Portraits of Science

A journey re-imagining heroes in the history of science

by

Pedro Bonatto de Castro

A thesis exhibition presented to OCAD University

in partial fulfillment of the requirements

for the degree of

Master of Design

in

the Interdisciplinary Master's in Art, Media and Design

Graduate Gallery, August 25 to 31

Toronto, Ontario, Canada, 2012

Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I authorize OCAD University to lend this thesis to other institutions or individuals for the purpose of scholarly research.

I understand that my thesis may be made electronically available to the public.

I further authorize OCAD University to reproduce this thesis by photocopying or by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

Signature_____

Abstract

Portraits of Science: A journey re-imagining heroes in the history of science

Master of Design, 2012

Pedro Bonatto de Castro

Interdisciplinary Master's in Art, Media and Design

OCAD University

This work creates re-imagined photographic representations of lesser-known figures in science history inspired by the mythology and narratives of popular science fiction and fantasy. My practice-based research is inspired by the aesthetics of contemporary portraiture and fashion photography. It explores the mythology of the 'hero's journey' in photographic works depicting characters through allegory and visual metaphor. The idea of faded heroes serves as an entry point for a discussion on notions of recognition, fame and authorship in the contemporary world. In an effort to blend science with other forms of visual expression, I explore how the aesthetics of highly stylized and fetishized imagery as presented in the fashion industry and commercial photography can provide a reflection on practices of science popularization where science becomes a commodity product and the figure of the scientist becomes a spectacle.

Acknowledgements

As it is the case in any interdisciplinary studio-based research project, this thesis work was only possible due to the thoughtful assistance and guidance from a number of remarkable individuals who added creative insight and scholarly depth to the work.

The guidance and patience of my advisers Barbara Rauch and Janis Cole whose help and challenge made this work the best I was able to deliver. Other professors at OCAD University contributed with thoughtful critique, suggestions and discussions. The ideas in this thesis were seeded during an experimental studio class by Kate Hartman and Luke Painter designed to push our practices to new levels. A solid background of scholarly works was introduced by Michael Prokopow and Paula Gardner in discussions regarding Critical Theory. Work as a research assistant under Martha Ladly, Greg Van Alstyne and Robert K. Logan taught me courage to pursue relevant yet untrendy lines of inquiry. A rigorous approach to research methodology in art and design was introduced by Lynne Milgram and Barbara Rauch. The thoughtful critique of Peter Sramek and insight and encouragement by Marie O'Mahony were fundamental in keeping the integrity of the studio work and yet elevating it to new realms of exploration. Roberta Buiani from York University also provided invaluable insight.

Most of all, it was the daily interaction with talented colleagues that tuned my research focus and creative intuitions when the horizon seemed to suddenly fall out of sight. All classmates gave me inspiration at some point, but I have to thank a few who over the course of two years became not only colleagues but friends: Ben Edelberg, for his sensitive artistic input in daily walks over coffee; David Clarkson, not only for his remarkably accurate insights in the theoretical underpinnings of my research but for collaborating with me in the creation of one of my favorite portraits in this thesis; Britt Wray, for a passion for projects in the intersection of art and science; Christine Walker, for her collaboration in prop creation for a portrait and for her creative insights in discussions over vision and execution; Nermin Moufti,

for sharing her design knowledge and aesthetics which always served as an inspiration to take my own work a step higher; Julian Higuerey Núñez, for his unique artistic vision always revealing new ways of thinking about artworks; Marian Wihak, for her help with enhancing elements of set design and wardrobe by refining of original concepts; finally, I must thank Keith Cole, Anya Chudnovtseva, Susan Campbell, Alexis Boyle for believing in my project and showing me incredibly inspiring works by artists who have gone through similar paths.

Creative portraiture and fashion photography by definition are not lonely practices. This work simply could not have been made without the time, talent and commitment of the models featured in 12 portraits. I must thank Adam Smith, Anjelica Scannura, David Clarkson, Ian Huggins, Laura Atma, Reena Smith, Simon Rose, Tatiana Kaptchinskaia and Veronika Radolovich for bringing to life the mythic visions of the characters portrayed. My early collaboration with bodypaint artist Natasha Kudashkina helped in crafting the tone and aesthetics in my work even before I consciously knew the reasons behind it.

A special thanks to all the staff at the Photography Department, specially Darren Cerkownyk, whose knowledge and expertise tremendously improved my creative practice, as well as all the staff at the Graduate Office, specially Alice Brummell, Gale Allen. and Allison Rowe.

George Herbert once said that “the best mirror is an old friend”. I had the fortune of counting on my dear friends Marcio Costa and Fabio Marchioro to provide a critical reflection on what I was trying to accomplish in a way only someone who knows you so well can.

Finally I cannot thank enough my partner Lisandra Binder for her support, patience, love and continuous inspiration.

I am grateful to each and everyone of you, mentioned explicitly and implicitly in this page, remaining a humble student of your practice.

Dedication

To all the people who inspired me in creative and intellectual pursuits over the years and to all the scientists whose legacy I tried to honor in re-imagined portraits.

To my father, a journalist, teacher and musician, a popularizer in his own right, who every night would bring newspaper cutouts of science articles and photographs in my earliest encounters with the wonders of scientific discovery. As a little boy, I would carefully place those pages on my wall along with posters of superheroes that together inspired my dreams.

To my mother, whose meticulous and highly realistic paintings made me want to see the world through fierce artistic eyes unbound by temporal aesthetic trends, inspiring me to become a photographer.

To my two little sisters, who today are mothers and scientists and always were role models in my life.

To my partner, with whom I share this journey of self-discovery in spaceship Earth, making the ride ever more sweet.

To my nephews, whose vitality and creativity are my ultimate source of joy. I wish my photographs inspire them to one day find their own heroes to guide them in their journeys.

Finally, this work is dedicated to you, the reader, who I hope to inspire with my scholarly research and artistic creations.

Table of Contents

List of Tables and Figures

List of Tables

List of Figures

Chapter 1: Introduction

1.1 Introduction

One of the main challenges of contemporary science popularization is to find engaging and effective ways to convey scientific ideas, in terms of expressing science's findings, methodology and history. A strategy used in science popularization efforts is the creation of narratives around the history of scientific discoveries, revealing not only findings but also the circumstances of the main characters involved in such discoveries. Numerous documentaries, science magazines, books, games and artworks are created with the goal of increasing scientific literacy in order to provide citizens with the basic knowledge to participate in the public dialog around the role of science in the contemporary world.

My professional practice and scholarly interest over the past 8 years have been around issues in science popularization. Between 2005 and 2010, I worked as a communication adviser in the Brazilian Ministry of Science and Technology, focusing on the development of science popularization materials to a variety of audiences, from students, to policy-makers to the general public. As a designer, photographer and writer, I was able to participate in the creation of works in a variety of media, from news articles to documentaries to photographic essays. I helped publish works by scientists explaining their research to a lay audience. I created photographic essays using a photo-journalistic approach and aesthetics to convey scientific discoveries, processes and history. As a graduate student at OCAD University I expanded my exploration of alternative forms of visual and interactive depictions of science themes. At the university's Mobile Experience Lab, I developed data visualization techniques to convey complex scientific information in compelling ways to a non-technical audience. I had the opportunity to explore how playfulness could spark interest in science and teach its contents by creating a board game about astronomy. In the Interdisciplinary Master's in Art, Media and Design program I was encouraged to approach my practice as both a maker and

a scholar. That led me from considerations on *how* science popularization was and could be done to reflections on *why* it was done in the first place.

This line of inquiry raised issues about fame and authorship of ideas in the mythic narratives around science, especially regarding iconic science figures presented in popular media. One example of this issue can be seen in the story about the invention of the airplane. In North America, the Wright Brothers are widely recognized as the first people to successfully fly an airplane in 1903. In Brazil and France however, inventor Santos Dumont is recognized with such achievement for his public flight in Paris in 1906. Barros (2003) discusses the technical merits of both inventions and the century-old discussion on who should be recognized for the invention that would revolutionize transportation in the 20th century. A critical view of the situation led me to the realization that this was mainly a case of nationalistic interest in claiming ownership of a heroic achievement rather than a discussion about pure scientific merit.

This same issue appeared again and again in popular depictions of science history and I became interested in exploring the idea of faded heroes in science history as an entry point for a discussion on the place of science popularization in the contemporary world. Such scholarly and practice-based exploration would not only address the use of narratives to engage the public but also (and perhaps more importantly) provide a critique of the practice of science popularization itself in that regard. Further, this research would bring a critical view of my own role as a visual artist and designer working in the field.

The present work creates re-imagined photographic representations of lesser-known figures in science history using elements of contemporary portraiture and fashion aesthetics inspired by the mythology and narratives of popular science fiction and fantasy[1].

[1] 'Science fiction' and 'fantasy' here refer to the two genres of fiction present in literature and visual arts.

1.2 Research objectives

The objectives of this research can be summarized as follows:

- Explore how the mythology of the 'hero's journey' can express a sense of wonder in photographic works of portraiture depicting science heroes through allegory and visual metaphor;
- Explore how re-imagining historical figures inspired by contemporary science fiction and fantasy can spark interest in the nuances of science history regarding notions of recognition and authorship;
- Explore how the aesthetics of highly stylized and fetishized imagery present in the fashion industry and commercial photography can provide a reflection and commentary on practices of science popularization where science becomes a commodity product and the figure of the scientist becomes spectacle.

Before getting to the next chapters where I discuss in detail the critical framework and research methodology, it is important to address a few creative issues regarding my aesthetic choices in this project.

The first issue regards the influence of science fiction and fantasy in my work. The artwork I created as the practice-based component of this project[2] was considered to have elements of '***Magic realism***'. *Magic realism* is an aesthetic style and genre of fiction, in which magical elements blend with the real world where a sense of mystery and wonder is a major theme (Zamora and Faris 1995, 4). According to Strecher (1999, 267) magic realism is "...what happens when a highly detailed, realistic setting is invaded by something too strange to believe." If we consider the imagery I created, it would be fair to place it within this sub-genre. However, though some of my influences fall within the realm of magic realism, most comprise of a broader spectrum of artistic creations in the fields of science fiction and fantasy.

The second issue regards my use of photography and specifically the choice of a fashion and commercial aesthetic as the creative means of expression in this work. The choice of photography was in

[2] Documentation of the artwork can be found in Chapter 3 and the Appendix section in this document.

itself metaphorical of the issues of reality, narrative and historicity raised by my inquiry. Photography has been used to both reveal and deceive since its inception. It has been used to uncover scientific facts as well as advance specific ideologies and world views. Furthermore, photography has a place as arguably one of the most popular and accessible forms of artistic expression, especially since the popularization of inexpensive digital cameras in the last 20 years. It must be said that the use of digital photography is in part due to a personal and subjective choice, since it is my favorite medium for artistic expression. However, the main appeal for its use in this project is the fact that photography holds in its nature a tension between documentation and fantasy, between recorded fact and constructed reality, issues at the core of the very practice of science popularization.

The choice for the aesthetics of highly stylized fashion photography tries to bring awareness and serve as a critique to the inherent seductive nature of the popularization effort. It refers to the question: are we as science popularizers trying to create a new cast of fetishized heroes where science is packaged as product and spectacle in the 21st century?

I explore in my artwork one of the main components embedded in the aesthetic of fashion photography: fetishism. I understand ***fetishism*** here in the context presented by Laure Mulvey in *Fetishism and curiosity*, where fetishism is seen "as a psychological and social structure that avowed knowledge in favor of belief" (1996, 2). Mulvey combines the concepts of commodity and sexual fetishism in order to understand a symbolic system of value, one within the social and the other within the psychoanalytic sphere. Muvley further argues that fetishism could maintain knowledge and belief simultaneously if fetishized images could be seen "as things that attract the gaze but also provoke curiosity" (1996, 3). Rather than seeing fetishism and curiosity as irreconcilably polarized, this work finds a more dialectical relation between them. I see the relationship between consumer culture and the aesthetics of the highly stylized fashion world as a dominant force in contemporary visual and social culture, which in turn influences practices of science popularization. The juxtaposition of this aesthetic with popularization of science

themes in the creation of a body of imagistic work does more than simply re-imagine faded heroes. It provokes reflection and offers a critique on notions of knowledge, belief, curiosity and fetishism. Furthermore, the creation of allegoric imagery using this aesthetic and style refers to an understanding of contemporary mythology and the mythic image as a tool for thinking about issues. Ansel Adams stated that "myths… are heroic struggles to comprehend the truth in the world" (cited in Cool 2006, 190), echoing a long tradition in the photographic practice to use visual metaphor to convey meaning. Finally, it is important to keep in mind Joseph Campbell's consideration of meanings in the mythic image: "the myth does not point to a fact; the myth points beyond facts to something that informs the fact" (1949, 49).

1.3 Outline of the Thesis

In order to address the issues presented above, I will discuss the critical framework in Chapter 2 regarding relevant issues in the field of science popularization, such as the relationship between science and the public, representations of scientists in popular media, the inspirational power of science fiction and fantasy, the concept and structure of the myth of the hero, and the use of allegory and visual metaphor in contemporary photographic practices. I will discuss in Chapter 3 the research methodology of design as research approach, combining a discovery-led design process with reflexive visual arts research as the basis for the scholarly and practice-based exploration. This research methodology is broken down in seven stages and is contextualized in a case study and an overview of the actual art-design work created. I will provide in Chapter 4 a reflection on the findings of the research as well as a discussion on possible implications for the field of science popularization.

Table 1 shows an overview of the critical framework (theoretical and practice-based) and the research methodology used, introducing the main fields invoked and the specific issues addressed in this study.

Table 1

Critical Framework	Science Popularization	Representations of scientists and the relationship between science and the public.
	Science Fiction and Fantasy	Selected contemporary narratives and aesthetics.
	Mythology of the Hero	As presented in Campbell and Vogler in an application of the 'monomyth' concept in contemporary culture.
	Allegory and Visual Metaphor	Applied to the subject of visual depictions of scientists.
	Contemporary Photography	The chosen art-design mode of expression, using portraiture and fashion aesthetics.
Research Methodology	Design as Research	Discovery-led Design Process. Reflexive Visual Arts Research.

Overview of the Critical Framework and Research Methodology.

Chapter 2: Critical Framework

2.1 Science Popularization

My professional work and scholarly research in science popularization focuses on bringing the subject to an entertainment and artistic realm, in a continuing effort to blend science in other forms of cultural expression. In fact, Stephen Jay Gould, considered an influential historian of science and science popularizer of the late 20th century (Shermer 2002, 489), stated that "science is an integral part of culture. It's not this foreign thing, done by an arcane priesthood. It's one of the glories of the human intellectual tradition" (1983, 250). The practice of popularizing science, the field to which this work intends to provide a contribution to, can be traced back at least to the genesis of contemporary science. Copernicus's *De revolutionibus orbium coelestium*, published in 1543 and one of the key texts of the scientific revolution, was arguably written for the general public. In *Science in Public: Communication, Culture, and Credibility,* Gregory and Miller argue, however, that the systematic study of science popularization and its impact in culture is a recent one (2000, 10), involving many different modes of inquiry looking at the field from a variety of lenses, including analysis of raw science content in different media, how science is framed and providing a critical view of the practice itself (Broks 2006, 135).

This thesis focuses on scholarly research in contemporary science popularization practices with special attention to depictions of scientists in popular works. In order to understand the current landscape of the field of science popularization it is helpful to contextualize it in what Gregory and Miller call the recent "public understanding of science movement" (2000, 02), which argues that increasing literacy and appreciation for science can provide benefits to individuals in intellectual, aesthetic and moral realms, to science itself, to national economies, to democratic government and to society as a whole, providing unparalleled possibilities in the realms of commerce, culture and democracy through interdisciplinary collaborations.

