEAUTY IDEALS

Angélica Dass, a Brazilian photographer, illustrates the differences and complexity in skin color in her ongoing project *Humanæ* [1]. She has photographed more than 3000 volunteers across the world, regardless of nationality, gender, age, race, social class or religion. The background for each portrait is a Pantone[2] color matching a sample of 11x11 pixels taken from the face (Dass, n.d.).

FIGURE 2: *A random photo selection of the Humanæ project by Angélica Dass.*

1 see http://humanae.tumblr.com

2 best known for its Pantone Matching System (PMS)

There's dark brown, almost white, pale pink, and every shade in between. Her project clearly shows that each of us is unique in terms of the combination of thousands of genetically determined characteristics.

However, Fernandez and Fairchild (2002) found out in their study that *"images with faces have a much tighter range of preference in comparison to images without faces"* (para. 1), which is consistent with Varis' earlier statement about viewer's preference for a much narrower range of color for skin. This preference has its seeds in the individual memory color for skin, but how is this memory color created?

Some studies have revealed subtle variations in skin color preference among different cultural backgrounds (Zeng, 2011), and many of the colorists I spoke to confirmed this. It seems reasonable, that we are used to *what* we see or *who* we see every day - this includes the population of the area we live in, as well as visual representations of humans in magazines, TV commercials, photography and social media etc. We are bombarded everywhere with the visual appearance of skin, but actually it's mostly beauty ideals for appealing complexion, defined by society.

Culturally, we are used to *"seeing media where skin tones have been very precisely adjusted, often away from 'reality', so much so that there's even a lot of mainstream debate as to the ethics of image manipulation"* (A. Inglis, pc). There is a famous saying that goes "*Beauty is in the eye of the beholder*". It is important to keep in mind that beauty and attractiveness is subjective and may not be the same to every individual. However, according to Kenny and Nichols (2017), most cultures agree on smooth, flawless skin (low skin contrast) as a universally accepted beauty norm, as it is *"a mark of someone resistant to disease, and the bright color of lips and cheeks speaks to a healthy heart and good blood circulation"* (p. XVIII). Many cultures may also prefer lighter skin on women and darker skin on men. Psychologists theorize, that while lighter skin on women may indicate youth and delicacy, hence fertility, darker skin on men represents more age, energy, masculinity and the capability to both provide and protect the family (Etcoff, 2000). A study by Richard Russell (2002) further discovered that additional facial contrast (not to be confused with skin contrast), meaning *"greater luminance*

contrast between the eyes, lips, and the surrounding skin" (Russell, 2002, Abstract), is related to the perception of gender. While faces with increased contrast appear female, faces with less contrast appear male. Facial contrast can be increased by cosmetics (see **"4.1.2 MAKEUP"**), which are linked to appear more feminine and considered attractive (Russell, 2002, Abstract).

> *"There's clearly a lot of cultural judgements with skin tone. In Europe in the 18th century people wanted to be as pale as possible, even to the extent of poisoning themselves with lead powder makeup. Being pale meant you were wealthy since you could avoid the sun, being tanned meant you were poor since you were out working in the fields. Then things changed, people who were wealthy went on foreign holidays and got tanned, people who were poor had to work in factories and were pale. (...) Today we are very good at spotting fake tan and will make judgements about people and their social status from that."*
> - **ADAM INGLIS** (pc)

There are definitely a lot of different beauty concepts around the world. Today, in western countries, lighter skinned people rather prefer bronzed skin, whether achieved by sunbathing or sunbeds, tanning spray or bronzing makeup (Sara, 2015). In other parts of the world with a lot of outside work and sun, mostly Africa, Asia and the Caribbean, a white, pale complexion is not only considered a characteristic of wealth and a high social status but also elegance, nobility, intellectual worth etc. This ideal leads to a relatively common phenomenon in these areas, which is known as skin-bleaching or skin-whitening to achieve this sought-after perfect fair skin tone (Kenny & Nichols, 2017).

Several colorists confirm to have had similar experiences with skin tones in different areas:

> *"The perception of skin tones varies greatly around the world. The US likes yellow warm skin tones, Europe likes more magenta warm skin tones, some parts of Asia like pale skin tones, but the list goes on and it is very difficult to generalize it. It is often more dependent on the project and the taste of the DP and director."*
> - **FLORIAN 'UTSI' MARTIN** (pc)

> *"Attractive or appealing skin tones tend to be warmer than usual, not too saturated, and not too contrasty. The actual tones are very dependent on location. Chinese skin is a good example. We would call their skin yellow, it certainly can have a yellow cast but they never portray their skin that way. In fact they push to magenta far more than we ever would in Europe. Asia loves very bright pink magenta baby like skin that is always white. In the UK we prefer darker, more golden tones."* - **KEVIN SHAW, CSI** (pc)

> *"My experience is that in Arab and Asian countries there is a certain image of high class people and they are associated more or less with fair skin. (...) Darker skin tones often tend to go more yellow, whereas with brighter skin, it's going more towards pink. It is a regular demand by my clients to brighten up the skin if the actor appears to dark. On the other side I did a commercial for Scandinavia, which was quite desaturated with a blue-green color palette. There wasn't any color left in the face and the director still asked me to get rid of the blush. In the north European countries there's definitely less sun and the environment seems to be desaturated compared to south Europe. Therefore the grade is mostly much cooler than in the south."* - **ANDREAS BRÜCKL, CSI** (pc)

> *"White European skin appears less saturated than white north american skin. Black african skin is usually darker than African american skin. (...) Native american and Indian skin allows for more contrast to be added as it won't appear as bright as white skin. When I graded The Constant Gardener, the cinematographer Cesar Chalone wanted the white skin to appear pink. This may have been because being from Brazil he was used to seeing white skin being slightly sunburned."*
> - **ASA SHOUL** (pc)

These constantly changing and progressing beauty trends are definitely not rules on how to grade skin tones, but as a colorist, it might be an advantage to research skin preferences in the country when working in local markets. Colorists themselves tend to go bluer, warmer, or more saturated, depending on their own location and what they are used to seeing. Even though skin tones may be a certain color depending on culture, health or age among population, in the end the client might want to go for his preferred skin tone anyway. After all, skin color, skin contrast, and skin enhancement are always relative to the context.

4 VISUAL STORYTELLING: WHAT'S THE INTENTION?

Color can have a huge effect on our emotion, often without us even noticing. It can set an overall mood, create tension and draw focus in order to drive the story.

When I asked colorists what comes to their mind immediately when thinking about skin tones, pretty much everyone agreed on the same: there is no "good" skin tone, there is only "appropriate". It always depends on the context and should be motivated by the story and character, with the director guiding the colorist. It may also be appropriate for the colorist to offer their own professional opinion of what they feel works best (R. Bessette, pc), but the client or the director can give a clear idea of what the film is about and give the information which the colorist can use to do their job properly (A. Inglis, pc). According to Josh Petok (p.c.), the client will *"push you further or reel you back depending on their own personal taste"*.

The story may demand that the character look healthy or sick, young or old, excited or depressed. It all depends on the particular film you're creating and *"whatever looks believable for the situation"* (D. Mullen, pc). Aleksandr Verkholiak (pc) further points out: *"If you compare skin tones from different projects, it will look completely different, but it has no meaning unless it works for the project."*

Unfortunately, the digitalization has not only brought advantages but also a kind of sloppiness to filmmaking. Often, many wrong decisions are made in pre-production and on set which in turn have to be fixed in post-production. Instead, wisely choosing a visual style from the outset will give the colorist more opportunities to enhance the vision afterwards. Against the widespread belief, the so called *look* is not always primarily created in color grading. This chapter addresses the way in which the portrayal of skin in motion pictures is influenced by storytelling decisions.

4.1 CHARACTER DEVELOPMENT

> *"There is a saying, 'Never judge a book by its cover'. But often we cannot help but do just that. The quality of skin, especially in motion pictures, is an important factor in character development, even for reality shows or news anchors. The skin is the cover of the book. I would say that just like the grade of a film or program overall, a good skin tone is one that perfectly reflects the character it reveals."*
> - **KEVIN SHAW, CSI** (pc)

As mentioned before, we are experts in reading faces, drawing a lot of information from looking at each other. We might comment to a colleague *"Hard week? You look tired"* or to someone else "*You look well, have you been away?"* (A. Inglis, pc). We will read their emotion and health from their faces, but most of the time we're also able to judge their age, ethnicity, and even their personality. While it might be appropriate to soften and even out skin tones for a beauty commercial, a flushed reddish skin tone might in contrary support the actor's performance during an intensive argument. Certain emotions usually come along with physiological changes, which alter the appearance of our skin.

> *"We blush with embarrassment, redden with anger, and blanch or yellow with fear. If you are strangled or choking your face becomes purple... If you exercise your face reddens; if you are feeling faint, your face may yellow or whiten.*"
> - **CHANGIZI** (2009, p.19f)

It's important to know who the character is and how the audience should perceive the person. What's the overall mood of the scene and how is the character feeling? A horror movie usually looks quite different compared to a romantic comedy. Colorist Simona Cristea (2016) explains:

"The briefs are different for different brands and types of films, from the translucid skins of high fashion models to the nice peachy skins of pampers babies."

The color of the skin can have a strong meaning depending on the context, and it's the director's decision if the skin tone is intended to be noticed or kept subtle. For example, a yellowish skin can be associated with sickness like jaundice, and a green cast can make us feel uncomfortable. Green and yellow are both often

associated with mental illness such as schizophrenia or mania, and furthermore envy, falseness, and lies. A great example for the obvious use of skin color is the evil, "Wicked Witch" from the film *The Wizard of Oz* (USA, 1939). Her green face is not a coincidence, of course. *"Our reaction to green skin is programmed at a very deep level. Our aversion is a knee-jerk response. We can't help it",* Bellantoni (2005, p. 6) explains in her book *If It's Purple, Someone's Gonna Die.*

FIGURE 3: *The "Wicked Witch" (left) and Amélie Poulin (right).*

But let's take a look at the film *Amélie* (France, 2001). It's a warm, rich color palette with greenish-yellow skin tones which integrate well into the overall look, and the illuminant makes our eyes adapt to the colors and perceive the skin tone as normal, due to *color constancy*. Along with the story, Jeunet creates a sympathetic atmosphere instead of triggering negative emotions as mentioned above. This tells us about the vastly different meanings of the same colors - relative to the ambient light and relative to the context. Figure 34 illustrates the various definitions for color terms related to skin, blood, and emotion which can be found in Changizi's *The Vision Revolution* (2009). For the audience to understand these meanings, the way of establishing the colors in the film is important.

RED

color of the cheeks/complexion/lips as a natural healthy color, sudden feeling or emotion: flushes or blushing (anger, shame, embarrassment, exertion etc.), sexual excitement, engorgement, erythema, strong, hot, angry, dangerous, aggressive, sexy

YELLOW

affected with jealousy, fear (blanch), shock, blood loss, weak, cowardly, jaundiced

GREEN

having a pale, sickly, hue; indicative of fear, jealousy, ill-humour or sickness, anemic, winded, weak, cold

BLUE

livid, leaden-colored, affected with fear, discomfort, anxiety, dismayed, perturbed, depressed, miserable, low-spirited, cold, heavy, sad, strong, cold, lethargy, choking, bruise, veins, sickness, cold

PURPLE

bloody, blood-stained, angry, choking, welts, slow

FIGURE 4: *Definitions for color terms related to skin, blood and emotion.*

In order to make a specific skin tone convincing for a character, it should also be consistent within the scene. In *The Walking Dead* (USA, 2010-present) for instance, each actor has their natural flesh tone color. "*Rick has a lot of color in his skin and Carol has very little color in her skin. A fair amount of work is needed to make sure everyone remains consistent throughout an episode*", colorist Jeremy Sawyer (2016) explains. The zombies, on the other hand, usually have a gray or green flesh tone, complimenting the dead skin.

FIGURE 5: *The Walking Dead: Carol next to a zombie.*

4.1.1 PAINTING WITH LIGHT

> *"The most common mistakes while shooting, when it comes to skin, is just lighting. I mean everything is all about lighting."*
> - **SEAN COLEMAN** (pc)

A good cinematographer will use suitable lighting in order to support the story. He will carefully control lightness and darkness to not only emphasize the characters but also to create depth, locate the scene in time and space and set the desired mood (Millerson, 2013). The light dictates the skin tone and every skin reacts differently to light. Not lighting the shot properly will clearly limit the possibilities for the colorist (B. Jones, pc), so it is essential for the cinematographer to portray the character as intended.

Light can either emphasize characteristics by adding texture and detail or it can conceal them, even modify them (Millerson, 2013).

There are several techniques to create atmosphere and style, ranging from soft lighting to silhouette lighting, and it is fundamental to make use of them, for the illumination on set will determine the skin tone in the grading suite. For a beauty shot, it might be useful to fill in blemishes with soft light, whereas a dramatic piece like a thriller might benefit from stronger contrast, allowing to introduce dark shadows.

