Introduction

Science plays an important role in contemporary culture. That is, both the results and the methods of scientific inquiry, as well as its applications, are not only influenced by the culture in which it is produced, but they also have an outsized influence on that culture. Some scientists become important cultural figures—for example, Charles Darwin, Sigmund Freud, Albert Einstein, Carl Sagan, Stephen Hawking, Richard Dawkins, Stephen Pinker, and Neil deGrasse Tyson, just to name a few. Scientific results and the ideas of scientists are accorded a special authority by most people, most of the time. Technology, today inextricably linked with scientific knowledge, in some ways plays an even more central role. Some of us with a more romantic bent may bemoan the situation, but it remains an undeniable fact of contemporary society.

Playing such an important role in culture, it is no surprise that science informs and makes important connections with other cultural products: art, literature, film, television, and, of course, comics. Scientists become key characters in narratives, and scientific research or its results become major plot points. In more subtle ways, scientific knowledge about a variety of subjects—biology, psychology, astronomy, engineering—becomes part of the context of background beliefs informing the creators of art, literature, and other media. And while science and technology have not always had the cultural authority or omnipresence that they have today, the interaction and interplay of science and culture are long-standing historical phenomena.

The humanities largely shies away from scientific topics. This is an example of the so-called “two cultures” split identified by C.P. Snow (1959). Whatever the general problems with the split of the sciences and the humanities, lack of

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1Even those who doubt specific claims, e.g., about the safety and efficacy of vaccines, or about the reality of anthropogenic climate change, typically have a lot of trust in the authority of science on other issues.
familiarity or comfort with the sciences limits the kinds of interpretation that humanities scholars can make of the relevant texts and artifacts. Insofar as the sciences inform the construction, content, or reception of the relevant texts, aspects of the text will be hidden from the science averse. An exception to this science-aversion are the areas of the humanities that themselves take science as their subject matter, including the history, philosophy, and cultural studies of science, or broadly the humanistic side of the interdisciplinary field of Science and Technology Studies (STS). Other exceptions are on the rise (for example, in the area of digital humanities).

In order to read and interpret texts and artifacts in the serious way that goes beyond a superficial reading (e.g., of plot, style, characterization) and characterizes research in the humanities, one must adopt a critical approach, a theory or a methodology of interpretation. The aim of this book is to provide a survey of such critical approaches for the interdisciplinary field of comics studies. Scientific humanities is such a critical approach for interpretations that are only possible across the two cultures divide. This chapter will lay out the scientific humanities approach and apply it to golden age *Wonder Woman* comics.

**Underlying Assumptions**

The first underlying assumption of scientific humanities, already canvassed above, is that science provides an important framework for interpreting many narratives, not only didactic popular presentations of science, but a variety of fictional and nonfictional narratives. This assumption works in various ways and is justified by various aspects of different sorts of texts and artifacts. First, science is part of the background of the production of certain texts. In some cases, stories are written by scientists who themselves have a scientific agenda in mind; this is of course true of didactic works, but not only those—the sample analysis in this chapter is of this kind of work. Second, scientists, scientific techniques, or scientific research can be part of the narrative’s content. Also, science can be part of a narrative’s content, or can help us draw further meaning out of a text. Even when science or scientists are not explicitly part of the narrative’s content, science may still provide a valuable interpretive framework, as they provide important information about topics that might be central to that narrative, such as the environment, consciousness, economics, or society. Even when the author does not explicitly reference science, understanding the nature of these phenomena and the background beliefs about these phenomena that the science of the time the text was written can help unpack the meaning of the text.

It is important to recognize that either popular or expert understandings of science are relevant, and indeed, these understandings are always in dialogue where science forms part of the interpretive context for a cultural text. Creators might be scientists or have scientific training, or they may do copious research about science in the process of creating the work. In such cases, it is important
to draw on expert scientific knowledge. On the other hand, creators might have no expert understanding of science, and may rely on general education, background cultural beliefs about science, and previous representations of science in popular culture. Likewise, whenever or insofar as we think about audience reception of such texts, we need to know about the popular understanding that is relevant. Work in public understanding of science or science communication becomes relevant here.