This movement involves more than scientists making their work available to lay audiences. Broks argues in *Understanding Popular Science* that science popularization today is a multi-directional network (2006, 134) involving a multitude of professionals from different fields (2006, 60), from journalists to artists to filmmakers to designers. This broadened notion of expertise redefines boundaries between lay and experts to encompass lay experts and experience-based expertise applied to the shaping and enhancement of science popularization practices. Examples of this can be seen in interdisciplinary collaborations between artists, designers and scientists in the creations of works which are only possible by the play between fields of practice and research, as will be discussed in examples in following sections. The essence behind the contemporary drive to popularize science goes beyond possible benefits to society and is reflected in Albert Einstein's words: "Restricting the body of knowledge to a small group deadens the philosophical spirit and leads to spiritual poverty" (cited in Gregory and Miller 2000, 134).

2.1.1 Science and the Public

The relationship between science and the public is dynamic, complex, and has been ever changing throughout history. The popularization of scientific ideas has played an important role in this relationship. To use a historical example, Galileo's "crime", according to the Catholic Church at the time, was not that he had espoused the heliocentric model of the solar system but that "he had popularized it" (Broks 2006, 142).

Since the focus of this study is in contemporary science popularization, the discussion of science and the public begins in a post World War II context, where the US emerged as a global superpower putting science and technology as a top priority (Tietge 2008, 20), which influenced policies in the field internationally. In *Rational Rhetoric: the Role of Science in Popular Discourse,* Tietge argues that in the last 60 years, given the unprecedented development of scientific ideas, the intersection between scientific activity and culture has changed drastically, especially concerning how science and scientists are viewed. In a culture of science and capitalism, there was a strong incentive in the educational field to provide training emphasizing science and technology (2008, 42). With the increasingly strategic importance of scientific

literacy[3], in 1972, the National Science Board began conducting regular social surveys that gauge people's knowledge and understanding of, and attitudes to, science (Gregory and Miller 2000, 44) and similar efforts were established worldwide.

Despite the close connections between science popularization and education, the field quickly broadened its presence in popular culture, especially with the dissemination of science fiction as a genre in radio, comics, cinema and art in what Tietge called ***science rich media*** (2008, 75). Unlike efforts in science education however, science popularization through science fiction and popular media did not have a focus in specific scientific knowledge, but an exploration of the ***wonder*** of science (Tietge 2008, 20).

The relationship between science fiction and science popularization is an essential element of this study and it is discussed in depth in section 2.2, but it is important to mention how it changes the notions of public, understanding, and science embedded within the idea of ***public understanding of science*** (Gregory and Miller 2000, 20). In education, the 'public' is the student, 'understanding' refers to the mastery of scientific information and processes and 'science' refers to a relevant body of knowledge as prescribed by the educators. In science fiction, the 'public' becomes the consumer of entertainment and artistic media, 'understanding' becomes less about knowledge and more about appreciation, and 'science' becomes a source of wonder and emotional impact weaved into narratives. In rhetorical terms, as elaborated by Tietge (2008, 171), science fiction relies much more on emotional impact (*phatos*) and scientific values (*ethos*) rather than propositional content (*logos*) to convey meaning. This research, embedded in the current studies of ways to enhance science popularization efforts, focuses exactly in forms of conveying meaning beyond the simple passing of informational content (Broks 2006, 143). Tietge points out that in order for science to have power and relevance to the contemporary layperson, creators of popular science content saw the need

[3] Scientific literacy provided strategic advantage when labour became ever more dependent on mastering new technologies based on scientific discoveries.

to educate the public about what science did, how it operated, and what, specifically, it was capable of explaining (2008, 109).

In *The demon-haunted world: science as a candle in the dark,* Carl Sagan (1997), an American astronomer and one of the greatest science popularizers of all time, argued that in order for science popularization to be successful, it must first spark a sense of wonder, providing a glimpse of the findings of science without thoroughly explaining how those findings were achieved. He held that the science popularizer should somehow chronicle some of the journeys of discovery and the deeply human stories behind them. Sagan advocated that "we should provide the evidence and let the reader draw his or her own conclusion. This converts obedient assimilation of new knowledge into personal discovery. When you make the finding yourself - even if you're the last person on Earth to see the light - you never forget it" (1997, 315). This idea of personal discovery seemed of the utmost importance in the relation between science and the public, serving as a guiding principle for the creation of my studio work, which is described in Chapter 3. The importance of this concept can be seen in Sagan's most important contributions to the field of science popularization which helped to re-shape it. Carl Sagan's 13-part television series and popular book entitled *Cosmos: a personal voyage* (1980) remains the most watched popular science program to date. Together with other works, *Cosmos'* innovative uses of emotional and engaging allegoric narratives in dramatizations of scientists' lives served as a guide for a myriad of science popularization efforts as ways of inspiring the public.[4]

2.1.2 Representations of Scientists

Building on Sagan's claim that the popularizer should chronicle some of the journeys of discovery and the human stories behind them in order to spark a sense of wonder in an audience, a discussion focusing on how scientists are portrayed in popular media and art provides useful insights for both research

[4] His work is important in the context of my practice both for the analysis of his widespread influence in the field of science popularization and for the reflection on the personal influence it had on me and my career as a photographer and designer.

and studio work. There is a long tradition of depicting scientists both in literature and in visual representations in paintings, photographs, films and other media. As English poet Matthew Arnold argued in 1888, science is a part of literature and, therefore, a part of culture (cited in Gregory and Miller 2000, 81). Mary Shelley's *Frankenstein* (1818) is an example of the depiction of a scientist in a literary work that became highly popular influencing culture even today. Another example is provided by Tietge (2008, 81) showing how inventor Thomas Edison, given all his inventions and gadgets, became one of the first media celebrity scientists. These two examples illustrate an interesting polarity in the way scientists are characterized, as pointed out by Gregory and Miller (2000): the mad scientist or the hero explorer, sometimes loved as saviors or hated as designers of weapons of mass destruction. While the monster created by fictional character Dr. Frankenstein represents how the misuse of scientific power can cause harm and dangerous consequences, Thomas Edison's real inventions, such as the first electric lightbulb, represents the wondrous powers of applying scientific knowledge to a greater good.

For the purposes of this research, the focus of the discussion is on depiction of scientists in post-1950's science popularization works to the present. Snyder, Mayes and Spencer (2009) argue that, starting at that time, there was a conscious effort (2009, 18) in fashioning research heroes in popular media with the goal of influencing the public's opinion of science endeavors, as discussed in the previous section. The authors describe how researcher-heroes and their discoveries became media commodities in works that selectively and dramatically retold a story of the obstacles these scientists overcame, their discoveries, and their enduring contributions.

This mythification trend applies to works depicting both fictional and real scientists in fictional and non-fictional media. The representations of scientists in news and journalistic oriented media fall outside of the scope of this research, but it is important to note the emergence of celebrity scientists as icons in popular media, since figures like Albert Einstein and Stephen Hawking became household names

worldwide representing "not only the power of the human mind, but the quest for adventure and exploration that is intrinsic to the human soul" (Tietge 2008, 188).[5]

In *Hollywood Science: Movies, Science, and the End of the World,* Perkowitz (2010) further illustrates the trend of depicting the roles of scientists as heroes or villains by showing dramatizations of the lives of important historical figures in major motion pictures and science documentaries. An example of this is the depiction of Robert Oppenheimer in the fictional film *Fat Man and Little Boy* (1989) and the documentary *The day after Trinity* (1981), illustrating his role in the creation of the atomic bomb, and his impact in technology, society and government (2010, 167).

In his analysis of depictions of fictional scientists in motion pictures, Perkowitz (2010) argues that the depth and richness of the portrayal varies widely, going from showing traces of meaningful characterization and motivation, such as Ellie Arroway (seen in *Figure 1*) in *Contact* (1997) and the mathematicians in *Good Will Hunting* (1997) to the extension of real characteristics into caricature, "as when the search for scientific answers becomes obsession or withdrawal from the social whirl" (2010, 170), such as Dr. Otto Octavious in *Spider-Man 2* (2004).

Figure 1

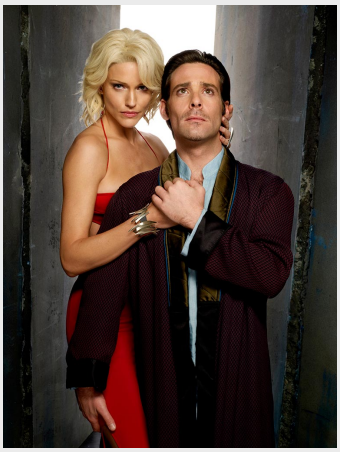
Still from *Contact*, 1997, showing fictional astronomer Ellie Arroway.

One example to note regarding depictions of depth and complexity of a scientist's personality and motivations can be seen in the figure of Gaius Baltar in the series *Battlestar Galactica* (2004-2008). Baltar is a brilliant but egocentric researcher who is responsible for the almost complete destruction of the human race due to his assistance in the plans of the Cylons, a race of

[5] If one is interested in popularizing science, it seems a good development that prominent scientists become popular among a general public. However, one of the byproducts of creating celebrity scientists is that there seems to be a tendency for oversimplification of the flow of science history and authorship of ideas. The selection of characters in this work reflects this issue.

cybernetic lifeforms created by humanity that subsequently rebelled against their creators. Baltar's journey throughout the series reflects his internal conflict and guilt regarding his romantic affair with a humanoid Cylon called Caprica 6 and his attempt to redeem himself by collaborating with the remaining humans in their fight against the Cylons. The character goes from a scientific and skeptical frame-of-mind to a belief in the religious implications of his acts due to the interactions with Caprica 6. An analysis of the visual metaphors present in *Figure 2* provides useful insights in how photographic works can depict scientists in poetic and interesting ways. The image, used as promotional material for the series, shows Baltar and Caprica 6 in an etherial environment, created in a photography studio, in an attempt to portray their relationship in symbolic terms. Baltar's religious quest, assisted by Caprica 6, is represented in their stance and the composition of the photograph. Further reflection on this image reveals an interesting ***dichotomy***, which is used in my own art-design work. If one is familiar with the story behind the character, the exploration of the symbolic elements in the image provides deeper understanding and appreciation of the themes discussed in the series. If one is not familiar with it however, the cryptic nature of the image serves as an invitation for engagement with the character and exploration of his story.

Figure 2



Studio photograph featuring scientist Gaius Baltar and human-like robot Caprica 6 in the TV Series *Battlestar Galactica*, 2004-2008.

Another example of this duality in possible meanings to different audiences can be seen in *Figure 3*, also a studio photograph done as promotional material, but this time for the TV series *House MD* (2004-2012). It shows fictional character Gregory House interacting with a representation of the caduceus, borrowed from Greek mythology and often used as a symbol for medicine in the United States. House is as a medical doctor, a scientist and an atheist. For one familiar with the character and the caduceus, the image

in *Figure 3* evokes a number of associations which enrich the understanding of the character. If one is not familiar with his story and the symbols involved, the cryptic and engaging nature of the image invites the viewer to further exploration.

Figure 3

Studio photograph featuring character Gregory House in the TV Series *House MD*, 2004-2012.

The portrayal of scientists as the idiosyncratic nerd, the villain or the hero, involved in highly emotional stories that discuss the power of science in society, can be seen clearly in other examples of contemporary fantasy literature and filmmaking, specially in the tales of popular super-heroes. Characters like the Hulk, Spiderman, Captain America, Iron Man and a myriad of others are often scientists and, more importantly, they are the fictional products of scientific experiments which reward them with mythical powers which are themselves metaphors for the perceived powers of science (Sandison and Dingley 2000, 44).[6]

One example in contemporary representations of scientists in popular culture which combines elements of real and fictional scientists in direct relationship with super-hero, science fiction and fantasy references is the television series *The Big Bang Theory* (2007-present), one of most successful sitcoms in today's television (*Figure 4*). In 2012, it has the highest share of viewership in primetime programing in Canada. The series depicts the lives of a group of fictional scientists and it routinely makes references to real scientists such as Richard Feynman and Carl Sagan, as well as having guest appearances by researchers such as Stephen Hawking and Brian Greene and popularized science fiction iconic celebrities such as Leonard Nimoy, the actor portraying Mr. Spock from the *Star Trek* franchise. In the series, one can see a

[6] This allegoric reference to the hero and the power of science is at the core of my studio practice and is further developed in section 2.2, describing the role of science fiction and fantasy as propellers of interest and engagement in science popularization efforts.

play with caricatured representations of researchers as nerds, geniuses, villains, heroes as well as more subtle depictions of real-life dilemmas and situations, in an attempt to not only humanize the traditional view of scientists but also provide a thoughtful and subtle reflection on their portrayal in popular culture. Although the series is sometimes criticized for over-caricaturing scientists, its success with the public is often seen as a positive asset in the "public understanding of science movement".

Figure 4

Studio photograph showing depictions of scientists referencing contemporary science fiction and fantasy in *The Big Bang Theory*, 2007-present.

2.2 Science Fiction and Fantasy

I draw upon elements of the visual narrative and aesthetics in the long tradition of science fiction and fantasy permeating popular culture in order to explore their inspirational power in relation to science. These elements include, for instance, the idealization of the human body in films like *300* (2007), the visual expression of the archetypical explorer in *Indiana Jones and the Raiders of the Lost Ark* (1981) and *Lara Croft: Tomb Raider* (2001) as well as the stylized construction of digital versions of oneself (*Figure 5*) in *The Matrix* (1999), to name just a few. This line of exploration serves two purposes: inquiry on how these genres impact science popularization and how they inspire my own studio work for this project.

Figure 5

Studio photograph featuring character Neo as the stylized hero in T*he Matrix*, 1999.

In *Pale blue dot: a vision of the human future in space,* Sagan (1994) argues that the "continuous dance between science and science fiction is a process that benefits both genres, where science inspires fiction and fiction inspires the next generation of scientists" (1994, 340). This idea is echoed time and again by renowned scientists who attribute the inspiration for scientific and technological breakthroughs to works

of science fiction and fantasy. One such scientist is Rodney Brooks, a specialist in Robotics and professor emeritus at MIT. In *Flesh and Machines* (2002) he expresses his gratitude for science fiction writers and moviemakers who inspires scientists like himself, specially when they "challenge the human spirit to soar beyond itself" (2002, 210).

Conversely, Easton and Schroeder (2008) argue that science topics fuel fantasy and science fiction to be agents of social and economic change by impacting popular culture. An illustration of this impact can be seen in Perkowitz analysis of the issue in his *Hollywood Science: Movies, Science, and the End of the World* (2010), as he shows that a search of the popular Internet Movie Database using keywords "science" and "scientist" yields hundreds of movies. A search for the term "science fiction" shows that Hollywood studios have produced more than 1,400 films of this genre since 1902 that were widely distributed in the United States. These numbers dramatically increase if the search includes television films and series or films distributed outside the United States[7].

Looking into the popular science fiction franchise *Star Trek* we can see examples relevant to both lines of inquiry discussed here: that of science fiction inspiring science and of science fiction influencing culture. In the first instance, the classical example is the invention of cellular telephones and smart-phones being directly inspired by Captain Kirk's personal communication device in the series[8] (Laytner 2007). In the second instance, an example is the American TV presentation in the 1960's, also in the original *Star Trek* series, of the first "inter-racial kiss" ever to be broadcasted - though there is some dispute about that fact - which was considered controversial at the time but nevertheless contributed to a shift in culture in regards to racial issues by benefiting the African-American movement of the period.[9] Science fiction has

---

[7] This information can be found at the Internet Movie Database at www.imdb.com

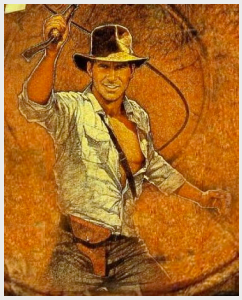
[8] Martin Cooper has stated that watching Captain Kirk using his communicator on the television show *Star Trek* inspired him to develop the first handheld mobile phone.

[9] This happened in episode # 65 of the original *Star Trek* series entitled "*Plato's Stepchildren*". Although there is some dispute about it featuring the first "inter-racial kiss" on American television the important fact is that overtime it became an icon in the African-American movement due in part to the increasing popularity of the series.

always been used to discuss some of the world's most controversial issues under the disguise of it taking place 'somewhere else': not in the real world but in a land of fantasy, a safe place for sociological and philosophical speculation. The creative engine in my research methodology and studio practice has been this interaction between science fiction/fantasy and science history in the exploration of the characters I have researched and portrayed.