Oscar winning breakout indie *Moonlight* (USA, 2016), for example, has an outstanding lighting design, especially in terms of exposing dark skin tones.

FIGURE 6: *Moonlight (USA, 2016).*

In order to capture the miami sun beating down on the actors' faces, Jenkins and cinematographer James Laxton decided to move away from a realistic, documentary look and *"push the contrast ratio in virtually every scene, using a single source lighting scheme with no fill light, so the light would fall off into shadows and sculpt the characters' faces"* (O'Falt, 2016, para. 5). To ensure a perfect contrast ratio that still holds detail and rich color, even when the faces were in shadow, Laxton worked very closely with the colorist in pre-production (O'Falt, 2016).

We can easily enhance in post-production what's already there, but the extent to which we can change a picture can be limited (or even impossible) depending upon how it was originally shot. Common problems when it comes to faces are produced for example by harsh lighting, too much contrast or direct lighting that "*doesn't have enough fall off or deflection*", Rob Bessette (pc) explains, *"In my opinion, this comes off as looking cheap."*

With the lighting also affecting makeup, costume, and set design, it is strongly recommended that all departments work closely to dovetail their ideas about the resulting look. There are a wide variety of books and reference materials on creative lighting, so I will not go into great detail here as this topic would go beyond the scope of this paper. I decided to focus on particular issues[3] about character lighting that seem highly relevant to me in terms of grading skin, especially faces as a whole. Relighting techniques are used frequently in post-production to bring out the character, and having a decent lighting from the beginning to work with will give the greatest possibilities to enhance the scene.

LIGHTING | DIRECTING THE EYE

Needless to say, lighting can guide the audience's interest and can move their attention from one area to another (Millerson, 2013). While mindful positioning of lighting absolutely makes sense, it is worth mentioning that uncontrolled lighting can cause distracting effects, such as unintentional shadows, reflections or hotspots which will pull off the audience. However, in some cases it's not possible to control lighting, for example when shooting a documentary or simply

3 *These are only recommendations and can be adjusted creatively.*

outdoors, where the weather may be changing. At these times it might be useful to decide the time for shooting, do proper framing depending on the lighting situation as well as to make use of reflectors, flags, diffusers and so forth. In my experience, just the act of positioning the character wisely in the sun or shadow (whatever is suitable for that moment), can have a huge effect on the shot.

LIGHTING | DEPTH AND DIMENSION

In some situations, the character is about to blend in with the background. Shooting against a flat wall or a dark background is mostly unfavorable, but may sometimes be unavoidable. A careful backlight, for example, can serve to *"rim the subject with light to reveal its edge contours and to help to separate it from the background"* (Millerson, 2013, Chapter 5). Separating the foreground, middle ground and background by varying levels of brightness and contrast can bring out the character as well. As it reduces texture and depth, a flat, shadowless illumination can make the face look boring and meaningless. Sculpting and contouring face and body with light can on the other hand emphasize personality and emotional values. The story, the type of film and shooting circumstances will determine if facial or body features should be either exaggerated, hidden or kept natural. This can be achieved by manipulating light and shadow of various parts of the skin, enhancing local contrast. An analogy to this process is known as *Contouring* in cosmetics and *Dodging & Burning* in photography retouching. Section **"6.2.4 CREATING DEPTH AND DIMENSION"** explains how to create a similar effect in color grading.

LIGHTING | DARK AND PALE SKIN TONES

Very dark and overly bright skin tones can sometimes be a challenge. Especially with mixed skin, there is a possibility that dark skin is either too dark or fair skin is too bright, both cases resulting in lost detail. Choosing the right wardrobe and makeup can already achieve great compensation, but there are some tips on lighting as well (B. Susen, pc).

Dark and light skin reacts differently to lighting: specular highlights define

dark skin, shadows define lighter skin. In his book *Skin: The Complete Guide to Digitally Lighting, Photographing, and Retouching Faces and Bodies*, Lee Varis (2010) explains that he tries to avoid shiny highlights with fair-skinned people, as the skin is already light and rather needs more shadow, whereas the opposite is desirable with darker complexions. Sometimes extra moisture and light sources near the axis of the lens will do the trick. Large, soft lights work better instead of hard lights, which will create a hot spot where the light is reflected.

When working with multiple actors, DP Cybel Martin (2014) prefers to "*light for the darkest skin tones and use half scrims, silks, flags etc to take light off of the lighter skin actors*" (para. 19), as adding light to darker skin can result in ugly shadows. Hot edge lights on one side of the face *"give shape to their bone structure, separate them from the background and make sure their lighting contrast is consistent with the rest of the scene"* (para. 10), she further explains.

Having more light on the darker actor and less on the pale one can help a lot, but nevertheless, it's always important to base the lighting on the dynamic range in order to retain every detail (see also "**5.1.1 EXPOSURE**").

LIGHTING | COLOR CONTROL

Everything is relative to the dominant light color, which means that skin reflects the ambient lighting of its surroundings. "*Even in real life, skin lit by a pure blue light can only reflect blue light. It is simple physics*" (K. Shaw, pc). Using colored light can help the audience identify time, location or weather conditions. The most familiar use is blue for a cold, and orange for a warm atmosphere, as they both refer to our experience of light in the natural world. However, there are many possibilities to use colored light as a specific characteristic. Different color gels can alter or adjust the lighting and even support or correct skin tones (B. Susen, pc). Darker skin, for example, tends to have blue undertones that can be neutralized by adding *1/4 CTO*[4], and *1/8 plus green* will correct a fair skin tone that is too pink (Martin, 2014). When it comes to natural skin tones, it is crucial to keep the illuminant color relative to the camera's white balance in order to render colors accurately. Several colorists advise not to light a scene too warm or too cold and to always do a proper white balance, otherwise it can result in

4 *"color temperature orange", an orange gel with density of 1/4*

an extreme color cast which will limit the access to neutral colors. Additionally, lighting sources differ in terms of color reproduction which will be mostly noticed when lighting skin (see **"5.1.2 WHITE BALANCE"** and **"5.2 LIGHTING"**).

LIGHTING | CONTINUITY

However the scene is lit, there is one more fundamental aspect: keep it consistent (unless a lighting change in the scene is intended). Typical situations are shot/reverse shot or lighting a wide shot and an additional close-up afterwards. If the lighting doesn't match, it will be difficult to keep the scene flowing without looking artificial. A good continuity will provide the colorist with more flexibility in the grading suite. Keeping the lighting consistent can sometimes be tricky and requires the gaffer to be knowledgeable in techniques to make it possible (B.Susen, pc).

LIGHTING | EYES - THE CENTER OF OUR ATTENTION

This paragraph is not really about skin, but with the human brain focusing about 80% on a character's eyes, it is worth mentioning (Whipp, 2016). Light reflections, known as eye lights or catch lights, make our characters look alive. Not lighting the eyes properly can result in "raccoon eyes", with the eye socket falling into deep shadow. This can give a dull, dead look to the subject, which could on the other hand also be a desired effect if the story demands it. Eye lights make us recognize a subject, even when we can't really see the face. Especially with dark skin, an eye light is desirable to retain the darkness in the skin and still capture the actor's expression.

> *"For moody performances, I might track eye lights on cast members so that the overall contrast stays strong but the viewer is still getting all the performance that's there. We try to 'ride the line' so the network does not ask me to bring the whole image up brighter."*
> - **SCOTT KLEIN** (Colorist, 2016, para. 10)

4.1.2 MAKEUP

> *"Makeup artists are masters at illusion. We manipulate the shapes and features of the face and body with our artistry. (...) Makeup design completes the character's look, mood, and style. We put the finishing touch on the actor's exterior to match the interior performance and to bring the character to life. This enables the actor to focus on the performance and not the look, and to become the character.*"
> - **DAVIS AND HALL** (2017, Chapter 1 & 9)

Back in early film, traditional stage makeup did not translate well due to orthochromatic film, which was blue-sensitive and would not pick up reds or yellows. Faces looked darker and kind of dirty, so in order to brighten skin tones, it was a common practice to cover the whole face with heavy pink greasepaint (Bennett, n.d.). Luckily, today we are much more flexible and color is used in all aspects of makeup. A good makeup artist can blend a foundation to match the actor's skin perfectly and determine whether it is warm or cool toned to avoid an unintended dull and lifeless look (Davis & Hall, 2017). Like everything else, the makeup will be determined by the type of motion picture, the script and the circumstances, but it always helps to a have good skin condition to start with (R. Bessette, pc).

In most cases, you would not want to see any makeup. This is more important than ever today with HD, 4K, 8K and higher resolutions. There are many ways to create the look of a character. It might be appropriate to cover a tattoo, apply 10 more years, create a natural, organic look or beauty makeup. It's all about the character. As mentioned before, *Contouring* is a technique in makeup to create dimension and highlight features. It is an "*updated version of the old Hollywood makeup*" (Davis & Hall, 2017, Chapter 6) and can be used in a subtle or heavy way.

> *"In case of brilliant lighting, it would be too bad not to model the face. It's possible to apply heavy Contouring and make it still look very natural. Makeup reflects the light and it can give great power to the actor. I really like working with shine, as it makes skin look more alive."*
> - **KITTY KRATSCHKE** (pc)

Whatever look the script calls for, a good continuity throughout the shooting when reapplying and recreating the looks is essential. Furthermore, lighting will affect the makeup on set, so it is important for the makeup artist to communicate with the gaffer and watch out for the type of lamps and kind of gels or filters that will be used (Davis & Hall, 2017, Chapter 4).

According to the colorists I consulted, makeup mistakes can be a real struggle for grading skin tones. The most addressed issue by far was a heavy coat over the face that stops at the neck, leaving a visible line, as well as forgotten or uneven tanned hands, arms or other parts of the body that don't match the face (K. Shaw, pc). Another common problem is shine or visible texture created by makeup brushes (A. Inglis, pc). Asa Shoul (pc) explains, that powdered makeup stops reflecting light, which results in a matte or single toned look. This isn't always desired and can be difficult and time consuming to correct. This is consistent with David's and Hall's (2017) advise not to over-powder the face, especially for close-ups. Some men may also require shaving throughout the day to avoid whisker growth, known as *5 o'clock shadow*, which results in a darker, bluish tint around the lips and jaw. This can be an unpleasant side-effect and is often an issue to be fixed in the grading suite (Van Hurkman, 2013).

Testing the looks before the shooting is hugely valuable and can save lots of time in post-production. Adam Inglis (pc) explains how it saved him from isolating the actress throughout the entire film:

> *"I did a film once, where we knew we were going very desaturated on the grade so we got some testmaterial, graded it, built a LUT and then put costume and makeup tests through it. The lead actress had a very pale skintone and our grade made her look even paler, so the makeup people decided to warm up her makeup as a result."*

Asa Shoul (2016) refers to a similar experience, when he had asked the makeup department to keep an eye on an actor's lips that tended to go slightely purple under a cooler light. He also recommends to check that none of the actors has a particularly different skintone to the rest of the cast, as he often has to

balance the skin tones of all actors to be closer together, and this is a time-consuming task (pc). The makeup department also works closely with the costume design. For changing an actor's characteristics for a certain role, the makeup can sometimes even be the decisive factor and inspire the costume designer (K. Kratschke, pc).

4.1.3 COSTUME

The choice of costume is another way of emphasizing skin tones. Usually, costumes that are close to skin color are an issue in post-production as it makes it harder to isolate skin tones. In order to retain the flexibility to separately grade skin and costume, color contrast between skin tones and costumes should therefore be considered. Rob Pizzey (2016) has an interesting story to tell about the grading of *Cinderella* (USA/UK, 2015):

> *"The biggest technical challenge of the film was being able to pull out the desired colour of Cinderella's pink dress before the transformation scene, Cinderella's ball gown colour and Kate Blanchett's stepmother ball gown. Firstly, Cinderella's pink dress was very close in colour to her skin tone, so I had to carry out a lot of intricate shapes with keys to make it work."* (para. 9)

Wardrobe tests before the shooting can be a big advantage. Aside from moiré effects caused by certain patterns, light and dark fabrics in the same shot can lead to unfavorable high contrast, especially in particular lighting scenarios (Stump, 2014). One idea is to tone down superwhite fabrics and/or to avoid absolute blacks to retain a little bit of detail, as this will help to keep the focus on the actor's face. Furthermore, the color of the costume can support the skin tone. There is a reason why people say that particular colors suit them when shopping for their clothes. Some colors are flattering to certain types of skin, whereas others may not be. There are various combinations and possibilities, and it all goes hand in hand with lighting, makeup and the whole production design.

4.2 CREATING THE LOOK

The overall *look*, a term which is used to describe the appearance and quality of a picture, is in large part created by a color palette that fits the story. It is carefully controlled on set by the departments and afterwards in the grading suite. The colors are driven by the story, including the world in which it takes place, time period, location, costumes and set dressing etc.