Another core assumption is that science itself is a sociocultural process and product. Science is not a set of timeless, apersonal truths. It is the product of socially, historically, and culturally situated human beings working individually and in groups. It relies not on pure rationality but on particular sociocultural practices of inquiry, on metaphors and heuristics, and on human values. It involves competition and “political” struggles between individuals and groups.\(^2\) It not only contributes to the larger society and culture, but it draws on and is influenced by them. This does not mean that we do not take science seriously. To say that science is a sociocultural process and product is not to deny that it produces knowledge or discovers truth. It is simply to deny that it does so through inhuman rationality, completely separate from its time, place, and culture.

The popular understanding of science and scientists, and their representation in art, literature, film, and pop culture, are thus doubly sociocultural products. First, it is itself a reflection of the sociocultural products of science. Second, it is read through a variety of sociocultural lenses, interests, fashions, etc. This pushes us to interrogate social, historical, cultural, and evaluative factors at two levels—of the broader culture, and of the scientists themselves or scientific process itself.

**Appropriate Artifacts**

Appropriate artifacts for scientific humanities in the field of comics studies include comics texts that involve representations of scientists or the scientific process, have content that relates to areas of scientific knowledge, or are authored by scientists or known science enthusiasts. This includes didactic/educational works about science, such as the work of Jay Hosler (Clan Apis, Evolution: The Story of Life on Earth) and Jim Ottoviani (Two-Fisted Science, Feynman, Bone Sharps, Cowboys, and Thunder Lizards). It also includes texts where scientists are the protagonist, antagonist, or significant side characters (consider characters such as Dr. Manhattan, Hugo Strange, and Reed Richards), or where scientific research forms an important part of the story (as it does in Frankenstein or Hickman’s The Manhattan Projects). Lastly, comics might themselves be authored by scientists (such as Wonder Woman’s creator William Moulton Marston) or known science enthusiasts (like H.G. Wells).

\(^2\)Typically, this is not “politics” as in liberals and conservatives, but as in “office politics.” Sometimes, though, political context informs scientific controversies.
Some, but by no means all, relevant texts will be in the science fiction genre, but not all texts in the science fiction genre will be appropriate for this approach. On the one hand, nonfiction, realistic fiction, memoir, and most any genre can fit in one or more of the categories above. On the other hand, there is much “science fiction” literature which portrays future worlds using different, futuristic technologies as tools, but where science or engineering, scientists, technologists play no role in the narrative; where the futuristic elements serve purely ethical, political, or entertainment purposes; and where setting those narratives or elements against a background of science or engineering would not reveal anything new.

**Procedure**

Scientific humanities as a critical approach draws on work in and the tools of the interdisciplinary field of science studies (including history, philosophy, and the social and cultural studies of science, as well as science communication) to read texts against a scientific background. The approach is inherently contextual: placing some aspect of the text against a relevant scientific background to see what new details and connections are thrown into relief. How the text itself is approached, and what counts as “relevant” information from science, science studies, or the public understanding of science will depend in large part on the particular text. One might focus on broad themes from the text or instead engage in close reading. Typically, this approach will be more revealing about thematic and narrative elements of a comics text rather than its visual elements per se (beyond how they contribute to the former). On the other hand, one might draw on the history of science, or contemporary science and its social or philosophical analysis, or, in cases where the creator is a scientist, biographical sources about the creator as a working scientist may be necessary.

One way this might go involves drawing on the history of science from when the text was produced. For example, Jessica Murphy provides a reading of Spenser’s *The Faerie Queene* in the context of early modern medical thought at the time it was written. Her reading concerns a particular passage from Book III where the character of the princess Britomart is described as a “sicke virgin” and the nurse Glauce attempts to cure her (Murphy 2010). Murphy argues against the interpretation of Britomart as “lovesick,” as lovesickness was a recognized malady with symptoms quite different from Britomart’s. Murphy shows that a recognized disease of the time known as “greensickness” better fits Britomart’s case, comparing Spenser’s poem to both historical medical sources and contemporary histories of early modern medicine. Because Murphy approaches the medical discussion of greensickness (a “disease of virgins”) from a feminist or critical gender and sexuality studies lens, she is able to provide a more nuanced reading of issues of gender in the interpretation of *The Faerie Queene* than are contemporary readers who are unaware of the relevant scientific-medical context.