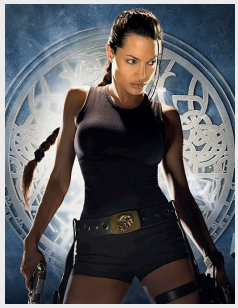
A character-driven analysis of contemporary science fiction and fantasy shows how Hollywood scientists can differ from real scientists by portraying them in narratives as heroes, nerds and villains.[10] As Perkowitz identifies (2010, 167), movie scientists tend to be constructed, both in appearance and conduct, according to archetypical representations rather than more naturalistic ones, in an attempt to create compelling and entertaining stories. Popular characters such as Indiana Jones (*Figure 6*) and Lara Croft (*Figure 7*) are fictional archeologists who are depicted as archetypical hero adventurers and explorers, in a mythic search for adventure and unlocking of mysteries. The archetypical villain can be seen even in early films such as *Metropolis* (1927) in the figure of C.A. Rotwang as the mad scientist, out of touch with the human spirit and with a deep lust for power over nature and mankind.

Figure 6



Poster featuring the Indiana Jones character for the 1987 film.

Figure 7



Poster featuring the Lara Croft character for the 2001 film.

By dwelling deeper in narratives of science fiction and fantasy, especially in relation to the portrayal of hero characters, one can identify mythological structures and themes in their speculative storytelling schemes. In fact, scholars such as Whitt (2008) and Campbell (1949) argue that science fiction and fantasy embody a version of contemporary mythology, exploring themes such as the pursuit of adventure, the quest

[10] The rationale behind focusing on science fiction in film is that the medium has very interesting characteristics for the context of my research: works on film and television are often inspired by science fiction literature, having very stylized visuals to draw inspiration from and they have broad appeal to a wide audience.

for truth, the meaning of life and the workings of society, in narratives that in other cultures and moments in history where present only in religion, folklore and popular tales.[11] Easton and Schroeder (2008) state that the possibilities explored in science fiction and fantasy stories are fluid, speculative, and very much like myths, having the potential to move from culture to culture. In their view, myths are stories "told... to explain the unknown, the mysterious, the very good, the very evil, the very odd. Most important, they were - and are - the stories that cause us to wonder about all the things that have been lost in the world, and all the things that might yet be" (2008, 31). This idea is strengthen by Rushing's argument that myths in science fiction "symbolize a new stage in the evolution of cultural consciousness" (1990, 144), in which scientific discovery is re-contextualized as part of a greater whole. The work of Joseph Campbell (1949) serves as a critical foundation for the creation of the studio work addressing this research explorations, namely the re-imagined representation of lesser-known figures[12] in science history through the lens of the mythology of science fiction and fantasy.

2.3 Mythology of the Hero and Heroes in the History of Science

Mythologizing science narratives is at the core of my practice of science popularization, where the inspirational qualities of the myth of the hero are explored through the creative lens of science fiction and fantasy. In *Myths and the movies: Discovering the mythic structure of 50 unforgettable films,* Voytilla (1999, 260) argues that science fiction and fantasy are our "New Mythology, and provide an important canvas that allows us to explore society's issues". Wagner and Lundeen support this view by stating that both traditional myth and science fiction provide narratives that "probe the unrealized possibilities of being" (1998, 7). As Stock (1993, 240) explains, "mythology speaks to our deep longing to understand the human condition: to know where we came from, why we are here, what will become of us." That

---

[11] Please refer to section 2.3 for a discussion of the definition of mythology used in this work in more depth.

[12] A discussion on what is meant by 'lesser-known figures' and the criteria for choosing those characters is discussed in the end of section 2.3.

description of mythology matches the goals of science fiction and fantasy (by means of metaphorical speculations) and the goals of science itself (by means of explaining the natural world).

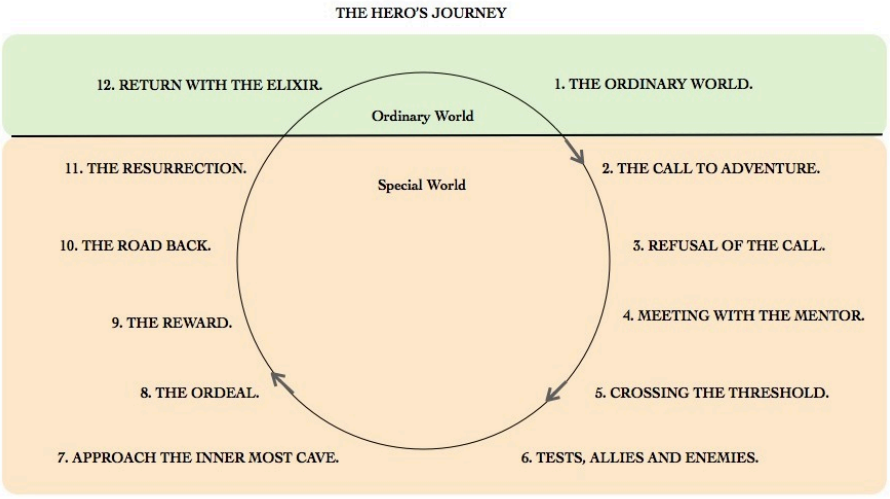
This connection between mythology, science and science fiction begs for a deeper understanding of what is meant by 'myth'. The word 'myth' has a variety of meanings, and a brief discussion of terminology is necessary. For the purposes of this research, its meaning is derived from Campbell's work were myths are seen as "stories of our search through the ages for truth, for meaning, for significance [...] Myths are clues to the spiritual potentialities of human life" (1988, 5). Campbell's main idea in his scholarly research in comparative mythologies throughout the world is the identification of recurring themes and functions of mythology in different human societies. In *The Hero with a Thousand Faces* (1949), Campbell describes the idea of the ***monomyth***, also known as ***the hero's journey***, which argues that there is a basic pattern found in mythological narratives from around the world[13]. This structure has 17 steps divided in three main stages: ***departure***, ***initiation***, and ***return***. 'Departure' deals with the hero's adventure prior to the quest; 'initiation' deals with the hero's many adventures along the way; and 'return' deals with the hero's return home with knowledge and powers acquired on the journey. Campbell summarizes this universal mythic structure this way: "A hero ventures forth from the world of common day into a region of supernatural wonder: fabulous forces are there encountered and a decisive victory is won: the hero comes back from this mysterious adventure with the power to bestow boons on his fellow man" (1949, 28). In fact, Campbell's analysis of the hero's journey has influenced a number of artists, filmmakers, musicians and other creative makers, most notably filmmaker George Lucas, who drew inspiration from Campbell's work to create the influential franchise of *Star Wars* (Cousineau 2003, 186). The journey of main character Luke Skywalker follows the stages of the hero's journey. Lucas incorporated many visual and narrative references to mythological constructs from around the world. Since *Star Wars*,

---

[13] Classic examples of the monomyth presented by Campbell and other scholars include the stories of Osiris, Prometheus, the Buddha, Christ, Ulysses, Homer's Odyssey and many other myths from many cultures which rely upon a basic structure.

science fiction and fantasy creators started to explicitly rely on the hero's journey mythic structure in the creation of their works. This structure was further analyzed and systematized in Christopher Vogler's *The Writer's Journey: Mythic Structure For Writers* (1992), which argues that most stories can be boiled down to a series of narrative structures and character archetypes, described through mythological allegory. My own studio-based exploration relies on Vogler's version of Campbell's structure, which is divided in 12 stages as seen in *Figure 8*.

Figure 8



Adapted from Vogler's steps of the Hero's Journey.

Vogler's structure can be summarized as follows: Heroes are introduced in the ***Ordinary World*** (1); they receive the ***Call to Adventure*** (2); they are reluctant at first or ***Refuse the Call*** (3); but they are encouraged by a ***Mentor*** (4) to ***Cross the Threshold*** (5) and enter the *Special World*; where they encounter ***Tests, Allies, and Enemies*** (6); they ***Approach the In-most Cave*** (7); they cross a second threshold where they endure the ***Ordeal*** (8); they take possession of their ***Reward*** (9); and are pursued on ***The Road Back*** (10); to the ***Ordinary World***, where they cross the third threshold and experience a ***Resurrection*** (11); and transformed by the experience they ***Return With the Elixir*** (12); a boon or treasure to benefit the ***Ordinary World*** (1992, 44). This is at first sight a complex structure, but Vogler holds that successful films and other

creative works innately adhere to its principles. Science fiction films such as *Star Wars* (1978), *The Matrix* (1999) and a myriad of others follow this structure closely in their storytelling.

Different societies and epochs employ varied strategies of storytelling in order to communicate ideas present in their mythology (Easton and Schroeder 2008, 27). Contemporary science fiction, for instance, reconstructs old myths and make new ones, often through electronic mediated forms (Whitt 2008, 73). My research focused in exploring possible visual forms of storytelling in contemporary photography where each character is featured in one of the 12 stages presented by Vogler. By developing a studio-based research practice exploring the lives and deeds of both famous and obscure scientists, through reflection, collaboration and critique, I came to realize the mythic nature of these characters' stories which in themselves followed the hero's journey, namely in their quest for knowledge through scientific discovery and their struggles through adversity. The interest in portraying historical figures whose achievements were substantial but underplayed tapped into an aspect of mythology of potential creative appeal, namely the poetic vision of the unsung hero in re-imagined allegorical images.

As a science popularizer working in the field for a number of years, I was familiar with the stories and lives of the main celebrated heroes in the history of discovery, such as Newton, Einstein, Darwin, etc. However, as Kuhn points out, "the history of science is often told as a series of great advances, revolutions and glimpses of genius by scientists. But there is always one before, one after and a historical context" (1962, 08). By exploring this historical context, I became familiar with lesser-known figures in the history of science, whose stories could add dimension and nuance to popular depictions of science history. An example of that can be seen in the development of the Theory of Evolution by means of natural selection. Although the early development of the Theory of Evolution is often attributed to Charles Darwin, an obscure scientist named Alfred Russel Wallace was fundamental not only as an independent co-

discoverer of the theory but also as one of the main drivers for it becoming public when it did[14]. Echoes of Campbell's and Vogler's hero's journey structure and creative symbolic potential could be found not only in Wallace's but also in other scientists' stories which seemed to reflect the monomyth concept. These stories tapped into what Campbell calls the ***metaphysical function of myth***, the awakening of a ***sense of wonder***, which served as a key for creating a series of portraits re-imagining lesser-known scientists as mythic heroes.

With that in mind, it is necessary to briefly discuss the criteria for selecting the so called 'lesser-known' figures in science history researched and ultimately portrayed in the art-design work related to this research. The first criteria, although internally consistent, is inherently personal and subjective. After researching in depth over 50 scientists and selecting 12 to be portrayed, a personal resonance between the story of the character and myself had to be in place for the development of a creative process. The second criteria relates to the importance and impact of the scientist's contribution to science in relation to the recognition of his contribution, with an interest in scientists whose discoveries were important to paradigm shifts in science history but due to social, political and historical reasons have not been sufficiently recognized. The merits of a person's contribution as well as an analysis of his or her presence in popular media is done by researching scholarly works about him or her. The third criteria, in light of the discussion of the celebrity scientist in section 2.1.2, is finding characters not popularly featured in narratives around important scientific discoveries but whose contributions were fundamental to such discoveries. The selection and understanding of the 'lesser-known' figures in science history is not meant to be a rigid characterization of importance and popularity of characters, but to serve to advance the main purpose of this research, namely to spark interest and engagement in the complexities and nuances of the history of

[14] This subject is discussed in detail in the case study '*Alfred Russell Wallace*' (2011) in the next chapter.

science. Therefore, as long as the figure has a compelling story that broadens our understanding of established popular depictions, it fits the criteria for character selection.

2.5 Allegory, Visual Metaphor and Contemporary Photography

In order to discuss symbolic interpretations as well as the creation of symbolic works, it is necessary to understand ***allegory*** and ***visual metaphor*** as ***rhetorical tools*** used to express myths in creative works, in the context of science fiction, fantasy and contemporary photographic practices. Indeed, the recurring use of the rhetorical tools of allegory and visual metaphor, according to Hart, shows a symbiotic relationship between myth and rhetoric, where "myth gives rhetoric something to say and rhetoric gives myth impact in everyday life" (1990, 321). This connection between myth and rhetoric is found in Barthes when he argued that myth should be understood as a "type of speech" (1972, 49).

An example of allegoric representation referring to mythology in science fiction works can be seen in *Figure 9,* showing a studio photograph created for the *Battlestar Galactica* (2004-2008) series referencing the Christian myth of the Last Supper, an account of the final days of Jesus as told in the Gospel of John, 13:21, when Jesus announced that one of his twelve disciples would betray him. Allegoric representations of this story can be found throughout history, having its most popular instance in the rendition by Leonardo DaVinci done between 1495 and 1498. The elements of treachery, suspicion and religious underpinnings of the *Battlestar Galactica* universe are represented in photographic form through a visual metaphor recreating that original allegory of the Last Supper to represent the mythology of the science fiction series. As Rowland reminds us, the storytelling power of mythology comes from its symbolic interpretation instead of a literal reading (1990, 103).

Figure 9

Studio photograph in allegoric reference to the Last Supper in *Battlestar Galactica*, 2004-2008.

Tietge (2008, 253) describes ***visual rhetoric*** as the production of an image or series of images aiming to reflect (and sometimes to forge) a symbolic value that both the producer and the recipient of those images can share. The author explains that every symbolic act that uses imagery is at some level a rhetorical act relating the ***representation*** and its ***referent***. Pauwels explains that every representational process involves a translation or conversion of some kind; a process of "inscription, transcription, and/or fabrication whereby the initial source (phenomenon, concept) is captured, transformed, or even (re-)created through a chain of decisions that involves several actors (scientists, artists, technicians), technological devices, and normative settings" (2006, 05). A relevant implication of this line of reasoning, as pointed by Rushing (1990, 02), is that the myths of a society are complex blends of archetypal and rhetorical elements.

In order to illustrate this point, we may consider two popular images related to the scientific *ethos* of contemporary society embodied in representations of two prominent scientists: Thomas Edison and Archimedes. Thomas Edison (*Figure 10*) became a household name because of his invention of the incandescent lamp. The myth of the strike of genius is often represented by a lightbulb being symbolically turned on in the head of a subject, in a direct reference to his invention of the first working electrical lamp. This same idea is echoed in representations of the greek inventor Archimedes (*Figure 11)*. It is said that upon making a discovery while taking a bath, he was so excited that he ran naked and wet in the streets yelling "Eureka" (meaning, "I've found it"). This visual representation of the popularly called 'Eureka moment' has become common place both in depictions of strikes of genius as well as in furthering the myth of the mad scientist out of touch with common social practices.

Figure 10

Thomas Edison in 1911 with his light bulb.

Figure 11

16th Century carving showing Archimedes.

These two examples illustrate, as Pauwels (2006, 04) puts it, the job of the popularizer of science as relating the 'referent' mental idea (i.e. moment of scientific discovery) to the 'representation' of the

conceptual construction (i.e. lightbulb or screaming "Eureka") through visual metaphor. The imagery in these cases serves as a reminder of the ideas presented in a narrative aiding the classical purpose of communication, that of reconstructing one person's idea in another person's mind. As Tietge argues (2008, 111) the rhetorical mode is the narrative and the visual representations are the rhetoric trope (2008, 120) - in this case, a visual metaphor - in an attempt to make the story engaging and entertaining in order to teach. The author also reminds us of the danger of producing artificial simplification by omission of detail and nuance (2008, 263).

The focus of this research is to engage in the complexities of the history of science embodied in the visual representations of some of its lesser-known characters. The rhetorical challenge therefore is to create a body of work that sparks emotional impact (*pathos*), as much as its propositional content (*logos*) to convey meaning (Tietge 2008, 171). In principle, one could engage with such rhetorical challenge by using any kind of audio-visual form of expression, from theatre to film to painting to interpretive dance. Besides the obvious and legitimate argument of personal choice by the creative practitioner, the case for using contemporary portraiture and fashion photography holds its strength in the intrinsic symbolic and mythical nature embedded in its aesthetic.