As we have learned by now, skin reflects its surroundings. Responsibility for the look of the surroundings falls to the production designer or art director. They work closely with the director and the other departments, choosing the colors of the set, props, and costumes.

> *"If you're shooting a scene with a white actor against a wall, then they'll stand out better if the art department paints that wall dark-ish/blue-ish than if they paint it cream. On the other hand, a black actor would stand out fine and blend in against a dark blue one."*
> - **ADAM INGLIS** (pc)

Production design, cinematography, lighting, makeup, and costume will determine the color palette that can be enhanced and manipulated in post-production to refine and improve the visuals of the film. It can be cool, warm, muted, pastel or vibrant, whatever is right for the story. The viewer will have certain reactions to particular colors, but there are no absolute rules, as it is always relative to the content and to how the color is established. A strong red can be associated with passion, but also with anger. Blue can have a calming effect and simultaneously feel uncomfortably cold. The most common balanced color schemes are monochromatic, complementary, analogous and triadic ("How to Use Color in Film", 2016).

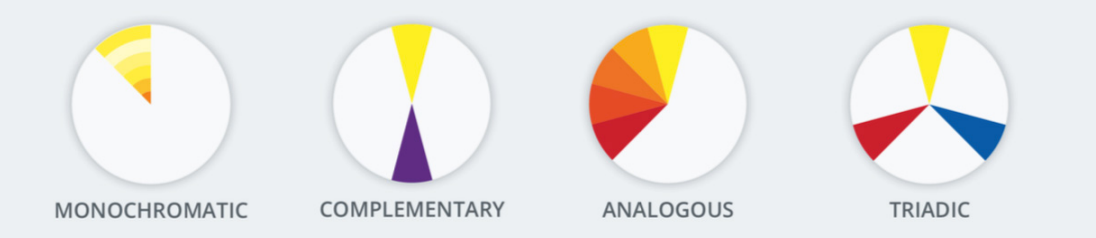

FIGURE 7: *Balanced color schemes.*

Now, how do skin tones fit into the overall look? It's all about how colors are established and interact with each other. The overall illuminant determines the skin tones. Natural skin tones sit with the lighting in the scene and can also help the audience for orientation in time and space.

> *"I believe there are two kinds of people, (or at least clients): Those who understand that often the colour of someone's face is affected by the light falling on it, and those that think the colour of the face is the actual colour of their skin. This leads to some difficult discussions. For example, someone may appear to have orange skin because they are looking at a golden sunset, or the window they are sitting next to has orange stained glass or curtains, or they might appear pink because they are standing by a pink neon sign."*
> - **ASA SHOUL** (pc)

Sometimes, further specific work on the skin tone is required or wanted on top of that. More extreme looks may pull back to a natural skin tone to not look "overdone", or they may demand for a more significant, even stylized one. Especially when working with a low saturated color palette, skin tones can easily appear too dull and ghostly. Although the desaturated surroundings would justify the dreary skin tones, they may still need a little push. Adam Inglis (pc) remarks:

> *"Skin tones are also important when it comes to audiences 'connecting' with the characters. There have been a number of times when we've gone for a certain kind of grade, often a desaturated look, and we have had to pull back from it due to people feeling less connected with the characters"*

He thinks it's a curious phenomenon that a desaturated look somehow feels distant to us. Lately, there have been a few posts on the internet about the colorization of black and white photographs that were taken even way before the 20th century. People were surprised how "close" and "real" they felt once they recognized at what time the pictures were actually taken. Some colorists therefore advise to retain a little bit of skin color when dealing with a desaturated look, even for night scenes. As Mark Todd Osborne,, CSI (2016) explains, *"In life, you still see colors around you on a cloudy day. Those colors are just muted on the cloudy day, not as vibrant, but they don't disappear completely"* (para. 7).

There has been a certain trend since the late 2000s to often push skin tones more than ever: the *orange and teal look*. The complementary color scheme works incredibly well, as teal is a great supporting color for skin tones. The look can either be subtle, created through the careful choice of production design, or it can be heavily "forced" in post-production. Especially with the rise of DSRL filmmaking, the look has become generally known as the sought-after *blockbuster look*.

FIGURE 8: *The complementary orange and teal look. X-Men: Apocalypse (USA, 2016), The Island (USA, 2005), Max Max: Fury Road (USA, 2015) & Transformers (USA, 2007).*

There have been many articles and posts discussing this trend and the excessive preservations of "correct" skin tones, mainly in scenes where it doesn't seem logical regarding the ambient lighting. However, it shows that it's possible to get away with pushing skin tones around quite a bit, if the "rules" of the look are established early on (P. Jarvie, pc). *Color constancy* will certainly make us accept the look after watching for a few minutes, especially in the cinema. Even extreme looks, which can give an artificial feeling to the film, but sometimes this might be exactly the target.

According to the personal opinions of the colorists I talked to, the *orange teal* look is very popular as long as it is presented subtle and naturally. Kevin Shaw (n.d.) states in his article *Colors that fade*:

> *"In our industry, some looks are becoming so familiar that the value of their effect is diminishing and becoming mundane. Any look is striking the first time, but with increased viewing the interest wanes."* (para. 3)

Ultimately, it is always a matter of personal taste, and I'm in agreement that the ongoing discussion among filmmakers is a result of us seeing this look repeatedly.

"Any look is striking for the first time". That's why certain films pop up in our minds when thinking about certain looks - because they essentially "established" it. One of those is definitely *The Matrix* (USA, 1999), as almost everyone can recall the sickly green colors inside the Matrix. These are in contrast to the cooler blue colors outside, which represent the "real world". However, the change of color separation of skin and surroundings is interesting to watch throughout Neo's journey in the Matrix. While in the beginning his skin is pretty much integrated into the greens, making him a part of the system, later on the separation gets stronger and his skin is about to break free just as he is himself (Kantor, 2012).

FIGURE 9: *The change of Neo's skin color throughout the film.*

Moreover, controlling the interaction of skin and surroundings cannot only help to tell the story, it can also imitate a particular aesthetic. *"I've graded a few 16mm/35mm short films that I've leaned towards magenta skin to mimic old scanners with magenta cast"*, Kath Raisch (pc) explains.

These are only a few examples to describe the possibilities of skin being integrated into the look or popping out of it, and it is undoubtedly a very subjective topic. Colorists are at odds with each other if there is a threshold of what skin can be pushed to without looking "wrong". It seems to be whatever is right for the story, the surrounding and most importantly, that they compliment

the overall look. *"Often, the 'look' of a film is rooted in the skin tones anyway as this is what we will predominantly notice"*, Adam Inglis (pc) states. In addition, some directors or cinematographers have more significance than others and will most likely get away with more extreme and unconventional looks (A. Minuth, pc). At the moment, it seems like the trend is slowly going back to more natural images, and this dovetails with Kevin Shaw's (n.d.) conclusion of his article:

> *"When everything has a look, breathtakingly good normal images will stand out. Then eventually, normal itself will lack impact, looks will get stronger and the cycle repeats."*

4.3 FILM VS. COMMERCIAL

The obvious difference between films and commercials is the length, but it's not the only difference. It happens that commercials often have a much bigger budget per minute of final screen time and thus, more production value (S. Coleman, pc). In commercials, it's all about the product that must be sold, and you need to tell a story in a very short amount of time which makes every frame essential. To achieve a perfect picture, much more time is spent not only on set but in post-production. You could describe ordinary commercials as very idealized, bright, happy, colorful, healthy and more glamourous - and the skin usually matters a lot. Often, detailed beauty work is done either to a certain extent by the colorist or digital makeup is applied by the visual effects department. You want to sell a product or a brand and both should be associated with a positive feeling, beauty and an ideal lifestyle. Therefore, the product must look absolutely perfect.

> *"(...) 9 times out of 10 I'm going to blow the product up and stick it in front of your nose and hit them over the head."*
> - **BOB FESTA CSI** (as cited in Hullfish, 2013, Chapter 8).

Contrary to this, film is more natural, as it's *"normally shot the way they want it in terms of lighting"* (R. Bessette, pc). The skin tones rather fall into place and it's more about composition and mood, so you need to *"let the photography*

through and just bring out the beauty through of it to a unified grade" (S. Coleman, pc). Although Asa Shoul (pc) states that every film he works on has a *Vanity Pass* where they look at skin tones, blemishes or tired eyes, the amount of detail that's put into a commercial is rarely possible in feature film grading due to a limited budget. In commercials, you usually get approximately 10 times the amount of time to work on each frame than in feature films (S. Coleman, pc).

You can see further differences between films and commercials in terms of specific colors. In film, it's not an issue when colors like skin, makeup or maybe costume change along with lighting and color palette, unless they are key colors of the creative concept. Conversely, particular colors of a product as well as the corporate identity design of a brand in a commercial need to be accurate and will be required to perfectly match the reference.

However, this comparison is quite stereotyped and simplified, as today's commercials tend to be more cinematic and TV series are including more beauty work. How a single project is treated depends highly on the client, the director's vision, the time and of course, the budget.

5 TECHNICAL ISSUES TO BE AWARE OF

Aside from creative choices, selecting specific camera and lighting equipment as well as taking care of the technical side will have an enormous influence on the overall quality of the recorded image, and thus the skin tones. From my own experience, there are some technical aspects that definitely make it harder or easier to grade them. The colorist should be the bridge between production and post, and being aware of the technical issues could advise the production to provide the best starting point for skin tones.

> *"Grading is all about modifying what is already there. The better my source, the more control and the more 'polishing' I can do".*
> - **KEVIN SHAW , CSI** (pc)

Having asked colorists about common mistakes being made on set, some issues came up repeatedly: exposure, white balance, compression and lighting. Lighting was especially mentioned in terms of what has already been covered in **"4.1.1 PAINTING WITH LIGHT"** but also technical issues when it comes to light sources.

This chapter recommends a basic knowledge of digital cinematography. Being familiar with the purpose of RAW- or log-recording and the fact that these images need to be processed afterwards is essential. It should also be mentioned that the following bullet points are only recommendations here, of course it is always possible to play with or against the technical side for creative purposes.

> *"It just depends on how much flexibility you want to make corrections in post versus how confident you are that the color effect you create in camera won't need much alteration."* - **DAVID MULLEN, ASC** (pc)

5.1 CAMERA

> *"There are a number of factors that affect how a digital camera captures skin tones, from the nature of the RGB filtering over the sensor, to the color science that converts the signal from RAW to RGB, to the recording format, etc."*
> - **DAVID MULLEN, ASC** (pc)

Choosing the right camera and format along with lenses and filters is not always the easiest part and is highly dependent on the budget and not least on the requests for the project. There isn't just one single spec that defines the quality of the camera. As Kevin Shaw (pc) explains, *"some cameras do not separate colors as well as others. (...) Each company has its own view on color science and the importance of different aspects of imaging"*. Skin tones need very accurate color rendition which in turn needs a good color science. A carefully controlled color managed workflow, for example *The Academy Color Encoding System (ACES)* can ensure a consistent color experience throughout the increasing variety of digital cameras and formats. Color management is a huge deal, but it would go beyond the scope of this paper which is why I will focus on other technical issues that control skin tones as well.

5.1.1 EXPOSURE

A high dynamic range, the area between the strongest signal and the weakest, or in other words, from the whitest to the darkest point within the scene is definitely a long-term desire. Recording RAW or log offers a greater range than standard Rec.709 gamma (ITU-BT.709), but proper exposure is still required in order to improve the quality and flexibility of the picture - and of course the skin.

> *"When it comes to exposure, fixing it in post generally means scrambling to come up with an image that is merely acceptable. (...) If you start trying to repair problems caused by mistakes made during shooting, there are almost always negative consequences."*
> - **BROWN** (2013)

Deliberately underexposed or clipped skin tones is a serious issue to struggle with in the grading suite. As RED explains, the *"goal is to strike an optimal balance between the disadvantages of too little and too much light — and therefore between noise and clipping"* ("Exposure with RED Cameras: Strategy", n.d.). Noise is introduced with underexposure and usually results in a muddy-looking image, whereas clipping is caused by overexposure when highlights get *clipped/blown out*. Clipped highlights as well as crushed blacks lack any information, resulting in pure white or black without any detail, and nothing can be done to fix it (Brown, 2013). Exposure therefore affects the overall contrast of the image, details, and subtleties in the shadows and highlights as well as color saturation and color contrast. Colors are rendered accurately only when the exposure is correct, otherwise it will desaturate the color (Brown, 2013).

When recording log or RAW, Andy Minuth (pc) suggests using the strategy *Expose To The Right (ETTR)*, which means recording as much light as possible without clipping. He explains that with current camera technology it's better to overexpose, as long as there's no clipping, and bring it back down afterwards in post-production. According to him, the ideal exposure of digital high-end cameras has shifted to just below clipping. So instead of a classic over-exposure, lowering the ISO rating of the camera has the same effect without making the image appear too bright. Especially for beauty work, cinematographers expose skin tones one or two stops over in order to capture beautiful, clean skin tones with less noise and great definition. This can be a risky technique if not paying attention to potential clipping candidates, and might not be appropriate for every type of project and lighting style.

