

The Role of Women in *Scientific American*: Science & Sexism 1845-1875

An Interactive Qualifying Project Report

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Abstract

This project focused on maintaining the database of Scientific American illustrations sponsored by the Antiquarian Society. Code was moved to a GitLab repository to ensure access for future teams. Furthermore, the role of women within the Scientific American was investigated to further understanding of social roles in the scientific community during the 19th century.

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Introduction

Scientific American was a weekly periodical started in 1846 by Rufus Porter. Quickly bought by Munn & Company it was the definitive magazine for scientists and inventors in the 1850s and 60s. Featuring many up-and-coming inventions, it included tips, tricks, and hints to help push budding inventors towards patenting and profiting off their work. Today, the pages are a view into the past. Here in Worcester, the Antiquarian Society has taken an interest in the illustrations from the pages of the paper. These images took skill to make, so being able to quickly access them would allow for better study of the artists, engraving techniques, and inventions from the 19th century. Starting in 2007, Worcester Polytechnic Institute students completed various IQPs to document the images throughout the paper and present them in a searchable format at sciam.wpi.edu.

The project was last maintained in the summer of 2019. Unfortunately, at some time during these two years the website broke. The purpose of this IQP was to get the website back up and running and formatted such that future groups have an easier time working with the code base. It took a while for this IQP to get access to the code and set everything back up. It should now be easier for future IQPs to get to the important work, like reconnecting the images to the database entries. Tutorials are included in the appendix, explaining various parts of the website, Django, and more.

Scientific American stood as a beacon of progress in the scientific and mechanical worlds, but what about the social one? Besides the technical website work, this IQP is interested in using

this paper as a view into the social world of the 19th century, particularly for women. Women in the 1800s did not have the right to vote, nor the right to own property until later in the century. The systematic and social oppression of women affect how they interact with the scientific world. Against these odds, women still had passion for science and contributed to invention in the ways they could. How did the periodical view and treat these women? Sexism was still rampant at the time, but the progressive scientific community differed in many ways from the general community. The social views held within the pages of the *Scientific American* can be used as a view into the complex role of gender in 19th century America. The rest of this report will investigate these views.

Research Method

Research for this paper heavily utilized the search function over volumes of the periodical uploaded to the Hathi Trust. Initial research was spent searching through later volumes (such as volumes 7 (1851), 22 (1869), 23 (1870), 28(1873), 29(1873)) for the term “woman” and names of female inventors from the period, as well as reading supplementary information such as Michael Borut’s 1977 thesis. As research continued, a more thorough method was utilized on earlier volumes. Volumes 4 (1848), 10 (1854), 1 new series (1859), and 29 new series (1873) where all thoroughly searched with the terms “female,” “woman,” “women,” “lady,” “Mrs,” “Miss,” “she,” and “her.” This process was lengthy as many of these terms found articles that were rather inconsequentially about women, or not about women at all. For example, “Miss”

frequently referred to “Mississippi” instead and “she”/ “her” more often referred to naval ships or countries rather than people. These terms, along with “Mrs.” were omitted from shallower searches for information preformed on volumes 3 (1847), 6 (1850), 8 (1852), 9(1853), 12(1856) 13 (1857), 14 (1859), 2-8 new series (1860-1863), and 13 new series (1865). Along with this, I had the privilege to go to the Antiquarian Society to read through volume 2 (1846) in person, which was by far the lengthiest way to do research but gave a good understanding of the early general culture of the early magazine before the comedy sections were removed. This search process is prone to error. I, likely, missed letters submitted by woman that were not preceded by “Mrs.” or “Miss,” and many volumes do not use all the search terms to save time. Later volumes were not as thoroughly searched through as early ones, so the portrayal of the periodical may not be as accurate for later years. Nonetheless, these volumes with this level of research should provide a fairly accurate general understanding of gender roles at the time.

Forward Thinking

During the beginning of the 19th century, women were economically and socially disadvantaged. Although single woman could own property, married women were indivisible from their husbands. All their property and economic control was handed over to the husband. Married women were invisible to the law, as “coverture” meant husband and wife were “one person” in the eyes of the government. Women could contribute economically to the family, but anything they produced would be legally controlled by the husband. Men could use their wife’s

property to pay off their debts without a consequence. This discouraged women from working outside their household, as anything they produced could legally be taken from them. The social roles of the time supported this. Mothers taught daughters how to maintain a house and be good role models. Since job and education opportunities for women were few or frowned upon, women's normal role and society was confined to the walls of her home. People at the time argued this is the way things should be, as granting women further independence could risk the destruction of the family unit, but, as industrialization grew and the untapped female labor market started to loathe their confines, the law started to change. At first, the laws were not from feminists; "The intent of [1830s-1840s] laws were to secure the property of a married woman from her husband's creditors in order to protect family assets during the economic downturn of the late 1830s" (Khan, B. Zorina). These early laws led to further expansion of women's economic rights. Through the second half of the 19th century, women were given rights to property, their earnings, and sole-trading on a state-by-state basis. The 1860s and 1870s saw the highest upturn for these laws, so, by the 80s women were generally able to participate in the economic market, with some exceptions. Low-income women would work in mills, while other women were able to publish novels and work almost wherever a man could. The social aspect of these changes took more time. Confining women to household meant many of social norms and stereotypes of women needed negotiation as women broke out of their normal roles.