The very use of this kind of photography holds symbolic meaning in multiple levels and becomes in itself an element in the body of art-design work. Susan Sontag is quoted in Perkowitz as saying that "[science fiction] movies can supply something the novels can never provide - sensuous elaboration… by means of images and sound." (2010, 03). Sensuous elaboration is also at the core of the portraiture and fashion photography aesthetic, which aims at persuasion by using archetypical symbols through allegory and visual metaphors. If persuasion is the ultimate goal of rhetoric in any form of popularization, then the use of said aesthetic becomes a symbolic commentary on the act of popularization itself. Another level where the use of highly stylized symbolic imagery is metaphorical is in obviating the personal nature of the

work, with both its creator and audience seeing subjective glimpses of the characters “through the looking glass” (Easton and Schroeder 2008, 26) of the photographer’s lens.

There are numerous cases of successful works of portraiture and fashion photography using the two rhetoric tropes of allegory and visual metaphor and what follows is a discussion of some of the works used as reference in this thesis. *Figure 12* shows a recent work by photographer Derrick Santini entitled *A Fool for Love* (2012) featuring his re-imagining of the Greek myth of Leda and the Swan. Santini used not science history as inspiration for his work, but an element of Greek mythology. He used a commercial studio photography aesthetic to create this image, showing an allegoric representation of the story, which refers to the god Zeus seducing Leda in the form of a swan where the mythological subject is eroticism. The artist’s vision recreates in photographic medium renditions of paintings by Michelangelo and other master artists going back to Ovid’s classical literary works depicting this specific myth.

Figure 12

Derrick Santini’s A *Fool for Love*, 2012.
Lenticular Lightbox. 35.2 x 47.5"

Drawing a parallel between this particular work and my own in terms of its critical framework, we can identify some similarities in approach: while Santini refers to characters in Greek mythology, I refer to characters in science history; while his subject is eroticism, mine is scientific discovery; Santini drew inspiration from Renaissance and earlier paintings, whereas I drew inspiration from science fiction, fantasy and creative portraiture and fashion. One of the main differences in our approaches is that he used already established visual metaphors embedded in the story (i.e. Zeus as a swan) and I created for each character my own set of symbolic elements based on their individual stories and discoveries; The main common element in both our works is the use of aesthetics, namely that of studio portraiture. Although Santini’s

work came late in my research, a number of other photographers and visual artists with a similar use of fashion and commercial aesthetics directly influenced the creative path which led to the creative work in this thesis.

Figure 13

Rodney Smith's *Rocketman*, 2009.

Figure 14

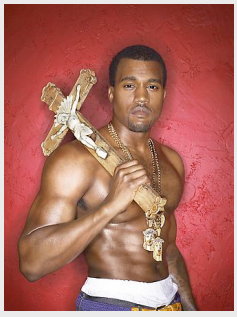
Rodney Smith's *Dancers*, 2010.

Rodney Smith appealed not only for the etherial contemplative mood of his works (shown in *Figures 13* and *14*) but also for his path from photojournalism to commercial and fine art photography, a journey experienced in my own practice. David LaChapelle's book *Heaven to Hell* (2010), introduced me to highly stylized images inspired by popular culture, religious iconography, erotic imagery and celebrity culture, which speak to a whole new set of elements in contemporary mythology, in works featured in many of the worlds most influential art institutions, such as the Museum of Modern Art (MoMA) and the Museum of Contemporary Canadian Art (Mocca). *Figure 15* shows, for instance, the work *Pamela Anderson: Miracle Tan* (2004) which can be seen as an impactful visual commentary in consumerism, body image and transformation. His re-imagining of Christian mythology (*Figure 16*) in *The Passion of the Christ* (2006) by combining religious elements (a Catholic cross) with contemporary fighter archetypes (embodied in the figure of the boxer) shows the creative potential of juxtaposing seemingly disparate symbols in popular culture for the creation of strong emotional mythic imagery.

Figure 15

David LaChapelle's Pamela: Miracle Tan, 2004. 40 x 60".

Figure 16



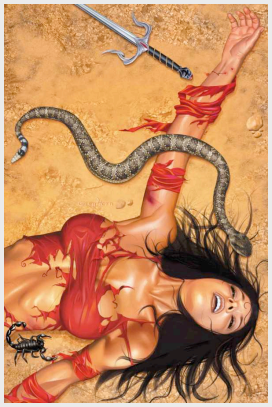
David LaChapelle's *The Passion of the Christ*, 2006.

Figure 17

David LaChapelle's *Pamela (Over Easy)*, 1998. C-print. 40 x 60".

LaChapelle's *Pamela (Over Easy)* (1998) delicate and surreal composition reveals the potentiality of studio photography to assist in bringing to life an artist's vision (*Figure 17*).

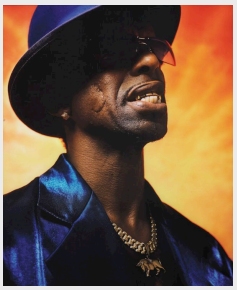
Figure 18



Greg Horn's *Elektra #13*, 2003. Comic book cover art.

In fact, fashion photography has inspired works of fantasy such as comic book artist Greg Horn's re-imaginings of popular heroes in elaborate cover artworks for graphic novels. *The art of Greg Horn* (2010) breaks down the artist's airbrush and digital painting techniques directly inspired by fashion photography depicting, as seen in *Figure 18*, Horn's vision of Marvel's character Elektra. I was also influenced by Andres Serrano's *America* (2004), where the author uses studio portraiture in order to create images recreating the mythic identity of the US after the events of 9/11/2001. Serrano's ongoing project features a consistency of style through his lighting and composition choices, as seen in the 2011 work in *Figure 19* and the 2003 work in *Figure 20*. Another influence of contemporary photographic practices is creative self-portraiture. Natalie Dybisz's *The adrenalin* (2008) digital manipulation creates a dream-like surreal theme in order to permit mythic self-expression (*Figure 21*).

Figure 20



Andres Serrano's *JB, Pimp*, 2003. 59 x 49".

Figure 19

Andres Serrano's *Blood Madonna*, 2011. Photograph. 60x49".

Figure 21

Natalie Dybisz's *The adrenalin*, 2008. Self-portrait.

Although the focus of this research is in contemporary practices in photography, it is useful to acknowledge that the exploration of visual metaphors in re-imagining mythic themes has a long tradition in the history of art. Man Ray's *Adam and Eve* (1924), for example, features Marcel Duchamp and Bronia Perlmutter in an early recreation of the popular myth (*Figure 22*). All these examples help demonstrate the creative possibilities of using portraiture and fashion photography as a medium for exploring metaphor and allegory in the exploration of mythic themes with a wide range of aesthetic influences.

Figure 22

Man Ray's *Adam and Eve*, 1924. Gelatin silver print. 12 x 10".

Table 2

Science Popularization - main field of research practice		
Representation of scientists	Lesser-known figures in science history	Represented as heroes of scientific discovery
Science Fiction and Fantasy	Inspirational power	Reference to films, comic books, TV series and literature
Mythology	Campbell's monomyth, or the hero's journey; science fiction and fantasy as contemporary mythology	Metaphysical function of myth, the awakening of a sense of wonder
Narrative Structure	Vogler's Hero's Journey Steps	Ordinary World (1) Call to Adventure (2) Refuse the Call (3) Meeting with a Mentor (4) Cross the Threshold (5) Tests, Allies, and Enemies (6) Approach the In-most Cave (7) Ordeal (8) Reward (9) The Road Back (10) Resurrection (11) Return With the Elixir (12)
Allegory and Visual Metaphor	Each character is depicted in a step in Vogler's structure.	Each character is depicted using unique symbolic elements.
Contemporary photography	Science Fiction and Fantasy Mythology and Aesthetic	Fashion, studio and portraiture photography aesthetic

Table 2 features an index of the main elements in the critical framework discussed so far to serve both as a summary for the reader and as a guide to the creation and interpretation of the studio work created.

Chapters 3 : Research Methodology and Art-Design Work

This section introduces the research methodology contextualized in a case study of studio work which helped to discover and consolidate theoretical frameworks, methodologies and practices.

3.1 Research Methodology Framework

When framing design as research as opposed to simply design practice, Anne Burdick (2003, 82) argues that research can be achieved by actual making combined with a critical reflection of the making process, aiming at both a ***specific application*** and an ***enhancement*** of the design practice itself. The specific application of this design research project is the creation of alternative allegoric representations of lesser-known characters in science history. This application aims at an enhancement of design practices in science popularization by serving as a possible way to spark interest and engagement in the complexities and nuances of the history of science through photographic works. The methodological framework combines the concept of ***design as research*** with ***reflexive visual arts research*** as the basis for the scholarly and practice-based exploration. The method of design as research follows a ***discovery-led process*** that hopes to provide space for a speculative design inquiry (Grocott 2003, 84).

As a photographer and designer working in the field of science popularization, most of my projects were assigned in a top-down manner with specific design outcomes, which is a typical reality of client-based deadline-driven work in a professional practice in this field. In the context of this Master of Design practice-based thesis work, I explore Grocott's approach of creating a space for experimentation and reflection in a client-free studio practice research project (Grocott 2003, 83), developing framed critical inquiry and solving professional imperatives, where critical speculation falls within the research notion of scholarship (2003, 85). The main notion arriving from my application of critical speculation in science popularization practice is the combination of the contemporary mythology of science fiction and fantasy with lesser-known narratives in the history of science through portraiture and fashion photographic

aesthetics. Refining this notion to a focus on specific scientists and mythologies I embarked in a discovery-led process aiming at enhancing science popularization efforts both in the specific design challenge of portraying these scientists and possibly providing a contribution to a larger community of practitioners (Grocott 2003, 85).

This methodology was broken down using Sullivan's structure framework for a reflexive practice-based inquiry (2004, 190) in visual arts research, composed of four realms of expression and inquiry: ***empiricist inquiry***, ***interpretive discourse***, ***visual practice*** and ***critical process***. This structure is further detailed in the breakdown of research methodologies as seen bellow.

3.1.1 Breakdown of methodologies

This is a dynamic and non-linear process, with one step serving as basis to the other. One can see the emergence of the main conceptualization of visual arts as research in Sullivan's framing: the relationship between the practices of creating and critiquing, where "new perceptions are imagined, relevant information is interrogated and alternative conceptions realized" (2004, 191).

1 - Empiricist inquiry

This step involves gathering and reflecting on data and information on the character to be portrayed. It is incapsulated in two basic stages: choosing the character through a self-reflexive approach and conducting a comprehensive archival research in scholarly works depicting the character's life and discoveries as well as relevant popular media works (films, comic books, photographs, artworks, etc.) to provide the basic body of knowledge to work with in the subsequent steps.

1.1 - Choosing a character

The inquiry process for the selection of a character to be portrayed, introduced in Section 2.3, is based on a self-reflexive practice that is directed by personal interest and creative insight, yet informed by disciplined knowledge and research expertise (Sullivan 2004, 101). A discovery-led process, although open

to serendipity (Grocott 2003, 86), must be grounded in the parameters of the project's aim at depicting lesser-known figures in science history whose contributions were significant to the development for a scientific field. The initial interest may be a personal curiosity about a specific scientist, but it is ultimately decided on the analysis of authoritative scholarly work reviewing the merits of that character's contribution. The subjective nature of this selection plays an important role in the direction of studio work and it opens doors for collaboration with other creative partners.

1.2 - Archival research

Once the character to be portrayed has been chosen, this step involves searching for qualitative content in the form of audiovisual materials, artifacts and material culture collections and archival document collections (Cross, 2007, 97). It is imperative to search for biographical information in scholarly history of science documents to provide a basic understanding of the character and his or her contribution. Since my intent is in contributing to the field of science popularization, I also researched representations and narratives about the character in popular science works, such as books, magazines, comic books, film and TV as well as works of art and design that have been influenced by, or based on, the character. This archival research gathers information from varied media content in order to reflect on trends in the character's depictions and the context in which it appears. Recorded interviews, found in specialized sources such as podcasts and other media outlets, either on audio or video, where experts comment on the character, are particularly useful sources for bringing key elements to the forefront, which serve as clues to thinking about the character's representation in the studio practice ideation stage.

2 - Interpretive discourse

In this step innovative thinking is triggered by the fusion of seemingly disparate phenomena (Koestler 1964). It also involves archival research in a variety of media regarding visual and mythological references, but the goal is to have a reflexive approach which arises "when different elements are played off against each other" (Alvesson and Sköldberg 2000, 249).

2.1 - Search and reflection on visual and mythological references

References range from a variety of sources such as film, photography, dance, painting or other forms of expression which can help inspire a vision of how to portray the character, seeking elements in science history, contemporary mythology and aesthetics in science fiction and fantasy works. It forces new "'ways of seeing' which act back on and reflect existing ways of seeing" (Alvesson and Sköldberg 2000, 280). Since the allegorical representation to be made uses the myth of the hero as the main theme, as understood by Campbell (1949), I try to identify other mythological elements which can be identified in the narratives about the character. That eventually helps to set the tone, style and symbology of the final piece.

3 - Visual practice

This step relates to the actual making of the studio work, divided in two main phases: ideation and execution, taking into account all the information and reflection gathered. As Sullivan puts it, "this requires understanding of the field where one can 'see through' existing data, texts and contexts so as to be open to alternative conceptions and imaginative options" (2004, 204).

3.1 - Ideation - sketching the vision and planning the execution

The ideation phase starts naturally at first encountering the character, but it is a continuous effort that changes through the process of researching the scientist and getting inspiration from other sources. This step adopts a poetic process (Grocott 2003, 86) which instead of superficially reworking the familiar, explores and discovers the unfamiliar, where the discovery-led process can make a distinction between simple invention and true innovation. By choosing a set of characteristics which will serve as symbolic and allegoric representations in portraying the character, the play with visual metaphors helps to transform meaning by illustrating similarities among the elements combined (Sullivan 2004, 204). Such elements include a synthesis of symbolic and aesthetic choices, which informs, in the context of the photographic work, the kind of person to cast, location, lighting, props, etc. The discussion of the initial idea with

colleagues and creative collaborators provides invaluable feedback which enhances and refines the original vision.

Planning the execution involves looking for knowledge about principles, practices and procedures of design in different people, processes and products (Cross 2007, 97). Usually there is a technical challenge in terms of photography, specially with making the envisioned mood translated into a lighting and composition setup. That is not a simple technical issue, but a fundamental element in the creative process, which applies to both studio and location works. The inclusion of props, makeup, wardrobe and other elements involve either the learning of a new skill or the partnering with creative collaborators. Casting is one of the most important steps in this stage and I draw from a variety of sources depending on the character. The ideation step is influenced by all pre-production work necessary for the creation of the studio work, which is part of the constructive nature of the design practice (Cross 2007, 97).

3.2 - Making, reviewing, selecting and processing the image

The act of making the image is as intrinsic to design as the research process both in terms of expression and reflection on the original vision. When the work is done in a studio setting, where changes can be made under control, unexpected results turn out to be the most exciting ones. The process of interacting with the model and supporting creative partners helps enrich the vision on the spot. The execution is not a series of instructions to be followed exactly, but a guideline for going about the work allowing for creative speculation. In many cases the original idea is materialized in the images created but the experimentation that follows has much more interesting results. Since each image is envisioned according to different parameters, technologies and tools, its making follows different paths. That is one of the advantages of a discovery-led design research practice, existing in a nexus between creative process, scholarly research, studio practice, and designed artifact (Grocott, 2003, 87).

The reviewing step is crucial in the creative process as well as on the reflection on the images produced, happening in several stages. Every photographer develops his own process for reviewing and

selection. I allow some time to pass in order to disengage from the excitement and intense concentration of shooting in order to see the work with fresh eyes. The selection of best candidates in a library of images is done either alone or in partnership with a collaborator, in a darken room providing a full immersive experience of the images shown a large screen. This process of selection helps analyze the imagery from the point of view of the original concept, but sometimes the image selected adds meaning in unexpected ways in an intuitive process based on a rigorous framework informed by the research on the character. After the selection is made, work on digital post-processing of the image, usually including mastering a new technical skill, provides the necessary enhancements to achieve the desired look, in a process of learning to see the image in the context of a series.