Moreover, digital cameras tend to have a much better low-light response than film, which can sometimes lead a cinematographer to shoot in extraordinarily low lighting levels (Brown, 2013). Underexposing skin tones when they are intended to be bright is extremely damaging. It can not only make them look dirty and desaturated, but also harm the texture by introducing noise when bringing them up again in post-production.

In all cases, it's crucial to check for clipping or crushing in all three color channels, as sometimes it can happen in just one of the individual channels and result in inaccurate color rendition ("Exposure with RED Cameras: Strategy", n.d.). On the other hand, it might be impossible to avoid clipping or crushing. Especially

direct reflections and other specular highlights which are extremely bright might clip easily, or blacks might crush when shooting with low-key lighting. If the lighting cannot be controlled in order to compress the latitude, a compromise is the only option. In most cases this is exposing for the most important subject in the picture (Van Hurkman, 2013). That said, exposing for both bright and dark skin tones in the same frame can be a tricky situation. As covered in **"4.1.1 PAINTING WITH LIGHT"**, it's important to prevent the dark skin from being too dark and the pale skin from being too bright. If the lighting cannot be controlled, Nik Summerer (pc) suggests to first control the contrast by proper framing and positioning the characters accordingly to the lighting situation. When it comes to exposure, exposing for the pale skin tone would underexpose the darker skin, exposing for the dark skin tone would overexpose the pale one. In case of doubt, a good balance can give the most flexibility afterwards to brighten or darken skin tones additionally with a mask if necessary (N. Summerer, pc). Photographer Ansel Adams divided the tonal range of an image into ten zones, zone 5 being 18% middle gray. Figure 10 shows Adams' guidelines for shadows, midtones, and highlights of average skin tones which can be useful when going for natural, visible skin tones.

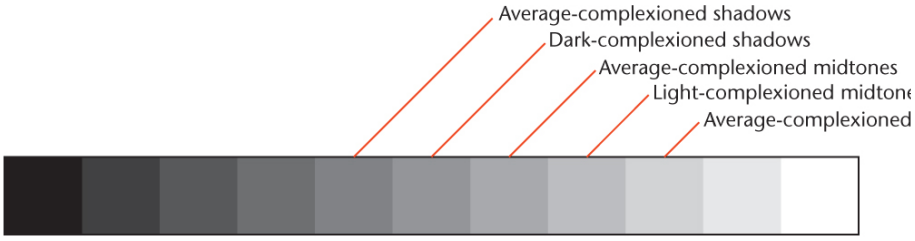

FIGURE 10: *Zones for skin tones as defined by Ansel Adams.*

However, as mentioned in the beginning of this chapter, a technically correct exposure is not always appropriate for the story. An underexposed picture can still be correct, for example if the character is positioned in darkness. It is therefore important for the cinematographer to properly evaluate the situation (N. Summerer, pc). Log-encoded pictures appear very flat and washed out, which makes it impossible to rely on the display without using a monitor LUT that will gamma-correct the picture. If this option is not available there are other tools as well that can help to judge exposure, such as the waveform monitor, false-color, histogram or zebra.

5.1.2 WHITE BALANCE

Setting a proper white balance in camera is one more thing to make sure that colors are rendered accurately - which means the best possible reproduction of colors as they appear in real life and what the camera is capable of (Brown, 2013). The white balance depends on the lighting conditions. Color temperature describes the warmth or coolness of light, the two most common being average daylight (5600K) and tungsten illumination (3200K).

So what happens if the white balance is off? Let's assume the scene is lit with tungsten lights, but the camera is balanced to daylight. The picture will be very yellow, extremely warm. A white paper in front of the camera will appear yellow, but of course we will still recognize it as white because our eyes are able to adapt, remembering *color constancy* from **"3.2 MEMORY COLOR"**. In contrast to our brain, the camera preserves this yellow color cast, resulting in shifted color channels. While a subtly shifted white balance isn't generally a huge issue with high-end cameras recording log (it can be easily color corrected in postproduction), I want to point out that it could just as well become one. Extreme deviations from the light source will result in a huge shift in color channels, which in the worst case can be clipped (A. Minuth, D. Mullen & S. Hullfish, pc). Once this occurs it cannot be remedied. Especially low-end cameras (with less bit depth, heavily compressed codecs and less dynamic range) will suffer from improper white balance, because there's just not enough color information left to pull out for compensation (L.Tielke, pc). Once the information is gone, there is no way to get it back.

RED ("Using White Balance to Control Color Casts", n.d.) officially states:

> *"(...) white balance also drives all subsequent color science and determines the correct colorimetry of a subject. Getting this right is therefore critical for accurate skin tones, and can improve color saturation dramatically—even though saturation isn't being adjusted directly."* (para. 6)

In order to get a neutral image with natural colors, it is necessary to either set the white balance relative to the color temperature of the light sources or manually white balance on a gray reference card (caution: white paper is not reliable as it

can vary in color!; Brown, 2013). The latter is recommended if the light source is unknown and uncontrollable, such as fluorescent lights that lack a wide color spectrum and can have a green or magenta tint (see **"5.2 LIGHTING"**). Using a gray card near the subject of interest can compensate for this tint as well.

Another option would be to balance the lights to the internal camera white balance by using color gels in front of the lamps. This would be the appropriate way when dealing with unintended mixed light sources that differ in temperature and tint. In case of the desire for colored light, it is necessary to first remove the color gels and to white balance to the source temperature, otherwise the color will be removed (Brown, 2013). Filters directly in front of the lens could be an alternative as well. However, it should be mentioned here that all filters and gels (whether used for lamps, in camera or in front of the lens) end up reducing available light.

Some light sources cannot be white balanced though. For example, orange sodium street lamps as the primary illumination are monochromatic and thus contain no colors that could be balanced ("Using White Balance to Control Color Casts", n.d.).

WHITE BALANCE | SHOOTING UNDERWATER

A common issue when shooting underwater is the heavy loss in light and color. Water filters the color spectrum of sunlight, hence colors change with increasing depth and gradually become bluish green. Skin tones vanish as descending deeper, as red wavelengths are already filtered out at 3 meters (Edge, 2010).

Unless an external light source is used, white balancing is essential to restore color separation, but it needs to be readjusted with changing depth (Friedrich, 2014). White balancing is achieved by boosting the red and blue channel in order to balance green, and a camera sensor will apply the lowest overall gain at 5600K due to the normal spectral response of silicon. That said, the adjusted white balance will extremely deviate from 5600K with descending deeper, which can increase noise by amplifying red and blue signals ("ALEXA Family FAQ", n.d.).

Another solution which can be found in several books of underwater

photography is using a red filter in front of the lens. It will already do most of the work to rebalance the color channels, and an additional white balance is said to further enhance the result (Friedrich, 2014). Nevertheless, those filters also block light from entering the lens, which leads to a loss of around one or two stops of light. It remains doubtful if using a filter will give a better result over white balancing only, but it is sure that the final result of the image will always heavily depend on the weather and water conditions (Edge, 2010).

5.1.3 COMPRESSION

In order to manage the huge amount of data that is generated with digital cameras, different forms of compression are used (Brown, 2013). Compression schemes are based on the principle of eliminating information that is considered "non-essential" (Stump, 2014). They can be either lossless when data information can be restored completely, or lossy when information can never be recovered (Stump, 2014). A lossy compression takes advantage of the limits of human perception: the algorithm "throws out" the information that won't be visible to the eye. However, a higher compression ratio comes at the expense of image quality and can still lead to visible artifacts, at least when tweaking the image in post-production (Brown, 2013). Compression is a major factor when it comes to skin tones, as it is a decisive factor for how skin color is rendered and how much variation it will contain. While high-end cameras use lower compression to give more flexibility in post-production, other cameras aim to use a higher compression in order to make the files more compact and easy to handle. If possible, compression should best be applied at the finishing stage.

> *"From an image-quality standpoint, it's risky to apply compression up front in the process. (...) It's better to stay with the whole content of the image while you are twisting, stretching, color correcting and manipulating the image. If you apply compression up front and you decide to stretch the contrast or bring detail out of the black during a color-correction session, you may start seeing artifacts that weren't visible in the original image."*
> - **KENNEL** (President of ARRI USA, as cited in Stump, 2014, Chapter 4)

The higher the compression ratio, the lower the data rate, and the more compromised the image will be (including skin tones). Common compression types, known as codecs (short for compression/decompression) are for example Apple ProRes, Avid DNxHD and h.264. Bit depth and color sampling are amongst other important variables for compression.

COMPRESSION | BIT DEPTH

In the words of Scott Billups (2008), a *"higher color bit depth gives you more shades of color—it's like having more crayons in your coloring box"* (p. 19). This is also true for capturing the luminance levels, as bit depth refers to the digital representation of gray scale or color information of each pixel (Stump, 2014). An 8-bit depth means 8 bits per color channel (red, green and blue), that is 24 bits of information per pixel, making it 256 levels of intensity per color channel. In contrary, the 10-bit depth already allows 1024 code values, which is four times as much information. This is sufficient for the human eye to perceive all the shades[5] smoothly (Brown, 2013). When capturing a wide dynamic range, for example over 14 stops, the image data is processed internally and mapped into the target range of the particular codec that's being used. While the range remains the same, the number of light levels between the brightest and darkest part of the image changes. 8-bit contains fewer steps in between and can therefore show *banding* artifacts, these are distict bands of lightness or color instead of a gradual change ("ALEXA Family FAQ", n.d.). *Banding* is therefore mostly present in wide gradients, for example in the sky or close-ups of skin. It's quite obvious that a higher bit depth provides us with more information for the subtle amount of color variation in skin, as it allows us to capture more shades of gray and color. Bit depth is still increasing with progressing technology, and 12-bit, 14-bit and 16-bit imaging store even more code values.

5 *All the shades of standard dynamic range images. HDR has more tone values and needs a higher bit depth.*

COMPRESSION | CHROMA SAMPLING

In YCbCr 4:4:4 video, each pixel contains full color and brightness information. The first digit represents the luminance signal, the others the color difference components. Because we are more sensitive to luminance than to color, half of the color information can be "thrown out" in order to decrease data size, resulting in a subsampled 4:2:2 video signal (Schenk & Long, 2014). Although this is considered a *visually lossless* compression, 4:4:4 is still an advantage, especially for visual effects work and heavier color grading. 4:2:2 is the most common video format for high-end productions, it comes mostly along with a 10-bit depth and is also broadcast standard. RGB 4:4:4 with an even higher bit depth is used by most digital intermediate (DI) workflows. Some cameras use 4:2:0 or 4:1:1 chroma subsampling, which is even more reduced in color information, and this indeed *is* visible to the eye and very sensitive to subsequent color correction (Schenk & Long, 2014).

COMPRESSION | 8-BIT LOG

> *"In my opinion, it's not sufficient anymore to record 8-bit these days, it's simply not qualified for high-end post-production. 8-bit will usually snap your neck, and with log it's even more difficult."*
> - **ANDY MINUTH, CSI** (pc)

8-bit log encoded material is something I'm constantly confronted with as a colorist, but I must admit there is no scientific reference to explain this particular issue properly. However, talking to David Mullen and other DPs confirmed my interpretation based on my experience so far, so I will make an effort to illustrate it.

The standard 10-bit log Cineon file format was originally introduced in the early 1990s with the purpose to preserve the maximum latitude from film, which is considered by Kodak to capture an equivalent of 14 bits of range (K. Shaw, pc). The camera manufacturers then took the idea of log film scanning and applied it to their sensors, so theoretically, you could say that log-curves were actually designed to work on 14-bit cameras to record visually lossless 10-bit images

(Shipsides, 2012; K. Shaw, pc). As explained earlier, the result of storing many stops of dynamic range into only 8 bits will result in fewer values for each stop. Stretching the footage afterwards, either via LUT or grading will often break the material.

So how does this affect skin tones? Our visual system is more accurate at perceiving fine detail in shadows and midtones instead of highlights, because it works logarithmically. Skin naturally falls into the midtones area, and too few values for representing the shades and color of skin cannot give the best reproduction. This is even worse for cameras with 4:2:0 or 4:1:1 chroma subsampling, which typically also have higher compression rates. Depending on the scene, this can lead to a noticeable overall loss in detail, color and possibly artifacts when tweaking the image. In short, banding in large areas of skin, for example in close-ups, or an artificial looking skin tone that lacks color variation.