In another kind of case, one might draw on contemporary science and its
philosophical analysis in critically analyzing texts. For example, Pamela Gossin, in discussing the ecological and environmentalist themes in the manga and animation of Hayao Miyazaki, brings in the mutual dialogue between ecology and environmental science, environmental history, and environmental philosophy (Gossin 2015). This allows Gossin to understand not only the environmental influences on Miyazaki, such as Clive Ponting’s *A Green History of the World*, but also to uncover a complex *ecosophy* being worked out in Miyazaki’s comics and films.3

One *seemingly* relevant question, but one that turns out not to have much significance, is the question of how *accurate* the science in a text is. (This could be understood historically, relative to the science at the time the text was written, or relative to the current state of scientific knowledge.) One can of course ask whether the radioactive spider bite in Spider-Man’s origin story is scientifically accurate, or whether it reflected the understanding of biology and radiation current in 1962. Perhaps, in a more sophisticated way, we could ask of the laboratory tinkering of a Doctor Will Magnus or a Victor Von Doom accurately represent how scientific research is done. But these questions are not the kind of questions that a scientific humanities approach should lead us to ask; pursued for their own sake, they are pedantic and superficial.

What sort of questions should we ask when we’re reading a comics text (or any other text) within a scientific context? Recall that cultural representations of science are a doubly sociocultural product; the science itself is the product of time, place, and culture, and the choice to represent it in a popular, artistic, or literary medium is likewise a sociocultural act with specific aims and values. There are thus many questions that are apropos of a scientific humanities reading, such as: Assuming a base level of scientific literacy of the time, what implicit details of the narrative can we uncover? What does the representation of science or scientists in the text tell us about what the author understands or believes about science, what they hope for or fear about science, or more generally, how they value science? What does it tell us about the audience’s understanding of or beliefs about science? How does science inform the creator’s goals? To answer some of these questions, along the way, we may have to make judgments of similarity or fit between information about science and the comics text itself. But these are instrumental to answering more significant questions, not the goal of the critical approach.

**Artifact Selected for Analysis**

This chapter will look at the early *Wonder Woman* comics authored by the experimental psychologist William Moulton Marston, and influenced by his partners Elizabeth Holloway and Olive Byrne, themselves psychologists in their own right. It turns out this is a particularly appropriate choice for using a

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3 In earlier work, Gossin (2007) practiced a scientific humanities approach in reading Thomas Hardy’s novels in light of astronomy and scientific cosmology.
scientific humanities approach. Marston once described Wonder Woman as “psychological propaganda.” It follows that we should understand the content of Marston’s psychological ideas, in order to understand the comics he produced to advocate for those ideas. I will thus read the Wonder Woman comics in light of an analysis of his psychological theories and experiments. Doing so leads to a quite significant reinterpretation of the dialogue, narratives, and imagery of the early Wonder Woman comics. This is an example of the interpretive possibilities revealed by the critical approach of scientific humanities. In particular, I will focus on Wonder Woman volume 1, #3 (February 1943), #4 (May 1943) and #5 (July 1943), written by William Moulton Marston, drawn by H.G. Peter. From #4, I will focus on one story, sometimes labeled “The Rubber Barons”; from #5, “Battle for Womanhood”; and from #3, “The Secret of Baroness Von Gunther.”

In order to provide the appropriate scientific context, one must also bring in sources to set that context. In general this could involve primary sources from the scientific literature or archives, works from the history, philosophy, sociology, or cultural studies of science, biographical sources, or science communication research about the public understanding of science. For my analysis, I have drawn on Marston’s psychological writings, particularly The Emotions of Normal People (1928), as well as secondary biographical sources on Marston himself, such as the work of Bunn (1997), Daniels (2000), and Lepore (2014).