4 - Critical process

Burdick (2003, 84) argues that the value of design research is defined by peers, scholars and critics as well as end-users, in order to explore unresolved and complex issues away from the possible distortions. This process involves setting up a context to exhibit the work as well as providing an environment for personal reflection and critique from peers.

4.1 - Ideation - Exhibiting the final work

This step is dependent not only on the image at hand, but in the series seen as a whole. As the images are produced and critiqued, designerly ways of thinking provide different methods of showing and enhancing the studio work by introducing other elements to the experience. This stage allows for experimentation with audio, text and different formats for showing the piece, be it in a gallery space, book or other media.

4.2 - Reflection and critique

An important element of this process is getting feedback from colleagues, faculty and working professionals in the field of science popularization as well as visual arts and design practitioners. This step

is crucial for the integrity of the design as research process, taking into account the qualitative dimensions that good research in the field must have, according to Cross (2007): be purposive, inquisitive, informed, methodological and communicable. This process is followed by a written report and notes on how to create the next portrait or a revision to the work created, looking for ways to enhance it based on the reflection and critique provided.

Table 3 shows an overview of the research methodology described above and the next section shows its application in a selected case study.

Table 3

Research Methodology Framework	Design as Research	Discovery-led Design Process Reflexive Visual Arts Research
Breakdown of methodologies	Empiricist inquiry	Choosing a character Archival research
	Interpretive discourse	Search and reflection on visual and mythological references
	Visual practice	Ideation - sketching the vision and planning the execution Making, reviewing, selecting and processing the image
	Critical process	Ideation - Exhibiting the final work Reflection and critique

Overview of the main components in the research methodology

3.1.2 Case Study: '*Alfred Russel Wallace'*, 2011

This case study shows how the methodology and its broken-down steps were refined and applied for the creation of the studio exploration work entitled '*Alfred Russel Wallace*' (2011). The reflection on the process of making this piece contributed to subsequent studio experiments in the practice-based research component of this thesis.

1 - Empiricist inquiry

1.1 - Choosing a character

During an experimental studio class at OCAD University, I became interested in allegoric representations and mythological narratives around iconic figures in the history of science and how they were presented in science popularization efforts. Some of these depictions became fairly known in popular culture. An iconic example is the image of an apple hitting Isaac Newton's head as the moment he came up with his theory of gravity. Newton himself often told the story that he was inspired to formulate his theory of gravitation by watching the fall of an apple from a tree (White 1997, 86), though not the cartoon version of the apple actually hitting his head. Newton was the first person to describe how the laws of motion governing ordinary objects on Earth were the same for the moon, planets, stars and other heavenly bodies. From a science popularization perspective, I was intrigued by the power of allegory to portray scientists providing visual clues to the context of their discoveries, in an effort to spark interest in their stories.

The first step in the forming methodology of discovery-led (Grocott 2003, 86) research was to select a character to be portrayed. I created a photograph re-imagining a lesser-known scientist from antiquity called Hypatia of Alexandria. [15] The process of making that work provided the first experience with the main elements to be developed further in this case study: a scientist whose contribution was substantial but not well known according to experts; the use of mythological references in science fiction and fantasy as a

[15] *'Hypatia of Alexandria'*, 2011, is one of the works featured in the body of studio-based works in this thesis.

source for allegoric visual representations; and use of portraiture and fashion photography as the aesthetics and medium. The choice of Alfred Russel Wallace as the character to be portrayed started through a serendipitous process (Grocott 2003, 86) by first learning about him in an interview with author Sean Carroll in the podcast *Are we alone?* (Shostak 2011). Carroll's *Remarkable Creatures: Epic Adventures in the Search for the Origins of Species* (2009) told the fascinating story of Alfred Russel Wallace, co-creator of the theory of evolution along with Charles Darwin, and his heroic struggles in Brazil and Sumatra as an explorer and scientist in the 19th century. Portraying Wallace was directed by personal interest and creative insight, yet grounded in the parameters of the project's aim at depicting lesser-known figures in science history whose contributions were significant to the development for a scientific field.

1.2 - Archival research

Gathering and reflecting on data and information on the character, informed by disciplined knowledge and research expertise (Sullivan 2004, 101), by conducting a comprehensive archival research to provide the basic body of knowledge to work with in the subsequent steps. Biographies of Wallace (Raby 2002; Shermer 2011; Flannery 2011) provided scholarly knowledge about his place in the history of science from the point of view of experts in the field.

Using Cross' method (2007, 97) of research in visual and qualitative content in the form of material culture and archival document collections, a more refined understanding of the character and his contribution started to emerge. The idea for the theory of evolution by means of natural selection had come to Wallace while having a delirious fever after spending seven years studying biology in the jungles of Sumatra. In a mere 20-page paper, he described the basic concept of the theory of evolution and sent it in a letter to Charles Darwin himself, unaware of the fact that Darwin had the same basic idea 18 years earlier and was writing a comprehensive book on the subject.

Shermer (2011) describes Darwin's apprehension on publishing his own work due to the potential religious and political implications of his revolutionary ideas. Upon receiving Wallace's paper, Darwin

decided to finish his book and publish it with Wallace's work as an introduction. One can only speculate on what would have happened if Wallace had not sent his paper to Darwin, influencing his decision for making their theory public. It is known that Darwin had put in his will instructions for the publication of his book, *On the origin of species* (1859), after his death. However, the fact remains that the theory was presented when it did because of the efforts of Alfred Russel Wallace.

Further exploration and analysis took several months and was done in conjunction with the next steps comprising a search for representations and narratives about story in science popularization works, such as books, magazines, comic books, film and television as well as works of art and design that have been influenced by, or based, on the character. What follows is a selection and discussion on the most significant works found in this research.

2 - Interpretive discourse

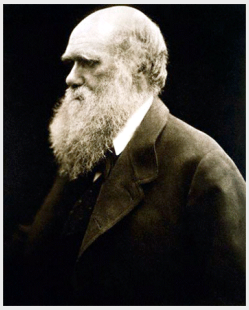
2.1 - Search for visual and mythological references

A reflexive critical approach is generated by playing different elements against each other, to be found in popularization of science history, contemporary mythology and aesthetics in science fiction and fantasy works. Fortunately there are numerous photographs of Wallace in many stages of his life. I was inspired by a portrait, shown in *Figure 23*, where we see him as a young man, not sitting, but in a dynamic pose, very unlike other portraits of scientists in the period. The appeal of that image resided on featuring Wallace as a person of action, echoing the accounts on his biographies about his resilience and courage to start again and keep working. He had lost all collected specimens after working for four years in the Amazon forest and nearly died on his way back to England, with nothing to show for. After a brief stay in England, he voyaged to the islands of Sumatra for seven years, working on

Figure 23

Photograph of Alfred Russel Wallace, 1862, by James Marchant.

Figure 24



Photograph of Charles Darwin
by Julia Margaret Cameron, 1868
Albumen print, 13x11'.

his research which would ultimately lead the way to his version of the theory of evolution. The image in *Figure 23*, taken a few years after the co-publication with Darwin's work, embodies the heroic facet of his character. The research of works by photographers from this period (1860–1880) led to a portrait of Charles Darwin by Julia Margaret Cameron, seen in *Figure 24*, featuring other mythic elements, were Darwin is shown as a heavy-browed thinker with reserved emotions.

Cameron's photographic works are filled with mythological references, inspired by myths and legends popular at the time, specially biblical and popular mythic stories, such as king Arthur's. In *The Passion Flower at the Gate* (1865), Mary Hillier posed as Mary Magdalena, as part of Cameron's Magdalena series, depicting allegorical representations of a woman in Christian mythology who had known carnal love before becoming a Christian devoted to Jesus, representing the human intersection of sacred and profane love (*Figure 25)*. Her work reflected the beginning of a long tradition in the photographic practice of using mythological references and visual metaphors in representations of historical characters. My own work was a step in bringing that tradition to a contemporary context, namely in the depiction of scientists. There are few depictions of Wallace's story on science popularization efforts in popular culture. He was briefly mentioned in the major motion picture *Creation* (2009), a dramatization of Charles Darwin life. An impactful image related to the film was a promotional poster, seen in *Figure 26*,

Figure 25

The Passion Flower at the Gate, 1865, by Julia Margaret Cameron.

in a clear reference to Christian mythology, specifically Michelangelo's *The Creation of Adam*. The provocative metaphor in the image alluded to two mythological ideas put against each other: one being the Christian idea of the creation of mankind by God and the other being the scientific view of humans and other primates charing a common ancestor. That allegoric representation of a scientist in a mythological context related to popular culture provided strong evidence supporting the direction my studio work and inquiry would take.

Figure 26

Poster from the film *Creation*, 2009.

Figure 27

The Delirium of Alfred Russel Wallace, by Mark Dion, 1994, mixed-media installation.

The discussion of the concept for Wallace's portrait with a colleague pointed to a work by artist Mark Dion that depicted the scientist in a very intriguing and innovative manner. *The Delirium of Alfred Russel Wallace* (1994) showed the character as a dog in a mixed-media installation (*Figure 27)*. The piece used the metaphor of an anthropomorphized animal in reference to the central idea in the Darwin-Wallace theory of evolution, namely the paradigm-shifting concept that a human is a kind of animal who evolved from common ancestors. The use of a dog is also a metaphor to the secondary place of Wallace as a companion figure to Darwin. In his biographic account, Carroll (2009, 242, 298) describes the relationship between the two scientists, where Wallace, although considered at the time a co-author of the theory, argued that Darwin's version was much more complete and he worked to defend and promote the work as it was harshly attacked after publication.

A reflexive analysis of Dion's cryptic and symbolic work led to a consolidation of the use of such elements in my own depiction of the character, serving as a main creative tool for depicting other characters. Further visual research in Dion's artworks revealed other informative and innovative forms of combining elements of science and mythology in allegorical representations. In *The Ladies Field Club of York (Figure 28)* he created portraits of an imaginary group of women amateur scientists from the 19th century. These portraits were made using the exact styling conventions and techniques of studio portraiture from the second half of the 19th century. The models employed for the eight portraits are contemporary art curators currently working in Britain. Together with a tableau recreating a mobile laboratory, the portraits were installed in a teak baggage car.

Figure 28

Mrs. Herbert Fowler, Anthropology, part of the work *The Ladies Field Club of York*, by Mark Dion, 1999.

As was the case in Santini's *A Fool for Love* (2012) [16], Dion's work shows a very good example of a variation of what became my own methodology: it uses allegoric representations of scientists (fictional characters representing fields of study - i.e. anthropology, geology, etc.) in a mythological context (the myth of the 19th century explorer and adventurer) inspired by a specific visual style (Victorian studio portraiture). When comparing these elements with my portrayal of Wallace, we can see the similarities in approach: an allegoric representation of a scientist (in this case, a real historical figure) in a mythological construct (the myth of the hero in contemporary science fiction and fantasy) inspired by a specific visual style (creative portraiture and fashion photography).

[16] Please refer to *Figure 12* in this document.

Figure 29

Still from the film *300*, 2007.

The aesthetics of the fantasy film *300* (2007) resonated for its use of the hero mythology as presented by Campbell (1949) in highly stylized fashion-inspired imagery. *Figure 29* shows actor Gerard Butler as King Leonidas, a mythic figure in Greek history whose story was dramatized in the film, where the character's heroic moral qualities are represented allegorically by the strength of his body. The idea of using bodily strength as a metaphor to a character's resilience and bravery was informed by Sullivan's understanding of the use of visual metaphor, which "involves creating an image that suggests a resemblance of one thing to something else so as to think of one thing as if it were the same as another" (2004, 204).

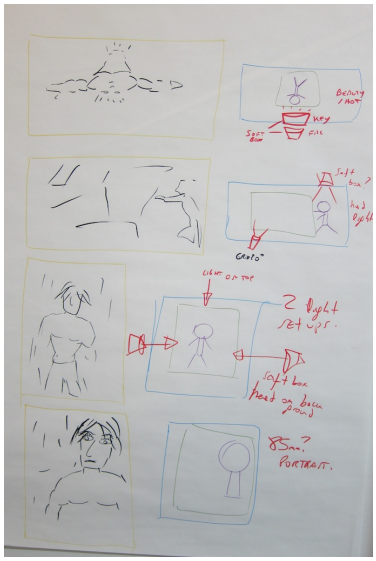
3 - Visual practice

3.1 - Ideation - sketching the vision and planning the execution

The ideation phase requires going beyond the "existing data, texts and contexts so as to be open to alternative conceptions and imaginative options" (Sullivan 2004, 204). This step adopts a poetic process (Grocott 2003, 86) where, instead of trying to fit a thousand words into a photograph, the challenge is portraying the essence of the character as I saw him, showing his resilience, courage, insight and subsequent fading from history in an image with mythical qualities in an allegorical representation that would invite the viewer to explore his story.

A creative process of word association, presented in Chris Orwig's book *Visual Poetry* (2010) as a technique for narrative portraiture, revealed keywords around both content and style to come up with possible visual representations. Based on that process, I sketched a few ideas on composition and lighting

Figure 30



Sketches of composition and lighting study, 2011.

as seen in *Figure 30*. The image would have four basic elements: a model portraying Wallace wearing modern explorer pants, a collage work of pages from Darwin's *On the origin of species* on the background, and a combination of soft and hard lighting setups. That process of visualization informed the planning and the execution of the work, which involved testing the lighting setup in the studio prior to the actual shoot, casting, creating the collage and selecting the camera and lenses needed.

Simon Rose was chosen among several candidates to be the model portraying Wallace, due to his intensive training in bodybuilding and subtle acting performance. As the vision was consolidated, the bodily strength, especially in the abdomen, serves as a visual metaphor for the mythical element of resilience in the process of discovery in science, a central point in my interpretation of Wallace's narrative. The collage work in *Figure 31*[17] used pages of Darwin's *On the origin of species*, symbolic of Wallace's insight, as a play with the authorship of the idea of the theory of evolution.

Along with a combination of soft and hard light using studio strobes, the choice for using a digital full-frame camera (Canon 5D Mark ii), and a fixed focal-length lens (85mm f1.2) helped inform the creative process of composition.

Figure 31

Collage detail and lighting concept, 2011.

[17] Christine Walker, a colleague at OCAD University who was developing a collage methodology as part of her own thesis work, provided creative and technical insights for the creation of this collage.

An analysis of metadata[18] from the previous work '*Hypatia of Alexandria*' (2011) showed best results when shooting at a 85mm range. A fixed focal-length lens requires the development of more refined composition skills, since the photographer has to physically move his or her body instead of zooming in or out to change the composition. However, this kind of lens provides a superior image quality and sharpness on the subject, retaining the possibility to work with variations on depth-of-field in order to blur a background, especially when shooting at a f8 aperture (for that particular lens). Putting together all these pre-production steps is necessary for the creation of photographic studio work and it also reflects an integral part of the constructive nature of the design practice (Cross 2007, 97) in the context of contemporary portraiture and fashion photography.

3.2 - Making, reviewing, selecting and processing the image

Although the ideation phase produced a solid concept for the image to be created, interacting with the model and supporting creative partners on set helped to enriched the vision during the shoot, by introducing one new element in the image, suggested by stylist Della Chiu, where I had the model holding a few pages of the work written by Wallace himself, bringing a new layer of meaning to the mythology of the work. One of the main differences of using digital instead of film cameras in studio photography, along with the possibility to instantly review exposure and composition, is the virtually unlimited number of photographs one can create. When using film one is usually constrained to a limited number of photographs and usually has to plan each shot with much more care. There are creative advantages and disadvantages to this approach, but it is ultimately a matter of style and personal choice. *Figure 32* shows the initial selection from the hundreds of images created. The first image (top left) is in direct symmetrical opposition to Darwin's portrait from Cameron[19], in a poetic commentary, very much a part of the mythology being

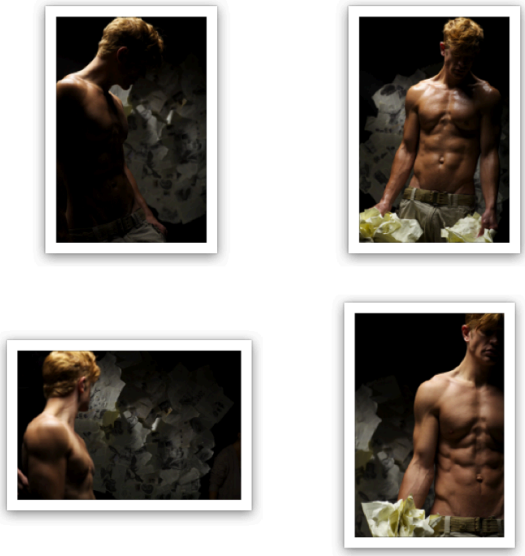
---

[18] One of the advantages of photographing using digital cameras is the ability to sort photographs using technical parameters such as ISO, aperture, shutter speed and lens selection. Careful analysis of this data in combination of critical reflection on the resulting images provide insights in creative possibilities for future works, as exemplified here.