> *"Assuming a proper exposure, skin tones [with low-end cameras] are often pink or magenta. You need to tweak the skin quite a lot to make it look normal. However, the result is often a rather monotone skin tone which has been compressed to a single hue. You can work quite well with low-end cameras in general, but it's extremely difficult to achieve a very good skin tone with still a little bit of reds in it."*
>
> - **STEFFEN PAUL** (pc)

David Mullen (pc) supposes that especially chroma subsampling may be responsible for a "*lack of fine detail in red and blue information to give flesh that subtle multi-colored effect that happens just below the surface of the skin*". When recording compressed 8 bits, he suggests to shoot "*something closer to the final intended look, with only a little extra overexposure detail to prevent overt clipping and to allow some flexibility in color-correction.*"

So instead of using log, most of the smaller cameras which record 8 bits offer modified gamma curves, for example hypergamma or cinegamma. Those are similar to standard Rec.709 gamma, but will capture a greater latitude by compressing the highlights (Chapman, 2011). They will not capture the whole dynamic range achieved with log, but with proper exposure, the quality may increase overall with less noise and better rendering in shadows and midtones.

COMPRESSION | WHAT ABOUT RAW?

The basic idea of RAW is recording the pixel-defect corrected[6] data that comes straight off the sensor, along with the metadata which includes information about the image, e.g. camera settings such as white balance. Those settings are not baked into the picture and can still be changed after it is converted into a viewable format - also known as processing or *debayering* when shot with a Bayer-filter (Brown, 2013). This is a great advantage, as white balance can be adjusted afterwards to get the color channels balanced.

RAW data usually comes at high bit depth between 12- and 16-bit and is in fact often compressed as well (Shipsides, 2012). While Arri's Alexa, for example, offers the recording of actual uncompressed 12-bit log ARRIRAW files[7], RED's REDCODE RAW format comes with wavelet compression ratios from 3:1 up to 18:1[8]. These compression ratios are limited when it comes to greater frame rates or HDRX® capability. RED further states:

> *"Just below 3:1 is mathematically lossless, but settings in the range of 5:1 to 8:1 are typically visually lossless and advisable for most usage scenarios. At the same resolution, these settings also require less storage space than the visually lossy ProRes 422 format."* ("Overview of the REDCODE File Format", n.d.)

Even though some RAW codecs like REDCODE may be compressed, they still don't perform chroma subsampling and will give a fantastic amount of flexibility for post-production. The more information across all three color channels is recorded, the better the skin and all colors can be reproduced.

6 *Sensor issues, e.g. Fixed Pattern Noise or hot pixels are fixed before recording the RAW data.*

7 *("ARRI Group: Image Processing Hardware", n.d.) | for fluidity in reading moved to footnote*

8 *("Overview of the REDCODE File Format", n.d.) | for fluidity in reading moved to footnote*

5.1.4 LENSES AND FILTERS

Lenses and filters can often cause problems due to possible color biases, either by design or unintentionally (D. Mullen, pc). Nowadays with digital cameras, there aren't different film stocks or specific lab processings anymore that give a certain look to the film. In order to create an individual touch, some DPs may choose to only use specific lenses or particular filters in a creative way (A. Minuth, pc). Doing it in-camera ensures the look will remain, even if they can't take part in the grading - which according to Andy Minuth (p.c.) happens quite a lot in the commercial business. Nik Summerer (pc) sets a high value on lenses to control skin tones in terms of sharpness and contrast. He refers to a set of accurate master primes compared to a set of vintage lenses which are rather individual and can give a certain charm to the image.

> *"Technically, those lenses aren't good, but emotionally and artistically they can give us something that others can't: a more beautiful shot of a face and maybe a subtle shift in the skin tones which makes it special."*
> - **NIK SUMMERER** (pc)

Some lenses and filters can certainly create desirable characteristics such as reflections, lens flares or diffusion, but this might not be the best option for all of the colors (A. Minuth, pc). Even though this may be exactly the look the DP is going for, sometimes the producer or the agency would like to reduce the effect - or the unintended side-effects that may come along with it. Trying to correct or reduce those effects can be difficult and time-consuming and sometimes only possible to a certain extent. Referring to a project that was shot using a *Black Satin* filter, Andy Minuth (pc) explains:

> *"In that case, you just have to accept the fact that you can't go for a high-class beauty look that's super clean. You've shot vintage - then the film's got to look a little bit vintage."*

Apart from artistic choices, there are also filters which are specially designed to correct out a color bias, for example to correct for fluorescent lighting as mentioned earlier. Another typical filter which should be added to the camera

is a polariser in order to manage reflections or suppress glare, as this cannot be done in post-production (K. Shaw, pc). Not using filters for technical corrections can result in worse color rendering.

A common issue is infrared (IR) contamination: to block the infrared wavelengths (starting around 700nm) the sensor is sensitive to, most cameras include an internal optical low pass filter (OLPF) with an IR cut-off filter (Hurlbut, n.d.). However, some still need help when using additional neutral density (ND) filters in front of the lens, for they will only block the visible spectrum, but not the infrared (Stump, 2014). The result is a color shift towards brown with blacks going red and a substantial desaturation (Hurlbut, n.d.). An infrared ND filter (IRND) is therefore necessary to reject the infrared wavelengths in addition[9] (Stump, 2014). There are various IRND filters for different cameras which use their own individual methods and every combination will have a different result. Nevertheless, some may even eliminate *far red* (a color that is on the very edge of the visible spectrum just above red) and this can have a devastating effect on skin tones (Adams, 2010). According to Michael Bravin[10], *"realistic and pleasing flesh tones require some far red in order to look natural"* (Adams, 2010, para. 32), so this should be taken into account as well.

In conclusion, it can be said that all lenses and filters should be used wisely. They can differ extremely in quality which can have unpleasant side-effects, such as uneven color casts or extreme vignetting (which are mostly impossible to fix completely).

9 *ARRI uses internal Full Spectrum Neutral Density Filters (FSND) in Mini, AMIRA and ALEXA SXT/XT. These filters evenly reduce light over the whole spectrum including infrared wavelengths. Though, ARRI still recommends to use an IRND when using additional ND filters above 0.9 in front of the lens. see: https://www.arri.com/forum/viewtopic.php?t=105&p=206*

10 *ARRI's former vice president of market development for digital camera products*

5.2 LIGHTING

Apart from the creative use of lighting, it is necessary to have an eye on the lighting sources that are used, as they have great influence on the colors.

> *"Color temperature tells us a great deal about the blue/orange component of light and very little about the magenta/green component, which can produce extremely unpleasant casts in the film, even if the meter indicates a correct reading for the color temperature."*
> - **BROWN** (2013)

Two light sources can have the same color temperature, but render colors differently due to their spectral reflectance. The *Color Rendering Index* (CRI) with a scale of 1 to 100 indicates the ability of a light source to reproduce colors accurately to mimic natural light. A CRI of 90 or greater is considered an indicator for good color rendition (Brown, 2013). However, CRI ratings *"do not necessarily translate into good color quality for camera sensors"* (Bertomeu, n.d., para. 4) as they rate as it appears to the eye. Especially skin tones are not included in the color samples used for those ratings. The *Television Consistency Index* (TLCI) measures the colors based on a camera sensor's reading instead and is therefore more accurate. Light sources for film should have 95+ for CRI or 90+ for TLCI (Tomkies, 2016).

These are light sources which have a continuous spectrum, for example tungsten lights. In contrast, some HMI, fluorescent, LED and industrial lamps have a discontinuous spectrum, hence a low CRI/TLCI (Tomkies, 2016). Especially industrial lamps like sodium vapor (often used in street lamps) are dominant in one color and often impossible to correct. Fluorescents and LEDs typically lack reds, which can create green tinted skin tones (Brown, 2013).

> *"It's very simple to spot poor light sources once you have a spectroscope with you. It's small, cheap and simple to use: you point it at the source and voilà, you see every missing color from the spectrum."*
> - **BENOÎT CÔTÉ** (Colorist, pc)

According to Andy Minuth (pc), using different colored light sources for skin is a common mistake made on set, especially mixing lights on the green-magenta axis. The human eye adapts to those color casts and it can still appear color correct to the eye, but to the camera it won't. Having a good color meter is therefore invaluable in a situation where the light cannot be fully controlled (Brown, 2013). Correcting these poor light sources with gels to match it to others is highly recommended, but they still won't be truly color correct and reproduce good skin tones, as the gaps in the color spectrums of these light sources simply cannot be compensated (Tomkies, 2016). However, there are also color-correct fluorescent tubes and LEDs which have gained much popularity (Brown, 2013).

> *"The best solution for poor LEDs is to avoid them. If possible, I replace them with color-correct LEDs. But this can get very expensive, which is why it also depends on the budget."*
> - **BJÖRN SUSEN** (pc)

Balancing unintentional different light sources with gels as well as keeping an eye on the spectrum of the light source can help to achieve good skin tones. It's tempting to use cheap lamps, but it will certainly affect the quality of rendered colors.

5.3 FILM VS. DIGITAL

Although digital has been developed very quickly with new and improved cameras being released regularly, from my research it seems that achieving the look of film - whatever this might be - is still sought after. Especially when it comes to skin tones, opinions differ. Did film produce "*better*" skin tones, and if so, what is "*better*"? Having grown up in the digital world and never worked with film myself before, I was curious about the characteristics of film in comparison with digital, relating to skin as a matter of course.

This chapter is about the individual, subjective impressions and opinions of the interview participants and omits personal communication marks *(pc)* for fluidity of reading. For easier separation between film and digital, I decided to use

the past tense for film and the present for digital, even though film is still being used. It should just serve for a better understanding.

The last bullet points tried to illustrate which technical properties among others matter when shooting digital. Going back to early digital Rec.709, film's advantage was definitely the wide color gamut along with the pleasing log capture that was perfectly interpreted by the print stocks (K. Shaw). Color information existed on multiple color layers of the negative, so film tended to preserve the color complexity of skin. It was even possible to correct an image that's totally off back to neutral - it seemed to have *"hidden or buried colors you could bring out to the front"* (D. Mullen).

Andy Minuth and Steffen Paul both illustrate that film fairly compressed skin colors to a certain extent, while still preserving a subtle, natural color variation. *"On most digital cameras, two Caucasian skin tones are often rendered further apart from each other than what we are used to seeing on images shot on negative stock"*, Florian 'Utsi' Martin (2016) explains. Blake Jones also remembers different film stocks that would change everything quite a bit, along with the skin. Every film stock was different and had its own strengths and weaknesses, and digital skin tones in comparison feel more neutral. The reason for that might be, that color negative was always *"designed to be colour-timed before viewing, you'd never look at your negative. Digital, however, is either just viewed through a LUT with no timing or RAW and as such needs to produce a more neutral image straight out of the camera"* (A.Inglis). Steve Hullfish remembers people preferring Kodak film stock over Fuji for beauty and people's faces, as it registered better on skin tones.

Colors on film seem to be more natural and varied, especially in the shadows (A. Shoul). Skin tones look more alive and dimensional (D. Mullen) and, according to Rob Bessette, have a nicer roll off. Steve Hullfish approves, he refers to the soft, natural highlights which he thinks feel a little electric on digital cameras, especially when they are about to clip. He supposes the soft look might be created through each color layer being slightly defocused when light hits the film, resulting in a little glow that helps soften skin tones - and the additional film grain did its magic as well by adding a soft, organic texture to the skin. It's very interesting to see that softness in skin is a general desire that correlates with the upcoming boost of resolution. Certainly, film's soft look also came through the number of prints that film was going through. Adam Inglis talks about subsequent

generation loss that resulted from printing. He states: *"The softness of film would be kind to faces, although lack of resolution is on paper a bad thing. Yet the sharpness of digital would be less kind even though higher resolution is in theory good."* Blake Jones agrees on this. He describes digital skin tones as "much harder", or in other words too sharp, so he tends to soften them a little bit.

Nevertheless, most colorists also agree that nowadays digital cameras can reproduce accurate skin tones as well with proper settings and exposure, which have been covered in this chapter. Even though there was a lot of resistance to digital, because early technology had its problems, it seems to have calmed down and top directors and DPs will happily shoot digital (A. Inglis). David Mullen points out, that a digital camera which records a wide color gamut, 4:4:4 chroma sampling and log or RAW capture can provide enough color information to work with. When it comes to differences between high-end cameras, colorists seem to prefer the Alexa for its tough color science, flexibility and perceived soft highlights. *"It requires a little bit of talent to get a bad skin tone out of the Alexa or Amira",* states Paul Steffen, but according to Asa Shoul there are still times when even the Alexa can make skin appear plastic or too smooth.

However, RED seems to be less controllable and takes a little more work. A reason for that could be the many different color spaces and gamma curves, which often lead to confusion and aren't used properly (S. Paul). Andy Minuth points out that digital is more unforgiving than film. Especially with RED, he thinks the biggest reason for less control in the skin tones is underexposure which cannot be handled as well. Blake Jones furthermore remembers a dramatic hue rotation when over- or underexposing the RED One, an issue that RED apparently seem to have addressed with redesigning their new image processing pipeline *IPP2*.

Generally, modern cameras seem to capture a lot of green due to the Bayer pattern, while film used to capture a lot of red light due to the speed of the layers, says Adam Inglis. Other colorists confirm to have sometimes noticed a little green cast which can usually be corrected easily.