Sample Analysis

In the panel from Wonder Woman #4 (Figure 1), we see two minor characters, Elva Dove and Ivar Torgson, engaged in a rather bizarre scene. Prior to this scene, Elva was caught by Diana Prince (Wonder Woman’s alter ego, working as a secretary to Steve Trevor) stealing secret documents related to rubber production. She works for the crooked rubber producer, Torgson, who she is also in love with, though he treats her badly. Wonder Woman saves Elva from Torgson’s wrath and recruits her to help reform Torgson. She shows Elva “an X-ray photograph of Torgson’s subconscious,” where he appears as a wealthy king and Elva his chained slave. Wonder Woman proposes to “cure” Ivar by making him think of Elva as his queen rather than his slave, dresses Elva to fit the part, in a costume rendered by the artist H.G. Peter as a green fur-lined two-piece with a kind of crown. Elva controls Ivar with the help of Wonder Woman’s Magic Lasso, which in its original form does not compel the person it binds merely to tell the truth, but compels them to submit to the wishes of the person that binds them. Wonder Woman promises that Ivar will love submission, that Elva will soon be able to control him without the lasso, and that after three days of this role-reversal, Ivar should be reformed of his evil ways.

We see in this panel that Peter has rendered Ivar as a square-jawed, hyper-masculine brute. It is no surprise that he resists “feminine control.” But Elva

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4In the original, the separate stories, of which there were usually 4-5 an issue, were untitled. These titles can be found in the Wonder Woman Archives or Wonder Woman Chronicles collections (vol 2 and 3) or Wonder Woman: The Golden Age Omnibus, vol. 1.
replies, as she has learned from Wonder Woman, that “Learning to submit is the final test of manhood.” And shortly after this, Ivar finds indeed that he enjoys the feeling of submission and no longer has any desire to resist. Elva’s lack of commitment ends up spoiling the experiment, and further hijinks ensue before Wonder Woman saves the day and reforms Torgson.

What is going on in this strange story? It brings together a number of common themes from the early Wonder Woman comics: women suffering or led to evil by the domination of a cruel husband or boyfriend, prevalence of bondage imagery, and a focus on reforming criminals rather than punishing them. But is the way these themes are tied together in this bizarre story merely a reflection of the kinky mind of its creators? I will argue that it is something more.

As mentioned above, Marston once described Wonder Woman as “psychological propaganda for the new type of woman who should, I believe, rule the world” (from a letter to early comics historian Colton Waugh, quoted in Walowit (1974, 42)). Marston was an experimental psychologist, as well as a lawyer, with his bachelor’s, PhD, and law degree from Harvard. He was trained by the noted psychologist Hugo Münsterberg, the student of Wilhelm Wundt who William James had brought to Harvard to take over the psychology laboratory. His specialities were in the psychology of emotions, deception, relationships, personality types, and the nature of consciousness; he also dabbled in clinical psychology. He published a variety of journal articles on these topics, as well as
two academic books—*The Emotions of Normal People* (1928), in some ways his culminating work of psychology, and *Integrative Psychology* (1931), a general textbook co-authored with his wife Elizabeth Holloway Marston and C. Daly King. Many of the strange elements of Marston’s *Wonder Woman* comics are reflected in some way in his psychological writings.

In the opening chapter of *The Emotions of Normal People*, Marston makes a striking claim: “I submit that the backbone of literature has been transplanted intact into psychology, where it has proved pitifully inadequate” (1928, 3–4). This quote captures his central idea that psychology needed to radically break from our commonsense psychological concepts, such as the emotional language of romantic poetry and literature. His approach not only clears the ground for setting a genuine scientific basis of psychology (based in neuroscience, evolutionary biology, and psychological experiments and observations), but it also serves an ethical-political purpose, eliminating potential status quo biases from a quite value-laden subject matter, human emotions and psycho-emotional health (Brown 2016).