[19] As seen in *Figure 24*, page 52.

portrayed. The second one (top right) has both elements of strength and fragility in it. One could read the word “nature” on the page the model was holding when the image is printed in large format. The third one (bottom left) had the composition focusing on the collage, and not on the character, which was out of focus, in a metaphorical reference to his forgotten place in the development of the theory of evolution. The forth one (bottom right), which was ultimately selected, seemed to hold all the symbolic elements in place, embodied in the collage, the lines on the the body, the low camera angle, the face covered, and the character walking towards the dark.

Figure 32



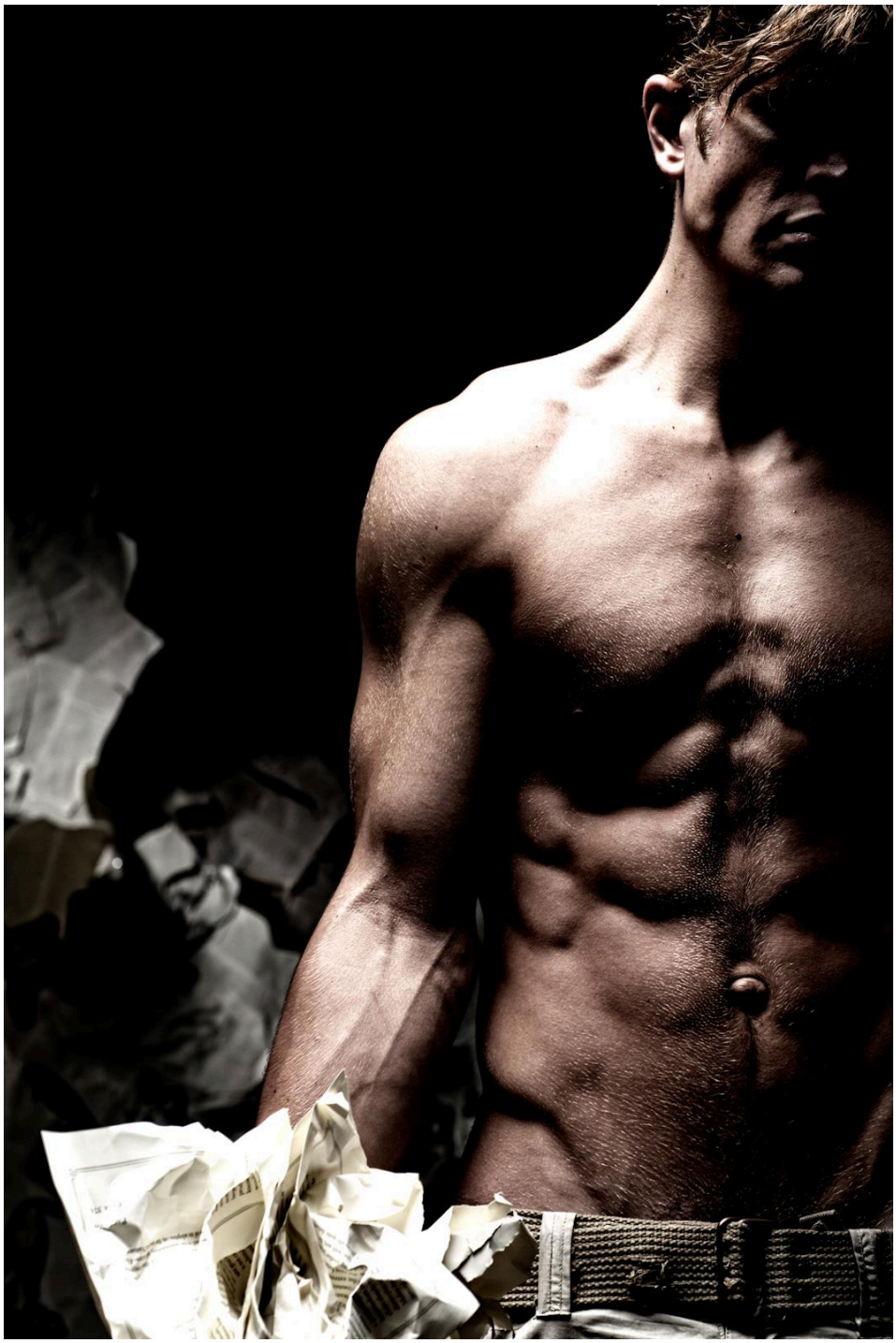
Final selection of 4 candidate images for *‘Alfred Russel Wallace’*, 2011.

4 - Critical process

4.1 - Ideation - Exhibiting the final work

At this early stage in my exploration, I decided to focus on the effect of the still image and presented the work in a large scale print (36x24”) on rice paper, hung on the wall of my studio at OCAD University for a number of months in order to get formal and informal feedback from colleagues, professors and collaborators. The piece ‘*Alfred Russel Wallace*’ (2011) can be seen in *Figure 33*.

Figure 33



Alfred Russell Wallace', 2011
Digital print on rice paper. 24x36".

4.2 - Reflection and critique

The reflection and critique on the work focused on how the image would stand on its own and how it could be featured in the context of a series as a whole. Along with a reflexive practice, Burdick argues that the value of design research is defined by peers, scholars and critics as well as end users (2003, 84). In order for critical speculation (Grocott 2003, 85) to fall within the research notion of scholarship, this work was set up in a context that provided a ground for personal reflection and critique from peers. What follows is my report on the value added in this process.

One lesson from this case study is that Grocott's model of discovery-led practice-based design research seemed to provide positive results for a professional photographer who engages in personal research projects that ultimately inform his or her practice. Without the setting up of a space for critical speculation, as a designer and visual artist, I would not have arrived at this work and the framework and methodology in which it was set. The validation of the methodological approach by no means guaranteed the success of this particular piece, but its making and subsequent reflection and critique did help the envisioning of further experimentation in the process of creating other works by consolidating some elements and providing a guideline in the search for further exploration.

Upon showing and discussing the work, I had different reactions from a variety of audiences in different contexts. People who knew the character seemed to enjoy the process of figuring out the cryptic references in the work. Peers, both in the academic and professional realm, had rich and mixed reactions about the use of my chosen aesthetic, with some being positive and encouraging and others being skeptical of its use in this context. This focus on the aesthetics, both positive and negative, came as a surprise, and it took a fair amount of reflection to take it into account and figure out how it would inform my future studio-based research. It seemed that, when presented on its own, as simply a photograph on the wall, there was a ***space between*** the public and the work and its stated goals and execution. It became apparent that in order to achieve the aims of the project, a photograph would have to be visually contextualized and embedded in

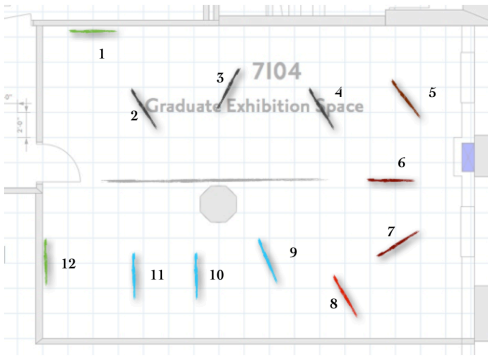
an larger experience. Further reflection on the concept of space between audience and artwork showed an opportunity for refinement in my design practice. The key was not in the aesthetics but in how to present the cryptic elements of the work and guide the audience through a partial decryption, since the work referred to a fairly unknown character. The image by itself did not seem to invite the audience for further exploration of the character. This happened in part because the cryptic elements in the image were too difficult to decode or appreciate without prior knowledge about Wallace. I had learned so much about the character that I created an image for myself, that informed my own reflection and that of an audience familiar with his story. Since the goal is to spark interest and engagement, further enhancements and reflection needed to be made. An analysis of the cryptic symbolism I wanted to use led me to revisit the iconic image of Newton and the falling apple mentioned at the beginning of this case study. Without prior knowledge about Newton's work, the image is as difficult to decode as the Wallace piece. The difference is that the Newton caricature is usually presented *in conjunction* with other forms of discourse, and that conjunction is what makes that image useful and powerful.

This thought process led to the realization that the elements in the image should be, at least to a point, workable clues about the character. In order for the portrayal of Wallace or any other character to be successful, to bridge the space between audience and work, the design challenge shifted to the creation of an ***experience*** that would lead the viewer ***into the image***. As Ansel Adams once put it, "a photograph is usually looked *at* - seldom looked *into*" (cited in Bohn 2007, 77). To achieve my research objective of sparking a sense of wonder, I had to take the viewer through my own journey of discovery, which comprised not only this character but the experience of the body of work as a whole. The key was focusing on the hero's journey and the common elements between all the characters, the multiple layers of meaning which could be explored by developing the visual metaphor of the concept of ***discovery*** into the design of the experience in a gallery setting.

3.2 Results: Overview of the art-design work

The art-design work created as the practice-based research component of this thesis is featured in a gallery exhibition comprising 12 pieces, each related to a specific character in the history of science. *Figure 34* shows the placement of the works in the gallery, where the numbers correspond to a portrait of a character, listed in *Table 4*. The very distribution of works in the gallery is metaphorical of Vogler's 12-step hero's journey, with each piece's mood and symbolic content leading to the next. Another allegorical element in the experience of the pieces, when seen as a whole, is the use of the discovery concept. This visual metaphor is achieved by taking the photographs out of the walls and having them hanging layered in the space. It is important to reiterate that the goal of this practice-based research is not in teaching about the characters, but in sparking interest in their stories through images rich in cryptic and personal metaphors, taking into account the subjective understanding and emotional engagement of the audience itself, which is as varied and valuable to my own as the creator of the pieces. *Table 4* provides a reference of all the art-design works, including the names of the characters depicted, which title the pieces, year of creation, their place in Vogler's hero's journey and a condensed list of visual metaphors and allegoric elements present in each one[20].

Figure 34



Gallery plan showing the distribution of artwork .

[20] A detailed description of each portrait is included as an appendix.

Table 4

#	Title of artwork	Steps in Hero's Journey	Visual Metaphor and Allegoric Elements
1	*'Landell de Moura'*, 2012.	**Ordinary World**. Shot on location. Strobe light. 'Real world' mood.	Self-portrait. Religious inspired location and costume. Composition refers to video-game Assassin's Creed. Book on hand.
2	*'Hypatia of Alexandria'*, 2011.	**Call to Adventure**. Shot in studio. Strobe light. Dark lighting mood.	Bodypaint art inspired by astrolabe devices, star charts and Library of Alexandria written scrolls. Dance stance referencing the Greek goddess of Astronomy and dance. Reference to comic book character Mystique.
3	*'Alfred Russel Wallace'*, 2011.	**Refuse the Call**. Shot in studio. Strobe light. Dark lighting mood.	Collage work using Darwin's writings on evolution. Contemporary clothing used in nature sports. Torn pages of Wallace's written works. Reference to Greek hero mythology as re-interpreted in the film *300*.
4	*'Carl Sagan'*, 2012.	**Meeting with a Mentor**. Shot in studio. Strobe light. Dark lighting mood.	Papyrus paper with the 'Hypatia of Alexandria' image and the Voyager plate designed by Carl Sagan and Frank Drake. Characterization of character as an ancient Egyptian scribe.
5	*'Henrietta Leavitt'*, 2012.	**Cross the Threshold**. Shot in studio. Strobe light. Gold lighting mood.	Golden orb and old telescope as astronomical reference. Tribal bellydance costume and stance referring to the 'dance of the spheres' concept. Lighting inspired by the photography in *Tomb Raider* (2003)
6	*'Maria Prophetissa'*, 2012.	**Tests, Allies, and Enemies**. Shot in studio. Strobe light. Gold lighting mood.	Steampunk costume and location. Table and props with chemical devices from multiple eras.
7	*'Émilie du Châtelet'*, 2012.	**Approach the In-most Cave.** Shot in studio. Strobe light. Gold lighting mood.	Burlesque Victorian style costume. Swords. Reference to King Arthur myth of Excalibur. Reference to a journey to mythic Hades.
8	*'Percival Lowell'*, 2012.	**Ordeal.** Shot in studio. Strobe light. Red lighting mood.	Paintings of Mars landscape by Clarkson, also the model in the piece. Large brush, cigarette, clothing and stance inspired by photographs of Jackson Pollock. Emulation of window light through painting.
9	*'Ada Lovelace'*, 2012.	**Reward**. Shot in studio. Strobe light. White lighting mood.	Loom referring to precursors of digital computers. Contemporary workout outfits using fabrics made possible by digital technology.
10	*'Rosalind Franklin'*, 2012.	**The Road Back.** Shot in studio. Strobe light. White lighting mood.	White spandex fabric and clothing trapping the model, covering part of her face, in an escape stance. Reference to DNA.
11	*'Marie Curie'*, 2012.	**Resurrection.** Shot in studio. Strobe light. White lighting mood.	See-through fabric and clothing in reference to x-rays and radioactive materials. The cello refers to the electromagnetic spectrum and quantum physics. The use of the white background, black musical instrument and red fabric relates visually a consolidation at this step of the three moods in the 'special world'.
12	*'Jeremiah Horrocks'*, 2012.	**Return With the Elixir.** Shot on location. Natural and strobe light. 'Real + special world' mood.	Steampunk costume and location. Scientist's invention studio as location. Photographs of other characters on the wall. Reference to Vermeer's The Geographer painting. Open letter (same as photography #1).

Overview of the characters depicted and the main allegoric elements in the art-design work.

A discussion on a selection of three of the portraits illustrates some of the key symbolic elements present in the work as a whole serving as visual reference to the conclusions presented in the next chapter. '*Hypatia of Alexandria*' (2011), in *Figure 35*, features the philosopher, astronomer and poet of ancient Greece. The work refers to the ***Call to Adventure*** step, the second in Vogler's structure, where the hero is introduced to the 'special world' symbolically represented by the *dark mood of the studio lighting*. '*Percival Lowell*' (2012), in *Figure 36*, features my vision of the astronomer obsessed with the possibility of life on Mars, referring to the ***Ordeal*** step, where the hero's deepest decent into the 'special world' is represented by the *red lighting theme*. '*Ada Lovelace*' (2012), in *Figure 37*, features the mathematician considered the first computer programer in history. The *lighter color scheme* in the piece refers to the ***Reward*** step, where the hero starts his return to the '*Ordinary World*'.

Figure 35

'Hypatia of Alexandria', 2011. Digital print.

Figure 36

'Percival Lowell', 2012. Digital print.

Figure 37

'Ada Lovelace', 2012. Digital print.

This visual progression in mood is gradually revealed by the contemplation of all 12 pieces in the gallery space in the order reflecting the hero's journey steps as seen in *Table 4*.

Chapter 4: Summary, implications, conclusions

This chapter discusses some conclusions drawn from this practice-based design research project in relation to the objectives presented in Chapter 1, as well as possible implications for critical practice and methodology as they may apply to other works in science popularization efforts.

4.1 Discussion, Conclusions, Implications

As I developed the research and studio practice in this project and my knowledge and understanding of the stories of the characters portrayed increased, I could not help but remember the opening lines of *Peter Pan* (1953): "All of this has happened before and all of it will happen again." This quote is a great reference to yet another important mythological concept present in my findings, the myth of the 'Eternal Return', where motifs of the human condition appear again and again throughout history. In my own work, this motif is the eternal quest for knowledge present in the efforts of the characters in understanding the universe. I hope the discussion in this document and the reflection on the related art-design work could make clear the idea that all these characters stories are part of an universal narrative, namely the quest for knowledge present in the lives of every scientist trying to unlock mysteries of the universe through scientific inquiry. If one sees the artwork not as individual pieces but as parts of a whole, it can be seen that it refers to the same character archetype, ***the researcher, the explorer, the inquirer***, echoing Campbell's monomyth concept in the multiple faces of the science hero, portrayed by different characters in individual steps of the hero's journey.