"I feel that with many of today's better digital cameras the difference in skin tones is largely down to style more than technical differences", Kevin Shaw states. He thinks, at the moment, most of what we watch is in fact favorable to skin tones but abstracted from reality and that there will be a return to more realistic images and skin tones in the future. Lukas Tielke supposes that nowadays the amount of

low-quality content is higher, because shooting digital is much cheaper than film, and so everyone's got a camera and just works on it. *"In the early days, there were only a few photographers, but they were great. Those who shoot film really look into the topic"* (L. Tielke).

According to most colorists, using film print emulation for the grade, softening and adding color, depth, and grain to the skin can give a "filmic" feel. Adam Inglis has from his experience come to an interesting additional theory - that the reason why film feels three dimensional is because it's created by a single light source shining through a physical barrier. This is a *"unique effect of celluloid going through a gate and creating a shadow play on the wall"*, which colored pixels being projected on the screen simply cannot achieve.

So, did film produce better skin tones in the end? Probably yes, at least without much effort. Modern cameras have been designed to look like film because a wide dynamic range and a wide color gamut are naturally an advantage, so it's sensible to strive for that. Additionally, I think it's just a matter of fact that softness is much more flattering to skin, it's simply the reason why we put on makeup. However, I can see two different sides here. Color rendering is more an issue of color science and softness is related to resolution. Both improve, but while color science will help to reproduce better skin colors, rising resolution will simultaneously reduce the overall quality of skin tones, or at least increase the amount of work in post-production with the need for softening faces.

Nevertheless, considering the current state of technology, overall I'm positive that digital skin tones can look very close to something that was shot on film when combining appropriate creative choices, reasonable technical decisions and accurate grading.

6 SHAPING SKIN IN POST-PRODUCTION

Revisiting the beginning of this paper, "*any colorist will tell you that half the job is grading skin tone.*" (Van Hurkman, 2013, Chapter 8). So far, we have explored the visual appearance of skin tones, its relation to storytelling and the technical background for reproducing ordinary skin color. Being aware of what has been influencing the skin tone on its way into post-production, we can now tweak and enhance it.

Alexis Van Hurkman dedicated almost a whole chapter to skin tones, which is very revealing on the basics of grading skin tones. I will not be repeating everything he has discussed, but would highly recommend reading his work. This chapter is a general overview of possibilities and ideas of how to deal with skin tones and assumes the reader to be familiar with basic color grading and using scopes.

FIGURE 11: *A vibrant skin tone graded by colorist Juan Melara.*

6.1 JUDGING SKIN TONES

Skin tones are created by a combination of brightness, hue, and saturation. Even though skin tones vary around the world, their hues fall within a fairly narrow range. Let's take another look at the *Humanæ* project by Angélica Dass in order to demonstrate this. The *vectorscope*[11] shows, that all the different skin tones fall onto or close to the in-phase indicator, meanwhile known as the *skin tone line*[12].

FIGURE 12: *Selection of Humanæ and responding vectorscope*

But within that narrow range, there is still plenty of room for variation - every complexion is different and even the most subtle tweaks to skin can change our perception of the individual's skin. Alexis Van Hurkman describes various groups of complexions under neutral lighting.

RUDDY/MAHAGONY
Tilts towards red, much more saturated.

PALE/PINK/FAIR
Tilts towards red, can be quite desaturated, sometimes slightly blue.

MEDIUM/DARK
Hue falls right on the I-bar, saturation varies.

OLIVE
Tilts to the left of the I-bar, may stick out when next to other complexions.

GOLDEN/ASIAN
Can fall far to the left, saturation depends on whether natural complexion or tan.

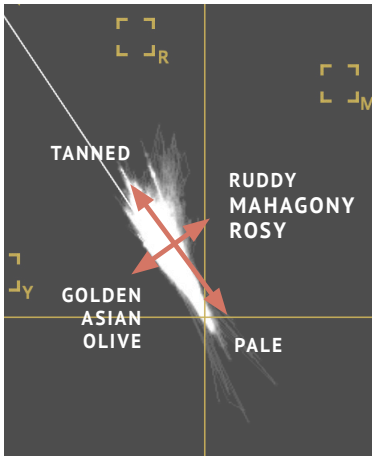

FIGURE 13: *Guidelines for complexion adjustments.*

11 *The vectorscope measures the overall range of hue and saturation within an image.*

12 *The original purpose of this bar was to align burst on a video signal, the sub black signal that signifies a new frame. Coincidentally it also happens to be a signpost of flesh tone.*

Figure 14 shows several shots which represent quite natural skin tones. For a clear result on the vectorscope, they have been isolated. Unsurpringly, all of the isolated skin tones fall right into this range.

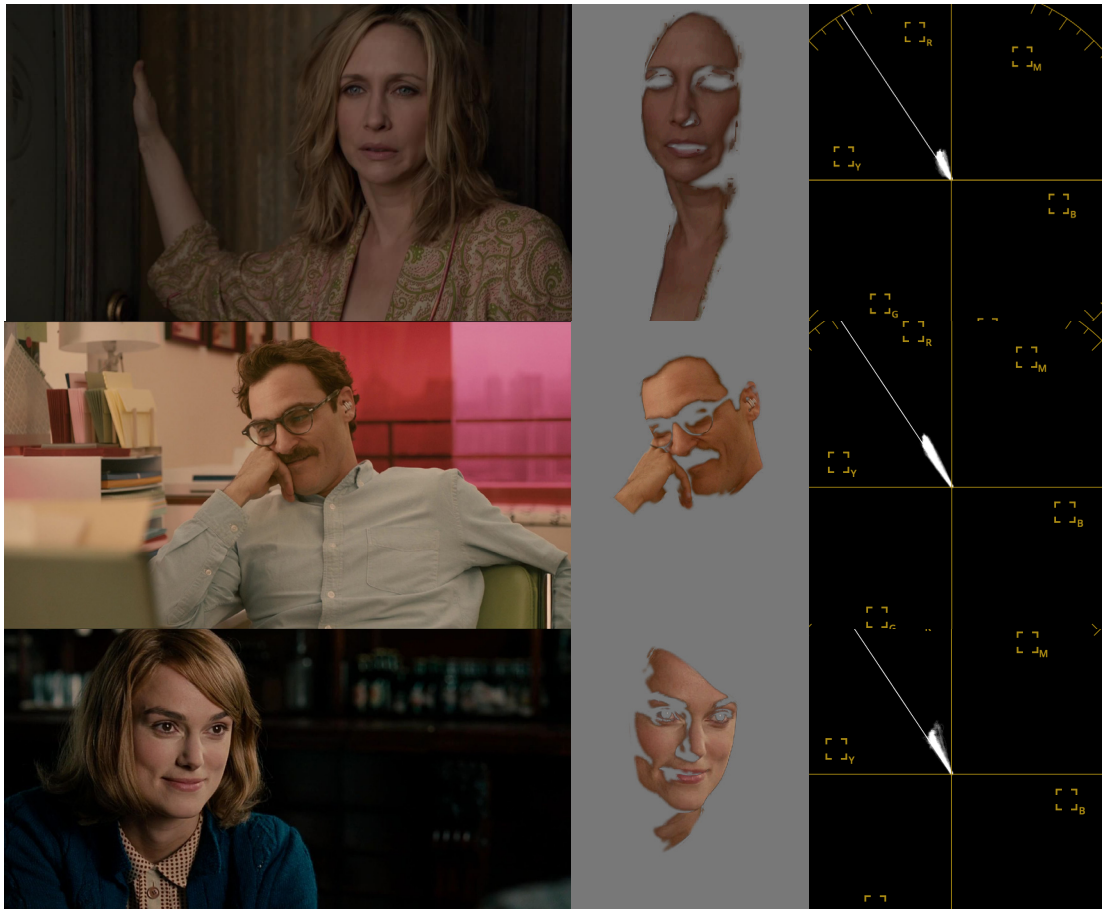

FIGURE 14: *Isolated skin tones. Bates Motel (USA, 2013-2017), Her (USA, 2013) and The Imitation Game (USA, 2014).*

As we know by now, the ambient lighting can change the skin tone. In another scene of *The Imitation Game,* Keira Knightley is surrounded by dim lighting. Still, the hue falls right onto the line, along with increased saturation.

FIGURE 15: *Another scene of The Imitation Game in dim ambient light.*

However, this is not true in every situation. The overall illuminant can change the skin tone even dramatically in order to fit within the scene. If we take a look at the isolated skin tones of Figure 16, it's quite overwhelming to see how strong they deviate from a natural tone, and still, they work within the shot.

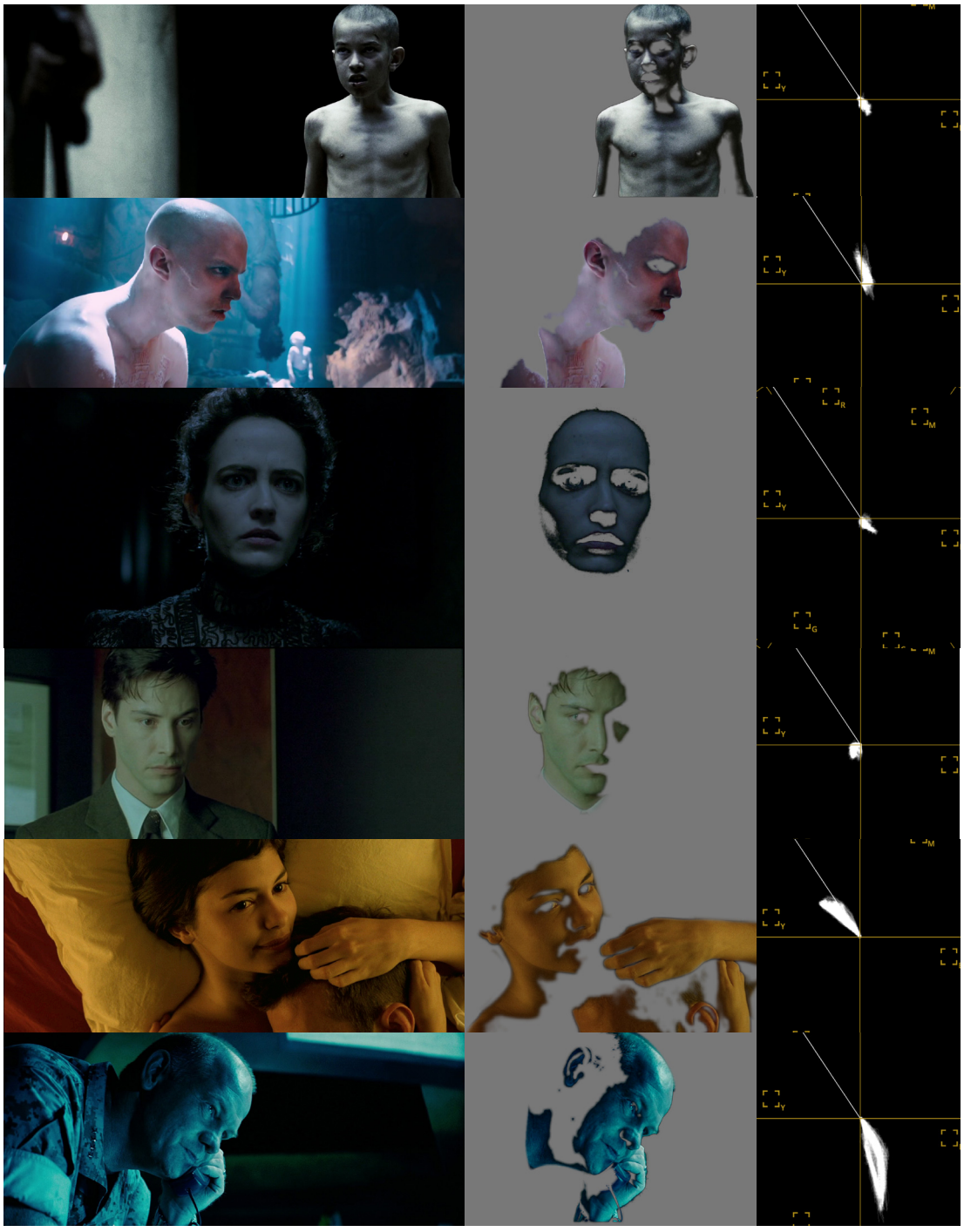

FIGURE 16: *Isolated skin tones and their signal on the vectorscope. 300 (USA, 2006), Mad Max: Fury Road (USA, 2015), Penny Dreadful (USA/UK, 2014-2016), The Matrix (USA, 1999), Amélie (France, 2001) and Transformers (USA, 2007).*

The skin tone line is undoubtedly a great tool to judge the color of natural complexion under neutral lighting, but it shouldn't be taken too literally. Using the vectorscope is an absolute personal preference. Many of the colorists I spoke to used it as a reference at the beginning of their career, others didn't at all, some still do.