According to Marston, emotions are constituted by the integration of signals in the motor pathways of the brain and nervous system. In particular, they are integrations of signals that derive from the self and from a stimulus. When self and stimulus are aligned, the emotion feels pleasant; when they are antagonistic, unpleasant. “Normal emotions” (as opposed to abnormal, i.e., unhealthy) tend toward promoting the pleasant and reducing or making transitory unpleasant emotions arising from antagonistic stimuli. The basic emotions, Marston argued on evolutionary grounds, must be normal emotions, as the promote the functioning of the organism. Emotions can also differ on whether the stimulus or the self signal is stronger. It is on the poles of these two distinctions (allied vs antagonistic, stronger self or stimulus) that Marston defined his “basic emotions”:

- **Dominance** (antagonistic, stronger self)
- **Compliance** (antagonistic, stronger stimulus)
- **Submission** (allied, stronger stimulus)
- **Inducement** (allied, stronger self)

More complex emotions (both normal and abnormal) were formed from either combinations or sequences of these basic emotions. The basic emotions also formed the basis of personality types and relationship styles. While there is

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5 Marston lived in a ménage à trois situation with his wife, Elizabeth Holloway Marston, and another woman, Olive Byrne, also known as Olive Richards. Elizabeth and Olive were trained psychologists in their own right, and they made significant contributions to the scientific work published under Marston’s name. It might be better, in fact, to refer to the authors of the scientific work as “Holloway, Byrne, and Marston,” but I will follow conventional attribution in the main text. Holloway and Byrne also inspired, but probably contributed less directly to, aspects of Wonder Woman. Two different interpretations of their relationship are provided by the historian Lepore (2014) and the filmmaker Angela Robinson in *Professor Marston and the Wonder Women*.

6 The personality types scheme survives today as the D.I.S.C. behavior assessment tool, where three of the four terms have been slightly renamed: Dominance, Influence, Steadiness, and Conscientiousness.
far too much going on here to discuss in detail in this analysis, there are several aspects of Marston’s theory of the emotions, his picture of psycho-emotional health, and the consequences he draws for society that are directly relevant to understanding the story of “The Rubber Barons” and other common themes from the *Wonder Woman* comics.

First, the nature of *submission* on Marston’s account has several surprising features. Recall the account of pleasant and unpleasant emotions in Marston’s theory: alliance-based emotions like submission are *pleasant*, and indeed, says Marston, “Under no possible conditions can true submission be unpleasant” (Marston 1928, 243). Many have looked at the terminology of “domination” and “submission” in Marston’s *Wonder Woman* and assumed commonsensical definitions of those terms which make them complementary (one person dominates, the other person submits) and in which submission can be understood as a kind of abnegation or even masochistic role. But on Marston’s account, the complement of dominance is *compliance* (one complies with a stronger dominator), while the complement of submission is *inducement* (one person induces another to submit).

One can only truly submit to a “loving authority” who has one’s own interests at heart, such as a wise teacher.

Inducement and submission form the basis of the group of “love” emotions. By contrast, dominance and compliance form the basis of the “appetite” emotions. For Marston, a healthy psyche is one where the love emotions predominate, and the appetite emotions serve or are “adapted” to the love emotions: “The normal relationship consists of complete adaptation of appetite to love. Any life which is both successful and happy must adapt its successes to its happiness” (Marston 1928, 381). This idea follows from what we have already said about normal emotions. Because appetite emotions contain conflict and unpleasantness, it follows that the well-adjusted person will use such emotions only when an antagonistic stimulus (whether an external threat or an internal stimulus, such as hunger) is present, and will tend to remove the antagonism. Someone who is persistently engaged in appetite emotions like dominance, competition, anger, or fear is thus in an abnormal or unhealthy mental state.

The primary complex love-emotions are passion (or passive love) and captivation (or active love). In the former, submission is primary, while in the latter, captivation is primary. In terms of loving interpersonal relations, one partner will be more of a captivator, while the other will be more passionate (passive, submissive). In a relationship, the partner who is stronger with captivation emotion is also called a “love leader.” Love is key to emotional health, and loving relationships are key to experiencing love, so every healthy person will be or will have a love leader. What’s more, a society, just like a person, must adapt appetite to love in order for the individuals within it to lead healthy lives. As such, our social and political leaders should also be love leaders rather than dominators.

Finally, Marston held a peculiar view that there are significant sex differences in one’s capacity for captivation emotion, and specifically that women were much
more capable of inducement and captivation than men, and thus that only women were suitable candidates for love leaders. He based his argument on putative behavioral data and surveys of women, as well as background physiological and hormonal information, such as it was. His view that only women could be love leaders, along with the view that healthy society required love leadership, led him to propose a social program of “Emotional Re-Education” in the concluding chapter of Emotions of Normal People. This program included both recognizable feminist goals (educational equity and self-sufficiency for women) and more radical claims (the inherent superiority of women, a call for a future matriarchal utopia).