In regards to my first objective, the exploration of allegory and visual metaphors to enrich the portrayal of scientists, I created 12 distinct yet related portraits using a variety of symbols in the creation of personal mythic imagery which reminds us of cryptic images of tales of fantasy. Tietge (2008, 49) quotes Arthur C. Clarke's law of technology which states that "any sufficiently advanced technology is indistinguishable from magic." We can see references to this understanding of 'magic' in the the symbolic

representations of the character in the art work: in the painted astrolabe on *'Hypatia of Alexandria'* (2011), the orb and telescope in *'Henrietta Leavitt'* (2012), the martian landscape through the window in *'Percival Lowell'* (2012), to name a few. A conclusion from this use of allegory and visual metaphor is that the created mythology can be understood basically as a system of analogy, giving new ways of thinking about the characters and their stories.

The second research objective dealt with the exploration of contemporary science fiction and fantasy mythology and aesthetics as ways to create engaging alternative representations of characters in the history of science. If we consider the body of art-design work as a whole, it can be argued that what was created is, in a sense, a science fiction of the history of science. In regards to mythology, this was done by using Vogler's steps of the hero's journey and the construct of the scientist as a mythic hero in the monomyth concept of Campbell. The aesthetics of highly stylized, hyper-real and super-hero-like images refer to a myriad of science fiction and fantasy styles. To name a few, *'Alfred Russel Wallace'* (2011) refers to the aesthetic of the body in *300*, *'Henrietta Leavitt'* (2012) refers to the posing and lighting in *Tomb Raider*, *'Carl Sagan'* (2012) refers to Egyptian scribes, in a common practice of science fiction of borrowing elements from ancient history and mythology. As an overall aesthetic theme, following Vogler's steps, the first and the last photographs are set in the *Ordinary World* and were created on location, while the part of the journey in the *Special World* was set in a studio environment. That metaphor is further enhanced by the color scheme in the display of the pieces, going from darker images, to red-golden ones at the middle of the journey and finally going to lighter ones at the end. The use of 12 characters is a direct reference to the 12 archetypical Cylon models in the re-imagined series *Battlestar Galactica* (2004-2008). A conclusion from the use of science fiction and fantasy references and structure is the demonstration through the art-design work of its power in creating a sense of wonder by embedding different levels of meaning and significance in attempts not to answer questions but to express insight.

The third research objective, the combination of all the elements mentioned above, namely science fiction, fantasy, hero mythology in visual metaphorical portrayals of lesser-known figures in science history using portraiture and fashion aesthetics, had the goal of inspiring interest and critical reflection on the nuances and complexities of the mythology of science history. This was achieved in a number of ways in messages to three main audiences: the public viewing the work, the science popularization community and myself as an artist and a designer.

For the general public, a critical reflection emanating from the artwork deals with what Bernard Cohen called the fallacy of scientific idolatry, regarding scientists "to be lay saints, priests of truth, and superior beings who devote their lives to the selfless pursuit of higher things" (cited in Gregory and Miller 2000, 78). Although that reflection is valid, it embodies the healthy skepticism necessary in scientific discovery and it inspires the appreciation of artistic media where 'science' becomes less about knowledge and more about a source of wonder and emotional impact. The attempt to spark a sense of wonder about people in science can be seen in other popularization efforts such as the ***Ada Lovelace Day***, created by social technologist, journalist and writer Suw Charman-Anderson in 2009. The Ada Lovelace Day[21] is an international day celebrating the achievements of women in science, technology, engineering and maths by engaging the public in their own representations of role models such as Ada Lovelace (featured in one of the portraits in this series). The goal is to encourage the public to share stories of women - whether engineers, scientists, technologists or mathematicians - who have been a source of inspiration in one's own life by writing a blog post, recording a podcast, filming a video, drawing a comic, or any other form of creative expression. My research in the three years of audience contributions in the Ada Lovelace Day, combined with the feedback at the graduate thesis exhibition of *Portraits of Science: A journey re-imagining heroes in the history of science,* will inform the next steps in enhancing a sense of wonder in

[21] Information on this project can be found at findingada.com.

future iterations of my work, exposing it to a wider audience on the Internet and in published formats as well as inspiring the creation of other portraits in a continuation of the series. Further exploration in the awakening of a ***sense of wonder***, the metaphysical function of myth, shall be guided by Campbell's assertion that mysteries cannot be captured directly in words or images, but through the experience of the contemplation of mythic symbols that point beyond themselves and "touch and exhilarate centers of life beyond the reach of reason and coercion.... The first function of mythology is to reconcile waking consciousness to the *mysterium tremendum et fascinans*[22] of this universe *as it is*" (1965, 4).

For science popularization practitioners analyzing the artwork, a critical reflection embedded is the issue of representation, which touches upon the very essence of all scientific activity as well as its subsequent popularization, reminding us that the science discourse fundamentally is a multimedia genre and sees concepts of science as semiotic hybrids. As put by Pauwels, "visual representations are not to be considered mere add-ons or ways to popularize a complex reasoning; they are an essential part of scientific discourse" (2006, 87). One of the possible benefits for the science popularization community is the demonstration of the inspirational and creative powers of using science fiction and fantasy mythology and aesthetics as references for the creation of new works, specially in light of Vogler's creative structures used in the artwork. Another possible contribution brought by this thesis is the use of its methodology framing design as research as opposed to simply design practice in discovery-led inquiries applied to the field of science popularization, exploring Grocott's approach of creating a space for experimentation and reflection in a client-free studio practice research project (Grocott 2003, 83).

An additional insight from reflecting on my imagery through the lens of mythology reveals deep personal longings to understand ourselves by creating our own myths, which render a subjective connotation to all creative work, both in art and science. As Richard Avedon put it, "my portraits are more

---

[22] This concept can be translated as 'a dread and yet alluring mystery'.

about me than they are about the people I photograph" (cited in Bohn 2007). In that sense, my own photographic practice in this project shows an unconscious concern brought to a conscious awareness: by attempting to create meaning through visual narratives, by re-imagining real people in obviously 'unreal' ways, I tried to embrace the inherent ambiguity of any story or idea deemed true, in a personal and professional struggle to advance a skeptical viewpoint, fighting illusions of certainty. Grunig reminds us that popularization is "essentially an act of persuasion" (1980, 185) and I tried in my own journey in this work to persuade the audience to explore the wonders of these science heroes, whose message in the end is that being your own thinker is the ultimate inspiration.

Bibliography

Books

Alvesson, Mats and Kaj Sköldberg. 2000. 'On reflexive interpretation: the play of interpretative levels.' In *Reflexive Methodology: New Vistas for Qualitative Research*. London, UK: Sage Publications, Inc. p-238-257 and 288-292.

Barthes, Roland, and Annette Lavers. 1972. *Mythologies*. New York: Hill and Wang.

Barros, H. L. 2003. *Santos Dumont*. Rio de Janeiro: Jorge Zahar Editor.

Bohn, Klaus. 2007. *The art within portrait photography a master photographer's revealing and enlightening look at portraiture*. [Sooke], B.C.: CCB Pub.

Byers, Nina, and Gary Williams. 2010. *Out of the Shadows: Contributions of Twentieth-century Women to Physics*. Cambridge: Cambridge University Press.

Burdick, Anne. 2003. "Design (As) Research". In *Design research: methods and perspectives*, ed., Brenda Laurel. Cambridge Mass.: MIT Press.

Broks, Peter. 2006 *Understanding Popular Science*. Maidenhead: Open University.

Brooks, Rodney A. 2002. *Flesh and machines: how robots will change us*. New York: Vintage Books.

Campbell, J. and Bill Moyers. 1988. *The power of myth*. New York: Doubleday.

Campbell, Joseph. 1949. *The Hero with a Thousand Faces*. 1st edition, Bollingen Foundation, 1949. 2nd edition, Princeton University Press. 3rd edition 2008, New World Library.

Campbell, Joseph. 1965. *The Masks of God, vol. 4: Creative Mythology*. New York: Viking.

Carroll, Sean B. 2009. *Remarkable Creatures: Epic Adventures in the Search for the Origins of Species*. New York: Mariner Books.

Clark, David H, and Matthew D. H Clark. 2004. *Measuring the Cosmos: How Scientists Discovered the Dimensions of the Universe*. New Brunswick, N.J.: Rutgers University Press.

Cousineau, Phil. 2003. *The Hero's Journey: Joseph Campbell on His Life and Work*, 3rd edition, Phil Cousineau, editor. Novato, California: New World Library.

Cross, Nigel. 2007. 'Design as Discipline'. In *Designerly Ways of Knowing*. Basel: Birkhaeuser, p 95-103.

Cool, Nathan Todd. 2006. *Is it hot in here?: the simple truth about global warming*. New York, NY: iUniverse, Inc.

Easton, Lee, and Randy Schroeder. 2008. *The Influence of Imagination: Essays on Science Fiction and Fantasy as Agents of Social Change*. Jefferson, N.C.: McFarland & Co.

Flannery, Michael A. 2011. *Alfred Russel Wallace: a Rediscovered Life*. Seattle: Discovery Institute Press.

Gould, Stephen Jay. 1983. "Evolution as Fact and Theory," in *Hen's Teeth and Horse's Toes* (New York: W.W. Norton & Company.

Gregory, Jane, and Steve Miller. 2000. *Science in Public: Communication, Culture, and Credibility*. Cambridge: Basic Books.

Grocott, Lisa. 2003. “Speculation, Serendipity and Studio Anybody”. In *Design research: methods and perspectives*, ed., Brenda Laurel. Cambridge Mass.: MIT Press, 83-93.

Grunig, James. 1980. “Communication of scientific information to nonscientists”. In: *Progress in communication studies*. Vol II edited by B. Dervin and MJ Voight. Norwood, New Jersey: Ablex.

Hart, R.P. 1990. *Modern rhetorical criticism*. New York: Harper/Collins.

Horn, Greg, Betsy Horn, and George Beliard. 2010. *The art of Greg Horn*. Berkeley, CA: Image Comics.

Koestler, Arthur. 1964. *The Act Of Creation*. New York: Macmillan

Kuhn, Thomas. 1962. *The structure of scientific revolutions*. 3rd ed. Chicago: The University of Chicago Press.

LaChapelle, David. 2010. *Heaven to hell*. Köln: Taschen.

Lathers, Marie. 2010. *Space Oddities: Women and Outer Space in Popular Film and Culture, 1960-2000*. New York: Continuum.

Mulvey, Laura. 1996. *Fetishism and curiosity*. Bloomington; London: Indiana University Press; British Film Institute.

Orwig, Chris. 2010. *Visual Poetry a Creative Guide for Making Engaging Digital Photographs*. Berkeley, Calif.: New Riders.

Pauwels, L. 2006. *Visual Cultures of Science: Rethinking Representational Practices in Knowledge Building and Science Communication*. Hanover, N.H.: Dartmouth College Press: University Press of New England.

Perkowitz, S. 2010. *Hollywood Science: Movies, Science, and the End of the World*. New York: Columbia University Press.

Raby, Peter. 2002. *Alfred Russel Wallace: a Life*. Princeton, N.J.: Princeton University Press.

Rowland, R.C. 1990. “On mythic criticism”. *Communication Studies*, 41(2), 101-116.

Rushing, J.H. 1990. “On saving mythic criticism - a reply to Rowland”. *Communication Studies*, 41(2), 136-149.

Sagan, Carl. 1994. *Pale blue dot: a vision of the human future in space*. New York: Random House.

Sagan, Carl. 1997. *The demon-haunted world : science as a candle in the dark*. 1st ed. New York: Ballantine Books.

Sandison, Alan, and Robert Dingley. 2000. *Histories of the Future: Studies in Fact, Fantasy and Science Fiction*. New York: Palgrave.

Serrano, Andres. 2004. *America and other work*. Köln; Los Angeles: Taschen.

Shelley, Mary. 1818. *Frankenstein*. New York: Dover Publications, 1994.

Shermer, Michael. 2002. "This View of Science", *Social Studies of Science* 32 (4): 489–525.

Shermer, Michael. 2011. In Darwin's Shadow: the Life and Science of Alfred Russel Wallace. New York: Oxford University Press.

Snyder, Peter J, Linda C Mayes, and Dennis D Spencer. 2009. *Science and the Media Delgado's Brave Bulls and the Ethics of Scientific Disclosure*. Amsterdam; Boston: Elsevier/Academ2ic Press.

Stock, G. 1993. *Metaman: The merging of humans and machines into a global superorganism*. New York: Simon and Schuster.

Strecher, Mathew. 1999. *Magical Realism and the Search for Identity in the Fiction of Murakami Haruki*, Journal of Japanese Studies, Volume 25, Number 2, pp. 263-298.

Sullivan, Graeme. 2010. *Art practice as research: inquiry in visual arts*. 2nd ed. Thousand Oaks [Calif.]: Sage Publications.

Tietge, David J. 2008. *Rational Rhetoric: the Role of Science in Popular Discourse*. West Lafayette, Ind.: Parlor Press.

Vogler, Christopher. 1992. *The writer's journey: mythic structures for storytellers and screenwriters*. Studio City, CA: M. Wiese Productions.

Voytilla, S. 1999. *Myths and the movies: Discovering the mythic structure of 50 unforgettable films*. Studio City, CA: Michael Wiese Productions.

Wagner, J. and J. Lundeen. 1998. *Deep space and sacred time: Star Trek in the American mythos*. Westport, CT: Praeger.

White, Michael.1999. *Isaac Newton: the Last Sorcerer*. Reading, Mass.: Perseus Books.

Whitt, David. 2008. *Sith, Slayers, Stargates and Cyborgs: Modern Mythology in the New Millennium*. New York, NY [u.a.]: Lang.

Zamora, Lois Parkinson, and Wendy B Faris. 1995. *Magical realism: theory, history, community*. Durham, N.C.: Duke University Press.

Podcasts

Shostak, Seth. 2011. *Are We Alone – Who's On First?: Sean Carroll*. http://radio.seti.org/blog/2011/03/are-we-alone-whos-on-first-sean-carroll/.