> *"I did a lot [use the vectorscope] when I started. I only do now when doing final passes for extremely accurate corrections. It's also useful if you are grading a scene for a long time that has a strong colour cast, for example, night or underwater, as your eye will start to neutralise the colour."*
> - **ASA SHOUL** (pc)

In my experience, the vectorscope can definitely help to train the eye in order to evolve a natural feeling for hue and saturation of skin tones. When in doubt, it's a good reference for a decent starting point[13].

13 *For a more detailed, general guide to "normal" skin tones, see chapter "Ideals for Skin Tones" in Alexis Van Hurkman's Color Correction Handbook or see https://larryjordan.com/articles/color-correction-make-people-look-normal/*

6.2 TECHNIQUES

There are two different approaches to grading skin tones and it was interesting to see that every colorist has an individual preference. One is to balance the shot for skin first and fix the rest, the other one is to balance the shot in general and then deal with the skin afterwards.
Colorist Trish Cahill (2016) explains:

> *"My approach is to dissect each shot and grade it accordingly to match. For example, if there is a close-up face with skin tone taking up 60% of frame, I grade my base with regard to the skin tone. If it's a wide shot with only 10% being made up of skin tone, I often grade for the other 90% and then the remaining 10% skin tone in a secondary."* (para. 16)

The *primary* color correction is the process of balancing the image. Setting the overall tone, contrast, and color balance alters the image as a whole. In most cases, balancing an image to a neutral state for the individual lighting situation[14] will give a good starting point for natural skin tones, unless the color cast was intended while shooting.

Secondary color corrections are used to adjust only specific parts of the image, for example, a particular object or subject. There is a variety of different tools to make secondary adjustments and it is tempting to overuse them. Secondaries should only be used in addition to a carefully controlled primary correction, otherwise it can result in unnaturally shifted colors that won't look "right" to the eye. Adam Inglis (pc) advices:

> *"If you're building up a lot of secondaries, then I would start to question if the primary grade is right or not. If you have a shot of a person standing in a field, behind them is a wall and above that the sky. If you end up with a secondary on the person, another on the field, another on the wall and another on the sky, chances are your primary isn't right since you've had to correct everything already. Get your subject looking right and then see what else might need fixing."*

14 *The term 'neutral' is still relative to the ambient lighting. If it's a sunset, it's okay for the skin to be warm and golden, if it's a cold afternoon, skin can be cooler and pale.*

In order to demonstrate this, let's have a little fun and balance the shot of *The Matrix* back to neutral[15]. A simple white balance using the *Gain* control corrects for the overall greenish tint and gives us a nice natural skin tone that falls close to the skin tone line. The vectorscope refers to the whole image.

FIGURE 17: *The original shot of The Matrix (above) and the color corrected one (below).*

Now, instead of balancing the whole image by primary correction, we will use a secondary correction, a *qualifier*, to limit the correction to the face. Although this adjustments makes his shirt look a little bit green, it still kind of works and makes Neo pop out of the image (which is similar to what happens at the end of the film as discussed earlier).

FIGURE 18: *The white balance adjustment limited to the face by using a key.*

15 *following Evan E. Richards (2011)*

However, applying the same procedure to the shot of *Amélie* gives us a different result. We can see that the adjustment using a secondary doesn't work well at all, it has an unnatural, wrong feeling to it.

FIGURE 19: *The original image (above), the primary balanced version (middle) and the primary balance limited to the skin (below).*

This points out two concerns. First, even though the skin falls close to the skin tone line, it doesn't look right within the frame. Second, it is a perfect example for *color constancy*. The original look of *Amélie* has an overall yellow cast, but we still perceive the pillow as white because our brain automatically corrects for the illuminant. In the last frame, there is a conflict, because the skin tone looks normal. As a result, the pillow appears yellow to us, as internal white balancing for the pillow would make the skin tone look wrong (all of this is of course happening subconsciously).

Over-complicating the grade with unnecessary secondaries can be very time-consuming, and much worse, it can destroy the natural color separation and look artificial. On the other hand, they can sometimes be essential in order to make a heavy look believable or stylized. *"If I have to create a very color tinted look,*

I often have to take skin tone out of this grading, since you don't want to look at dead faces or red tomatoes", Florian Martin (pc) explains. The section **"4.2 CREATING THE LOOK"** already explored the possibilities of blending in skin tones or making them stick out of the overall look.

6.2.1 SECONDARY TOOLS

There are several secondary tools that can be used to achieve different results, depending on what is suitable for the situation. They can be used individually or in combination with each other.

Qualification, also known as *keying*, is used to isolate part of an image based on a specific range of color or lightness. The matte which is created by pulling a key will determine which part of the image is being affected by the following adjustments. It can be used on multiple nodes or layers and combined, inverted and controlled in terms of opacity. Creating a matte can be tricky depending on the material, especially on heavily compressed and chroma subsampled material (see **"5.1.3 COMPRESSION"**). Although in most cases it's not necessary to be extremely accurate as in visual effects work, it's still essential to make sure that the key is adjusted properly to avoid noise, fringing, chatter, halos or other undesirable artifacts. Unless the key isn't limited by a *shape*, it doesn't need to be tracked or keyframed.

Shapes, masks, or *windows* can be used as well to affect a particular area of an image. With isolating large areas smoothly, they work extremely well in terms of digital relighting and are usually adjusted faster than qualifications. They can be simple or detailed, combined and adjusted in many ways. Contrary to keys they need tracking or keyframing if the camera, the subject or the object is moving.

HSL Curves are a quick way to alter user-defined ranges of hue, saturation or luminance in relation to each other. *Hue vs. Hue*, *Hue vs. Saturation* and *Hue vs. Luminance* are the most common ones. Although they are easier to handle than the qualifier, they need to be controlled carefully as they cannot be blurred. This can potentially lead to artifacts, especially with higher compressed material.

6.2.2 ADDING AND REDUCING COLOR VARIATION

> *"Quality skin tones for me means these subtleties in reds to yellows are seen. When skin tones get compressed (reds and yellows swung to orange), it creates a plastic-y look that, in my mind, is a bad grade."*
> - **PARKER JARVIE** (pc)

There are two extremes. Skin tones which include many different hues, for example, red and pink cheeks with green blotches under the eyes, and then there are skin tones which lack variation, so every part of the skin is the exact same color. An ideal skin tone seems to fit right in between, evening out different hues to a pleasing, unified tone that still includes a little bit of color variation (S. Paul, pc).

EVENING OUT SKIN

In order to reduce color variation or even out the skin tone, it's necessary to bring the different parts closer together. If the difference is in hue only, it can be easily compressed by using the *Hue vs. Hue* curves, otherwise pulling individual keys and adjusting brightness, hue and saturation until they match should work. Another option would be to desaturate the whole skin to a certain amount to minimize the difference, and afterwards pushing the skin towards the desired hue. This is a common practice in the commercial world (A. Brückl, p.c.). However, too much evening out can potentially result in an artificial looking monotone skin tone.

FIXING MONOTONE SKIN

To avoid a plastic looking skin, color variation can be added or enhanced. It is basically the reverse of evening out skin. This can be done by isolating the skin tone and using the primary tools to separately change the color of the different sides or by tinting the skin. Colorist Juan Melara (2012), for example, suggests to add blue or purple to the shadows and to give the highlights a little bit of

yellow. Another option is to directly split the hues in order to get a wider palette by pulling different keys, for example isolating the more reddish parts and then either increasing saturation or pushing them further towards red. Van Hurkman (2013) further advices not to desaturate the shadows of skin tone, as it can *"make a complexion look gray and ashen"* (Chapter 8).

FIGURE 20: *Comparison between a skin tone with natural color variation (The Lucky One, USA, 2012) and a flat, monotone skin (Knowing, USA, 2009).*

6.2.3 DEALING WITH DIFFERENT COMPLEXIONS

Although in real life we probably wouldn't notice it, some complexions may stick out in motion pictures when next to others, especially under mixed lighting.

> *"There's a bit of a running joke that every film has a 'pink man'. These tend to be older British actors who have spent a lot of time in the pub. To meet them in real life you wouldn't necessarily notice it, but on film they stand out and require separating. There's almost always one."*
> - **ADAM INGLIS** (pc)

The aim is again to bring different skin tones closer together, similar to evening out skin, but still we don't want to make everyone's complexion the same. Balancing the image in a way that makes the majority look good and consistent will preserve the subtle differences among characters. A secondary correction can then be used afterwards to address the character who's sticking out. Usually,

the *Hue vs. Hue* curves work their magic, but sometimes you can't get around pulling keys and using masks.

When dealing with very light and very dark complexions in the same picture, trying to get a primary correction that works between the lightest and darkest skin tone is the easiest way (B. Jones, pc). If that doesn't work, it's good to evaluate whether the bright person is overexposed or the dark person is underexposed relative to the scene, then grading for the correct person and putting a key or a window on the other one (A. Inglis, pc). However, Kevin Shaw suggests keeping the natural differences as realistic as possible, unless the contrast is too high (pc).

6.2.4 CREATING DEPTH AND DIMENSION

As described earlier, a flat face will probably look boring and lifeless, and adding some contrast will create depth and dimension to avoid this. Even when going for an overall flat look it's important to retain some contrast in the midtones. The aim is to lower the darker areas and brighten the highlights. *Specular highlights* (which are technically blown out) can further give *"gloss and punch [which] serve as another tool to direct viewer focus even more specifically*" (Van Hurkman, 2013, Chapter 8). Enhancing contrast in particular areas can be done in a subtle or heavy way, whatever is right for the shot. Using a window on the face and increasing the contrast can already have a huge impact.

To perform more of a *Dodging & Burning* technique, a qualifier can be used. Isolating and boosting the higher midtones/highlights of the skin will add gloss and make the skin pop. In order to intensify the result, another key can be created, this time isolating the lower midtones or shadows which can be darkened afterwards. Adding local contrast can also be taken to extremes with reshaping the face and body, which is a common practice in beauty retouching (see also "**6.2.7 BEAUTY RETOUCHING**").

6.2.5 PRESERVING NATURAL SKIN TONES

When creating extreme grades it may be necessary to protect the skin tones from disappearing inside of the look. This can be done by isolating the skin and using the inverted matte to limit the heavy adjustment to the outside of the isolated area. Another possibility is to copy the unaffected isolated skin tone back into the image later where it's needed, for example by using a *Layer Mixer*.

It is crucial to keep in mind that skin reflects its surroundings by interacting with the dominant illuminant. Overprotected skin tones can look strange and artificial, almost like a bad greenscreen composite. In order to avoid this, reducing the opacity of the matte will effectively blend the skin tones into the scene.

6.2.6 FIXING MAKEUP

As addressed in **"4.1.2 MAKEUP"**, poorly applied makeup can be a struggle in post-production and can only be fixed to a certain extent by a colorist.

MAKEUP | UNFLATTERING SHINE

Unflattering shine can be minimized by isolating the shiny highlights, bringing them down and pushing in some color. Sometimes a little bit of softening can be helpful as well. This is also an option for fixing blown out highlights.

MAKEUP | UNEVEN MAKEUP

For uneven makeup, the technique for evening out skin mentioned in **"6.2.2 ADDING AND REDUCING COLOR VARIATION"** is appropriate.

MAKEUP | MAKEUP TEXTURE

Visible makeup texture can be reduced by isolating the area and softening it by adding blur or reducing midtone detail. See also **"6.2.7 BEAUTY RETOUCHING"**.

MAKEUP | FIVE O'CLOCK SHADOW

Whisker growth can result in darkening in the mustache and beard area, which typically creates a bluish or greenish tint around the lips and jaw. If this needs to be corrected, it can be isolated, brightened and pushed towards a warmer color. *Hue vs. Hue* works great to easily shift the hue towards an orange tone.

MAKEUP | ADJUSTING THE MAKEUP

There can be various reasons for changing makeup colors. The makeup may not be coming across correctly (A. Inglis, pc), it may have been altered by a LUT (S. Coleman, pc) or it may need to be a particular color (A. Brückl, pc). Whatever the reason, it's normally quite simple to pull a key of specific makeup items like the lipstick or rouge, as they are usually saturated enough to stand out. Often, the *Hue vs. Hue* or *Hue vs. Sat* curves work great in a short amount of time. Changing the colors to specific references is especially common in commercials.
Rob Bessette (pc) explains:

> *"When needing to match particular colors (lipstick), secondaries and masking are huge. Sometimes when the job is done there is almost an entire image underneath the final image of isolated areas. That way there is complete control of the areas that we want to tweak."*

6.2.7 BEAUTY RETOUCHING

> *"A beauty grade on a close up portrait might contain 2-3 times as many layers as a product shot. Even in a feature grade."*
> - **ROB BESSETTE, CSI** (pc)

Since HD had been storming the market and higher resolutions as far as 8K are coming up, beauty retouching has become a regular process in the industry. Often the beauty work is passed over to visual effects, but nowadays many colorists are asked to do vanity passes to a certain extent as well. It always depends on the type of motion picture, how it's supposed to look and the budget. Usually, the beauty of someone's skin matters more in a commercial than it does in a feature film or documentary.