Fifteen years later, the psychologist was now a comic book writer, crafting the narrative of “The Rubber Barons” and various other stories. On the background of Marston’s scientific views, many details of the story become clearer; in a sense, Wonder Woman has become a means of “emotional re-education.” Ivar Torgson represents the abnormal state of being driven by appetite, by competition, hunger for wealth, etc. Torgson rejects and mocks Elva’s professions of love early in the story. He leads a life of crime that ends up hurting him, those who love him, and his country. Wonder Woman wants Elva to help her reform Ivar by realigning his emotional life to be well-adjusted, that is, governed by love rather than appetite. She sets up Elva as a love leader for Torgson, and it seems that she would have succeeded if she were more committed and better trained.

The evils of male domination are a common theme in Wonder Woman comics. In “Battle for Womanhood,” Wonder Woman rescues Marva from her husband.
Doctor Psycho, who has put her in a trance and used her as a source for his supernatural powers. In the final panel of the story (Figure 2), Marva sits despondently in what appears to be a darkened room. She complains to Wonder, “Submitting to a cruel husband’s domination has ruined my life.” Here the terminology is a little sloppy, for Marva never truly submitted, as one cannot submit to domination; instead she was hypnotized, forced to marry Psycho against her will, and then entranced and exploited. Male domination always leads to bad ends in *Wonder Woman*, whether the dominator be a villain like Doctor Psycho or even the well-meaning Steve Trevor. When Marva asks Wonder Woman, “What can a weak girl do?”, Wonder Woman answers with elements of her program of emotional re-education, “Get strong! Earn your own living…” That is, don’t depend on dominant men for your safety or sustenance.

Bondage imagery is extremely prevalent in early *Wonder Woman* comics. Tim Hanley discovered that fully twenty-seven percent (27%) of panels from the first ten issues of *Wonder Woman* involved some form of bondage (Hanley 2014, 46). This prevalence has led to some significant criticism of Marston’s work. Bryan Dietrich describes Marston’s Wonder Woman as “the strangest set of Freudian images comics had ever endured” (2006).

Bradford Wright, in *Comic Book Nation*, his comprehensive history of the American comic book industry, says about Marston’s *Wonder Woman*:

> On the other hand, there was a lot in these stories to suggest that Wonder Woman was not so much a pitch to ambitious girls as an object for male sexual fantasies and fetishes. The stories were rife with suggestive sadomasochistic images like bondage, masters and slaves, and men groveling at the feet of women. (2001, 21)

These criticisms seem to me based in a very superficial engagement with Marston’s body of work, in part because the scientific context of the work is left out. I see the bondage imagery as largely involved in demonstrating a crucial distinction in Marston’s theory between (often unhealthy) compliance to a stronger dominator and the pleasure of submission to a love leader. We often see Wonder Woman and the other Amazons or the Holliday Girls tying each other up for fun, but we also see the unfortunate results of women allowing themselves to be bound by men or by evil women. Note in the panel below (Figure 3) that Wonder Woman thinks that “The bad thing for them is submitting to a master or an evil mistress.” There are no good masters for Marston, though there are good mistresses (love leaders). Teaching the distinction between true submission and problematic compliance is a preoccupation of the comics that becomes quite clear when read in the appropriate context.

A final caveat: Marston’s scientific work does not reflect our current scientific understanding of the emotions, mental health, sex and gender differences, or human relationships. It is in many ways a highly idiosyncratic episode in the

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7 The prevalence of Freudian interpretations of *Wonder Woman*, including Fredric Wertham’s attack, should be read in the context of the many anti-Freudian arguments in Marston’s own psychological writings. See Brown (2016, 11–15).
history of science, though it does have some contemporary resonances. But scientific humanities is not looking for scientific accuracy in the texts that analyzes. Rather, it is looking for interesting and revealing connections, and between Marston’s scientific and comics work, there are many such interesting connections.8

References


8 For more, see Rhodes (2000); Brown (2016)