Film

300. Directed by Zack Snyder. United States: Legendary Pictures Virtual Studios, 2007. DVD

Creation. Directed by Jon Amiel. United Kingdom: Recorded Picture Company/ BBC Films, 2009. DVD

Contact. Directed by Robert Zemeckis. United States: Legendary Pictures Virtual Studios, 1997. DVD

Fat Man and Little Boy. Directed by Roland Joffe. United States: Paramount Pictures, 1989. DVD

Indiana Jones and the Raiders of the Lost Ark. Directed by Steven Spielberg. United States: Paramount Pictures, 1981. DVD

Lara Croft: Tomb Raider. Directed by Simon West. United States: Mutual Film Company, 2001. DVD

Lara Croft Tomb Raider: The Cradle of Life. Directed by Jan de Bont. United States: Mutual Film Company, 2003. DVD

Metropolis. Directed by Fritz Lang. Weimar Republic: UFA, 1927. DVD

Peter Pan. Directed by Clyde Geronimi, Wilfred Jackson and Hamilton Luske. United States: Walt Disney Productions, 1953. DVD

Spider-Man 2. Directed by Sam Raimi. United States: Marvel Enterprises, 2004. DVD

The day after Trinity. Directed by Jon H. Else. United States: Pyramid Films, 1981. DVD

The Matrix. Directed by Andy and Larry Wachowski. United States: Warner Bros, 1999. DVD

Television

Battlestar Galactica. Developed by Roland D. Moore. United States: SciFi Channel, 2004-2008. DVD

I dream of Jeannie. Created by Sidney Sheldon. United States: Screen Gems, 1965. DVD

Star Trek: The Original Series. Created by Gene Roddenberry. United States: Paramount Television, 1965. DVD

The Big Bang Theory. Created by Chuck Lorre and Bill Prady. United States: CBS, 2007-present. DVD

Web

Laytner, Lance. 2007. "*Star Trek Tech"*. Edit International. http://www.editinternational.com/read.php?id=4810edf3a83f8

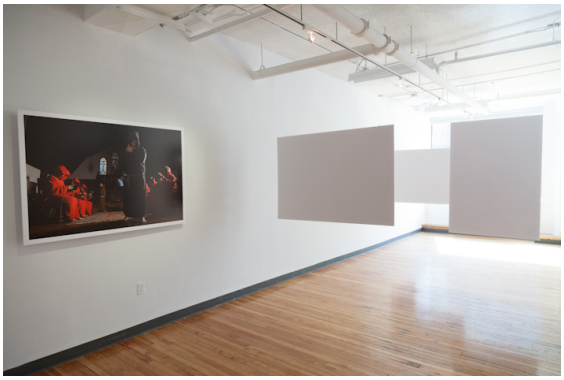
Ouellette, Jennifer. 2011. "*Henrietta Swan Leavitt Comes to Life on Stage: Discovery News*". http://news.discovery.com/space/star-fiend-henrietta-leavitt-comes-to-life-on-stage-110415.html

Ada Lovelace Day. 2012. http://www.findingada.com

Appendix A: Images and description of artworks

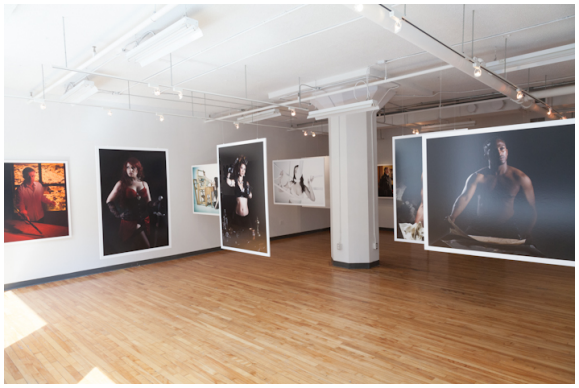
This appendix features two views of the distribution of the artwork in the gallery. It also includes images of all 12 portraits with detailed descriptions of the symbolic meaning embedded in each one as well as creative and technical aspects of their creation. *Figure 38* shows a view from the entrance of the gallery, where the viewer sees one photograph on the wall and the others from the back, hanging in the space. This layout was designed to invite the audience to the exploration of the works, which cannot be seen as a whole at one glance. *Figure 39* shows a view from the back of the gallery, where the viewer can see a large portion of the artworks and start to explore the collective meaning of the pieces, where each one leads to the next. After exploring the gallery once, the audience finds next to the last portrait an exhibition guide and series of postcards including the images in the gallery, quotes from the characters and a small biographical introduction to their contributions to scientific knowledge. The viewer is invited to take home the postcards of the characters they wish to know more about and further explore the visual metaphors behind each of the re-imagined portraits.

Figure 38



View from the entrance of the gallery.

Figure 39



View from the back of the gallery.

'*Landell de Moura*', 2012.

Figure 40

Portrayed by Pedro Bonatto de Castro. Shot with a Canon 5D Mk ii, 50mm lens, at 1/200s, f11, ISO 100. Printed on 40x60" semi-matte paper.

This piece refers to the first step in the hero's journey, the *Ordinary World*. It depicts Landell de Moura, a Brazilian Catholic priest, scientist and inventor. He may have been the first to publicly demonstrate a radio broadcast of the human voice in 1900, though his contributions were largely neglected by the Brazilian government and press. Moura was considered a renegade and heretic priest by the local population, but he believed that the Church was not an enemy of science and fought to further the view of a compatibility between science and faith. This image is a multiple exposure photograph were I portray all the characters in the frame. On the right one sees a group of priests in red robes in an accusatory stance. On the left one sees another group of priest with the same garments but seemingly indifferent to the situation. The character wearing blue is going towards the viewer and away from the scene. He holds a blue book, which will be seen again in the last photograph. On the back one sees a last character, the only one showing his face, looking at the character walking away. His expression represents a dynamic tension between science and religion, skepticism and faith. Having a self-portrait as the first photograph in the exhibit aims at conveying the personal and subjective nature of the work. It also serves as a self-criticism of my role as a science popularizer and the issues raised in this research.

'*Hypatia of Alexandria*', 2011.

Figure 41

Portrayed by Anjelica Scannura. Bodypaint art by Natasha Kudashkina. Shot with a Canon 5D Mk ii, 100mm lens, at 1/250s, f8, ISO 100. Printed on 40x60" semi-matte paper.

This piece refers to the second step in the hero's journey, the *Call to Adventure*, the first step out into the '*Special World*'. It depicts Greek astronomer, philosopher and poet Hypatia of Alexandria, who was the last director of the Alexandria Library, the hub of knowledge of the ancient world. The bodypaint art refers to her design of the flat astrolabe, a navigation device based on the positions of stars which was consistently used for centuries after her death. Hypatia was also a teacher and popularizer, believing that all people would benefit from education and free-thought. For her views, she was accused of witchcraft and godlessness and killed by a mob of early Christians. This image re-imagines Hypatia as the Greek goddess of astronomy and dance, in a reference to her inspiration to authors and artists in the Renaissance and the Age of Enlightenment. Here I play with the idea of her physical beauty as a metaphor to the beauty of her ideas, where knowledge symbolically poured through her skin. This is represented by the cryptic writings on her arms, in reference to Library of Alexandria's written scrolls. If the sirens of ancient myth would take sailors to the bottom of the ocean, I saw Hypatia as a siren of science, leading ships to safety.

'*Alfred Russel Wallace*', 2011.

Figure 42

Portrayed by Simon Rose. Styling by Della Chiu. Shot with a Canon 5D Mk ii, 85mm lens, at 1/250s, f8, ISO 100. Printed on 40x60" semi-matte paper.

This piece refers to the third step in the hero's journey, the *Refusal of the Call*. It is my representation of British explorer and biologist Alfred Russel Wallace, who independently proposed a theory of evolution by natural selection. Wallace had his insight during a delirious fever after 10 years exploring the biology of Brazil and Sumatra. He wrote a 20-page paper describing his theory of evolution and sent it to Charles Darwin himself, who had been developing a similar and more comprehensive version for decades. The collage work on the background and the pages on the model's hand in the image were made using Darwin's *On the origin of species* in a play with the authorship of the idea of evolution. In fact, Darwin was prompted to publish his work when he did due to Wallace's independent discovery. For a time it was called the "Darwin-Wallace Theory of Evolution". Here I represent Wallace as the ultimate explorer, where the strength of his body serves as a metaphor to the resilience of his quest, which would revolutionize biology and contemporary Western thought.

'*Carl Sagan*', 2012.

Figure 43

Portrayed by Ian Huggins. Shot with a Hasselblad H4D-31, 120mm lens, at 1/500s, f11, ISO 100. Printed on 40x60" semi-matte paper.

This piece refers to the fourth step in the hero's journey, the *Meeting with a Mentor*. It features a representation of Carl Sagan, an American astronomer who developed pioneering work in a number of fields, including planetary sciences, scientific search for extraterrestrial intelligence, and science popularization. He is re-imagined here as an Egyptian scribe, one who sought a connection between the skies and the people in the Earth. In the image, the model is holding a papyrus reproduction of a plate put on the Pioneer spacecraft, designed by Sagan and Frank Drake as the first physical attempt to send a message to possible alien civilizations. In his popular *Cosmos* television series and book, Sagan describes his inspiration by Hypatia of Alexandria, represented here by my photograph depicting the character on the desk in front of him. Sagan inspired a generation of scientists, engineers and artists to the wonders and importance of science. His *Cosmos* series is being re-created by African-American astronomer Neil deGrasse-Tyson, who was his student and is consider his successor as a leading science popularizer.

'*Henrietta Leavitt*', 2012.

Figure 44

Portrayed by Tatiana K. Shot with a Hasselblad H4D-31, 80mm lens, at 1/250s, f16, ISO 100. Printed on 40x60" semi-matte paper.

This piece refers to the fifth step in the hero's journey, named *Cross the Threshold*. It depicts American astronomer Henrietta Leavitt, whose contribution provided a method for measuring the distances to faraway galaxies. Leavitt worked at the Harvard College Observatory in the early 20th century as a human "computer" in a group of women named "Pickering's harem". Women were not allowed to directly operate the telescope, so she had a task of examining and cataloging photographic plates containing information about positions and brightness of stars. Her work led Edwin Hubble to discover the expansion of the Universe, a revolutionizing idea at the heart of contemporary cosmology. The intricate tribal bellydance costume refers to her detailed work with the "dance of the spheres", a metaphor to the astronomical sciences, and the "harem" concept, where the orb represents her astronomical insights and the vintage telescope symbolically puts the astronomer's tools on the character's hands. To his credit, Hubble argued for a shared Nobel Prize with Leavitt in light of his use of her method of determining astronomical distances.

'*Maria Prophetissa*', 2012.

Figure 45

Portrayed by Laura Atma. Shot with a Canon 5D Mk ii, 50mm lens, at 1/200s, f11, ISO 100. Printed on 40x60" semi-matte paper.

This piece refers to the sixth step in the hero's journey, known as *Tests, Allies, and Enemies*. It depicts the first historical alchemist in the Western world, Maria Prophetissa. Although very little is known about Prophetissa, the invention of several chemical apparatus for sublimation and distillation used to this day are attributed to her. She is portrayed here wearing a steampunk inspired costume, in reference to this genre of science fiction which re-imagines history by displacing historical figures and discoveries in time and space. She is the author of the "Axiom of Maria", which states: "one becomes two, two becomes three, and out of the third comes the one as the fourth". This idea was used by psychologist Carl Jung as a metaphor for the process of wholeness and individuation.

'*Émilie du Châtelet*', 2012.

Figure 46

Portrayed by Red Herring. Shot with a Canon 5D Mk ii, 85mm lens, at 1/200s, f8, ISO 100. Printed on 40x60" semi-matte paper.

This piece refers to the seventh step in the hero's journey, the *Approach the In-most Cave*. It depicts Émilie du Châtelet, a French mathematician, physicist, and author during the Age of Enlightenment. Her translation on and commentary of Isaac Newton's *Principia Mathematica* is still considered the standard French translation. Voltaire, one of her lovers, declared in a letter to his friend King Frederick II of Prussia that du Châtelet was "a great man whose only fault was being a woman". She was prolific in many areas, having works in finance, biblical scholarship, philosophical discourses on happiness and support for women's education. The red Burlesque dance attire represents a shift in the journey, getting away from the dark theme of the previous photographs. The sword in her hand is a replica of the mythic Excalibur, in reference to the legend of King Arthur. The idea behind this play with a traditionally feminine costume and male weapon is to convey the fight for women's recognition in the world of science.

'*Percival Lowell*', 2012.

Figure 47

Portrayed by David Clarkson. Shot with a Hasselblad H4D-31, 80mm lens, at 1/500s, f11, ISO 100. Printed on 40x60" semi-matte paper.

This piece refers to the eighth step in the hero's journey, the *Ordeal*. It portrays Percival Lowell, an American businessman, author, mathematician and astronomer who was fascinated with the possibility of life on Mars. The thought he saw evidence of canals on the red planet, and his drawings mapping these imagined structures fueled speculations that would influence the development of science fiction - starting with H.G. Wells' *The War of the Worlds*. Lowell is portrayed here by artist David Clarkson, who uses Nasa imagery to inspire his paintings of Mars landscape. Two of his paintings are included in the image. The one on the back resembles a window conveying the idea that he might be on Mars soil. The red color of the last piece takes over on this one, emulating the idea of window light on Mars. The goal was to convey the contrast of Lowell's scientific observations leading him to "imaginary" findings (i.e. a civilization on Mars) with Clarkson's artistic renderings inspired by actual scientific data (i.e. Nasa's actual images of the planet). The clothing, cigarette and stance make reference to portraits of painter Jackson Pollock.

'*Ada Lovelace*', 2012.

Figure 48

Portrayed by K. B. Shot with a Hasselblad H4D-31, 80mm lens, at 1/250s, f11, ISO 100. Printed on 40x60" semi-matte paper.

This piece refers to the ninth step in the hero's journey, the *Reward*. It depicts English mathematician and writer Ada Lovelace, who is considered the world's first computer programmer. The loom refers to her work on an earlier mechanical general-purpose computer known as the analytical engine which includes what is recognized as the first algorithm intended to be processed by a machine. The journey back to the 'Ordinary World' is represented by the introduction of white in the lighting setup and background. The black of her garments make reference to the adventure in the dark themed photographs in earlier stages and to the work of her father, poet Lord Byron, one of the main Romantic writers. The contemporary fabrics of her outfit refer to the fact that certain materials used today are only possible by digital technology, evoking a metaphorical circle from the loom, to her pioneering work in computers to todays advancement in garment technology. This also refers to her foresight in the 19th century of the capability of computers to go beyond mere calculating or number-crunching.

'*Rosalind Franklin*', 2012.

Figure 49

Portrayed by Anjelica Scannura. Shot with a Canon 5D Mk ii, 105mm lens, at 1/250s, f8, ISO 100. Printed on 40x60" semi-matte paper.

This piece refers to the tenth step in the hero's journey, *The Road Back*. It features my re-imagining of Rosalind Franklin, a British biophysicist and X-ray crystallographer who made critical contributions to the understanding of the molecular structures of DNA, RNA, viruses, coal and graphite. In fact, her work helped revolutionize our understanding of the very fabric of life, encoded in the genetic molecule structures in every living creature. This step in the journey is sometimes referred as '*The Magic Flight*', where the hero still has a few trials before getting to the end of the adventure. This tension is represented by her trying to get away from the fabrics trapping her. The fabrics are also a metaphor to the DNA double-helix, the fabric of life. Her face is covered in reference to the fact that her contributions were only recognized years after her death. Franklin was portrayed by Anjelica Scannura, the same model featured in the '*Hypatia of Alexandria*' piece, referring to the recurring themes of authorship and recognition present in all characters portrayed and one of the central issues discussed in this work.

'*Marie Curie*', 2012.

Figure 50

Portrayed by Veronika Radolovich. Shot with a Hasselblad H4D-31, 80mm lens, at 1/500s, f11, ISO 100. Printed on 40x60" semi-matte paper.

This piece refers to the eleventh step in the hero's journey, the *Resurrection*. It depicts French-Polish physicist and chemist Marie Curie, who developed pioneering research on radioactivity. She was the first woman to win a Nobel Prize and the only woman to date to win in two fields. She discovered two elements, polonium and radium and was a pioneer in medical diagnosis using radiology. The see-through fabric and the electric cello make reference to x-rays and radioactive materials. This step in the journey is also known as '*The Master of Two Worlds*', being the final step before going back to the '*Ordinary World*'. This is represented by the color scheme in the photograph, combining the black cello as a representation of the beginning, the red fabric as a representation of the middle and the white background as a representation of the end, consolidating the three moods in the 'Special World'.

'*Jeremiah Horrocks*', 2012.

Figure 51

Portrayed by Adam Smith. Shot with a Canon 5D Mk ii, 50mm lens, at 1/200s, f8, ISO 400. Printed on 40x60" semi-matte paper.

This piece refers to the twelfth and final step in the hero's journey, the *Return With the Elixir*. It features my representation of British astronomer Jeremiah Horrocks, who was the only person to predict the transit of Venus of 1639. The observation of this astronomical event helped measure the size and scale of the Solar System and it inspired a generation of astronomers in the following century to develop the first large scale international scientific collaboration in order to get ever more precise measurements of the size of the known universe then. Horrocks is wearing a steampunk themed outfit in reference to the genre discussed earlier in the piece '*Maria Prophetissa*'. It is set on location, like the first photograph, in reference to the idea of being back to the '*Ordinary World*'. The image features a number of symbolic artifacts. In his hand one sees the same vintage telescope from the '*Henrietta Leavitt*' piece, as well as the orb on the desk. The blue book on the first photograph is also in the frame, in reference to the tension between faith and science. He has three photographs reminding the journey, each with a distinct color mood. He is looking out into the Sun light coming through the window, in a reference to the idea that the journey continues.