FIGURE 21: *The amount of masks that Andreas Brückl used for grading this beauty commercial. Ungraded log-encoded image (left) and the final result (right).*

Beauty passes address several issues, for example accentuating the overall bone structure by adding or reducing local contrast, evening out skin tones, getting rid of blemishes and wrinkles, smoothing skin, enhancing makeup, brightening eyes and teeth, adding gloss or removing shine. Most of the techniques have been already mentioned so far and these are mostly a combination of isolating skin, adding windows and then altering the area with primary controls or color curves.

In order to smooth skin, blemishes or wrinkles, contrast needs to be lowered in these parts of the skin. This can be done by isolating the parts and using the blur tool or decreasing the midtone detail. This method may be the fastest, but it is not necessarily the best option as it will most likely destroy the natural skin texture and result in an artificial looking skin when applied heavily.

There is a popular retouching technique which is known as *Frequency Separation*. This is a process of decomposing into spatial frequencies in order to work on them independently. High frequencies contain all the information about fine details, for examples pores, hair, and skin imperfections, whereas low frequencies contain luminance, colors, and tone. Basically, this means that it is possible to independently make changes to the overall complexion without destroying the texture and to improve the texture without altering the overall skin tone.

FIGURE 22: *Smoothing skin by using frequency separation.*

The setup for this technique in Blackmagic's *Davinci Resolve* is somewhat complex, but is explained by colorist Benoît Côté and retoucher Paul Wittenberg online[16]. The setup is a combination of *Layer Mixers* and different *blending modes*. Figure 22 shows an exaggerated example of using frequency separation. It is a powerful technique and should be applied carefully.

Even though frequency separation is popular for smoothing skin, it can also be used to bring out and intensify detail. This can dramatically change the appearance of a character and can be useful for storytelling (Figure 23).

16 see https://vimeo.com/96743549 and https://www.youtube.com/watch?v=GHg0bsduRWs

FIGURE 23: *Skin manipulation series by Benoît Côté: natural soft look (left), tired (middle) and textured look (right)*

6.2.8 ADDITIONAL TIPS

TIPS | NOISE

If the shot is underexposed, it can be very noisy. Skin may look dirty and it can be difficult to pull a decent key. In this case, noise reduction can be used, but applying it too heavily creates a plastic, artificial look. This can be avoided by reducing noise only in the color channels, with blue channel noise reduction sometimes being sufficient.

TIPS | TEXTURE

Adding grain can create a pleasing texture which covers skin imperfections easily. According to Florian Martin (pc), "*it helps to focus on the eyes and the person, not on the skin itself.*" Another option to add texture is to increase sharpness, for example, by boosting the midtone detail. This can especially be used to accentuate facial detail such as eyes or even wrinkles when going for a gritty look. It always depends on the character.

TIPS | CONTINUITY

Keeping skin tones consistent will make the film flow. The viewer is generally following a face, so it's important to have a good match throughout the scene. While backgrounds can change, people usually don't, unless there is a change in the lighting situation. It's helpful to keep a reference frame when matching the scene.

6.3 LIMITATIONS AND COMMON MISTAKES

A colorist can only enhance what's already there and hide what's unnecessary or unpleasant, as replacement is the province of visual effects. Still, there are situations when hands are tied because it's almost impossible to fix skin. As covered in **"5. TECHNICAL ISSUES TO BE AWARE OF"**, poorly shot imagery which is over- or underexposed, too compressed or heavily color shifted are probably the most common problems, but poor lighting and bad makeup both play a huge role as well. In those cases, making skin not look terrible will probably be the best a colorist can do. Another variable which hasn't been addressed so far is time and money. Sean Coleman (pc) explains:

> *"In general, the more you add, the more things you have to worry about. So you've got be subtle with your initial grade."*

Overdoing it with improvements is a good way to waste time. As mentioned before, keying the skin tone before getting the primary correction right can make the grade fall apart and lead to strange looks and inconsistency (A, Inglis, A. Shoul & M. Osborne, pc).

> *"The trick is to know when a primary correction will be faster and when a specific issue with the footage means you'll be faster moving on to a secondary; learning which is which simply takes time."*
> - **VAN HURKMAN** (2013, Chapter 8)

Tweaking the skin in an aggressive way just because it's possible doesn't mean it's appropriate - it's important to know when to stop (R. Bessette, pc). Other mistakes include boosting the saturation too far (S. Hullfish, J. Petok, pc), compressing the colors and brightening too much (A. Brückl, P. Jarvie, pc), clipping the red channel or *"making the skin thin or dull"* (K. Shaw, pc).

6.4 INDIVIDUAL PREFERENCES FOR SKIN TONES

This very last section is dedicated to the personal preferences for skin tones of some of the interview partners I spoke with. I found these comments of interest, and thought it would bring further insight.

> *"Healthy, gradient, glowing. Every colorist has a different feel of how a skin tone should look. Some more red, some more green. I like more of a golden look. But its important to build separation in all part of the skin tone. Otherwise the skin looks very matte."*
> - **MATT OSBORNE** (pc)

> *"Generally, I like a slightly warmer tone, which is rich in contrast and beautifully expresses the face. A warm skin tone is related to health, and that's appropriate in many stories."*
> - **NIK SUMMERER** (pc)

> *"I want everything to blend and to feel right. I think just accuracy with skin is definitely something that makes skin tones look good to me. It all starts with balancing the picture accurately and just making sure you're not contaminating the skin with green or red, too much color. Skin tones look good to me when they're proper and correct."*
> - **SEAN COLEMAN** (pc)

> *"I lean more towards warmer (orangey yellow) skin tone but sometimes (pending camera format, mood/vibe of film) I lean towards magenta."*
> - **KATH RAISCH** (pc)

> *"A 'good' skintone for me is one that naturally sits with the lighting in the scene."*
> - **ASA SHOUL** (pc)

> *"To me personally, a quite pale skin-tone with a fine texture on a dark grey or cold background looks the best. For beauty, lower contrast flatters the skin, but for rough faces quite the opposite is true. The texture is almost as important as the color and contrast."*
> - **ANDY MINUTH, CSI** (pc)

> *"I prefer skin tones on the warmer side, but they shouldn't be too yellow, if anything then orange. It all depends on the overall grading and saturation. Magenta is quite unflattering, but a slight rosy skin tone is okay. Green skin tones look usually very ugly, but in cases of e.g. a very stylish greenish TVC grade it might work well. You just have to be careful and find the right balance. I try to keep my skin tones somewhat neutral, but still warm. The same rule for night shots. Nights can be blue or green and dark, but the skin tones shouldn't get tinted with blue or green. They should always appear warmer than the environment."*
> - **ANDREAS BRÜCKL, CSI** (pc)

> *"My feeling is that I like a warmer skin tone, I like something that has some life, my preference is definitely something warmer and also a more reddish tone."*
> - **STEVE HULLFISH, CSI** (pc)

> *"For me what makes skin tone look good is a slight warmness to it. Not oversaturated. This all depends on story and lighting though. Lighting with nice contours is always pleasant to me. Always like to make sure to get lighting right on the eyes so there are no 'raccoon eyes'."*
> - **ROB BESSETTE, CSI** (pc)

> *"I think about a natural look with a color gradation as film does. For me, it should be 'placed' to the rest of the picture. If the environment is cold, no way skin should look super warm. I should see color variation from cheeks to forehead and under the eyes for example."*
> - **ALEKSANDR VERHOLIAK** (pc)

7 CONCLUSION

The main purpose of this paper was to draw attention to skin tones in motion picture. With all of the possibilities given by the constantly improving digital technology, skin tones have become a difficult task to perfect in post-production. In order to gain a deeper understanding of how the visual appearance of skin is created, reproduced and shaped, this paper examined several fields that have a strong influence on skin tones in visual media.

Due to the subjectivity of this topic, it was difficult to use only classical scientific sources. Instead, the paper aimed to include practical experiences of the industry's professionals. The content mostly builds on their thoughts, opinions, and experiences in order to give a realistic view of this subject.

The beginning of this paper has described a colorist's craft and pointed out the importance of client communication, which is essential for putting skin tones into context. In the second chapter, the biological structure of skin has given an idea of how skin color is created. We have learned that skin is actually a memory color, which means that it's familiar to everyone. Still, everyone has an individual preference which is influenced by their daily surroundings. It can therefore vary in different cultures and the ideal of beauty as portrayed in the media definitely plays a vital role in creating this memory and preference color.

When it comes to motion pictures, skin acts as a messenger of emotions and status. The context dictates the character, and therefore the skin tone. Different departments work closely to create the character and fit them into the scene to tell the story. Chapter 4 pointed out the relationship between skin tones and storytelling and how creative choices on set can influence the skin tone in post-production.

Additionally, technical choices must be made to control the digital reproduction of skin tones. Chapter 5 discussed technical issues to be aware of, such as exposure, white balance, compression or lighting sources. These choices

eventually affect the amount of flexibility in post-production. In order to find out about the differences in skin tones between shooting film and digitally, professionals' opinions and impressions have been presented.

The last chapter explored various possibilities to shape skin in post-production. Different approaches, techniques and tips have shown how to deal with skin tones to either enhance or repair them. The very last section gave an idea of different, individual preferences for skin tones.

In summary, skin passes through many stages. Different scenarios will need different decisions and adjustments. The process starts with casting the actor, and their complexion will be altered throughout the production. Depending on the type of film, scene, and story, their character will then be formed and adjusted by makeup and costume design, and be heavily influenced by the dominant illuminant of the scene. Once the scene is set, skin color reflects lighting sources and is reproduced by technology. Having arrived at the grading suite, skin can then be tweaked in many ways, depending on the client's vision.

Throughout this paper you will have noticed that there is an amount of repetition across the different sections. This was unavoidable due to all of these elements affecting and being interconnected with each other. This goes further to the point that each of these sections are important and the understanding of each will impact the other.

The *journey* of skin during production clearly shows that there is no perfect answer to how skin tones are supposed to look, but if anything then there is a way to determine how they should look in context and how they can serve the story as well as the director's and DP's intention.

However, taking away the context, the question *"What makes skin tones look good to us?"* remains, and this investigation has pointed out some characteristics which can be used to shed some light on this matter.

A natural, "*pleasing*" skin tone, at least for the western world, seems to fall in a narrow range of color, but still includes a little bit of variation. This is exactly what film had in advantage, in addition to a certain softness and texture. In digital, color variation is best obtained and reproduced by several technical

factors: an appropriate exposure as well as white balance for the scene, a high bit depth, little compression and high-quality lighting sources. Overall, a little bit of warmth makes skin tones look healthy and vibrant, but they shouldn't be too saturated. Three-dimensional, soft lighting is generally flattering as it hides imperfections and creates depth.

As technology is moving so fast, we can assume that digital reproduction will improve constantly with the help of progressive color science as well as color management. With *HDR* and *Rec.2020* (a wider color gamut) coming up in the future, it will be interesting to see in which way they will affect skin tones. Kevin Shaw (pc) and Blake Jones (pc), for example, are both of the opinion that HDR will give better, more natural and less saturated skin tones due to greater shadow detail and less channel clipping. The experience which Andy Minuth made so far is that skin tones don't need a wider gamut than P3 - they can be reproduced well even with Rec.709 primaries. The tone-scale in HDR, on the other side, has a larger impact on skin tones: it's possible to keep a nice, saturated color even within the highlights. Additionally, those skin highlights are less compressed in bright scenes. Having them sit around 100-150 nits lets them "breathe", creating more three-dimensional characters.

Looking deeper into the mystery of skin tones has definitely furthered my skills as a colorist since it has made me aware of the little details in skin and what makes it so special. Even the smallest tweaks can alter our perception, which I think is fascinating, and we can use this knowledge to not only define the outer shell of a character but also trigger certain emotions and feelings.

THANK YOU FOR YOUR INTEREST IN READING THIS PAPER.

If you have any more questions or would like to discuss further, please feel free to reach out to me. I'm looking forward to hearing from you!

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8 APPENDIX

8.1 LIST OF ABBREVIATIONS

4K	horizontal resolution in the order of 4,000 pixels
8K	horizontal resolution of 7,680 pixels
ACES	Academy Color Encoding System
ASC	American Society of Cinematographers
CTO	Color Temperature Orange
CRI	Color Rendering Index
CSI	Colourist Society International
DI	Digital Intermediate
DP	Director of Photography
HD	High Definition
HDR	High Dynamic Range
HSL	Hue, Saturation and Luminance
IR	Infrared
IRND	Infrared Neutral Density (Filter)
K	Kelvin
LED	Light-emitting diode
LUT	Lookup Table
ND	Neutral Density
OLPF	Optical Low Pass Filter
pc	personal communication
TLCI	Television Consistency Index
TV	Television
VFX	Visual Effect

8.2 LIST OF FIGURES

8.3 BIBLIOGRAPHY

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