This is where *Scientific American's* opinions come in. Although the general population still had some reservations about emerging women, the change seemed like common sense to editors. Just as *Scientific American* wanted more self-starting men, they wanted more working women. In their second volume in 1847, the editors lamented in a column titled "Idle Daughters"; "It is a most painful spectacle in families where the mother is the drudge, to see the

daughters elegantly dressed reclining a their easy... and never dreaming of their responsibilities... Such scenes are becoming too common in our Republic” (“Idle Daughters”). Although this column does not directly allude to pushing women into work or science, it shows the underlying motivations for those claims. *Scientific American* does not like wasted woman minds, even in their early volumes. In volume 4, the opening of a women’s tailoring shop was announced in the paper, followed by the opinionated exclamation; “This is right; why can they not enjoy both the benefits of labor and capital” (“Female Operatives”). To the editors, it is common sense to let women participate in the economic market. The economy can only grow with more workers, regardless of their gender. This position is constant throughout all the volumes.

As the years passed, clearer articles articulating this opinion were published. The first article to clearly articulate their sentiment was published in volume 12 in 1856 with the title “Scientific Ladies – Experiments with Condensed Gases.” The opening excerpt reads;

“Some have not only entertained, but expressed the mean idea, that women do not possess the strength of mind necessary for scientific investigation. Owing to the nature of woman’s duties, few of them have had the leisure or the opportunities to pursue science experimentally, but those of them who had the taste and opportunity to do so, have shown as much power and ability to investigate and observe correctly as men.” (“Scientific Ladies”)

The article goes on to mention two prominent female scientists of the time and some of their honors, as well as detailing an experiment done by Eunice Foot on the sun rays' effect on gas temperatures. The study was in-depth and well done, providing helpful insights for the scientific

community. The article concludes by reinforcing the purpose of their thorough case study; “the experiments of Mrs. Foot afford abundant evidence of the ability of woman to investigate any subject with originality and precision” (“Scientific Ladies”). This definitively clarifies *Scientific American*’s stance on scientific women as favorable. Before this article, that sentiment could be inferred by the various case studies on industrious women and the occasional opinionated sentence, but this article states outright that women are fit for science. This was an uncontroversial statement for the progressive scientific community but was still up for debate for society at large. This article frames their opposition’s view as preposterous by acknowledging the lack of opportunity for women and highlighting the merits of women who did have the opportunity. Not only is it common sense for women to join the labor market, but they fortunate women were already showing the merits capable of their gender.

In a later article from 1861, the editors further posit that woman need better education opportunities; “Woman are not employed in many pursuits... because they really are not possessed of the requisite skill... If these means are furnished, and proper schools established where woman can acquire skill... a wider field of operations will be opened to her talents” (“Employment For Women”). This observation was quite astute for the time. Many believed women were simply unfit for non-traditional jobs. Connecting woman’s failures in different fields with a lack of opportunity is an observation many still struggle with today. *Scientific American* not only pointed this out, but also publicized women’s education opportunities, such as the opening of Vassar College (*Scientific American*, vol. 13), Queen’s College (“Female College”), and Wellesley College (“Wellesley College”). It is no secret to that *Scientific American* had female readers, so these announcements could easily nudge mechanically interested woman to education and employment in technical fields.

The true proportion of female readers is undeterminable, but they aren't hard to find in the paper if you are looking. Women at the time frequently anonymized their gender, but some did not, and *Scientific American* would take note with a "Mrs." before their names. For example, female readers would occasionally appear in the correspondence section asking science related questions ("Notes & Queries"), asking for advice on an invention ("Mrs. L of NY"), and submitting patents using the *Scientific American* as an intermediary ("To Correspondents"). Other times, women would submit full letters to be published by the periodical. In volume 2, Sarah Bagley wrote an article marveling at the scientific progress of the age, as well as the important social progress (Bagley, Sarah G), and in volume 8 of the new series, Julia Cook wrote two in-depth articles on the chemistry of limes and bread (Cook, Julia A). Furthermore, starting in 1873, *Scientific American* published a re-occurring column on astronomy written by prominent female astronomer Maria Mitchell. A later section of this paper will be dedicated to Miss Mitchell and her relationship to the paper, as she was the only known reoccurring female columnist and many other articles were published in the paper celebrating her achievements. These articles illustrate that women were participating in the community of *Scientific American* and were treated just like their male counterparts. The editors often would encourage women to participate more and were happy to publish and respond to these women.

Spotlighting poetry (Sigourney), advertising books (even feminist ones) ("Literary Notices"), and noting awards ("The Fair of The American Institute") completed by women, *Scientific American* would celebrate the achievements of working women when they could. They told stories of women fishermen ("Fishing Women"), heroes ("Honor to the Female Brave"), gamblers ("Female Stock Gamblers"), farmers ("A Female Farmer"), soldiers ("The Female Army of Switzerland"), mountain climbers ("An Adventurous Lady"), tailors ("Female

Operatives”), factory workers (“The Mechanical Employment of Women”), and aeronauts (“A Female Aeronaut”), but their favorite of all was the woman inventor. Women inventors were few and far between at this point in history as “only 77 patents were credited to women inventors from 1790 to 1860, even though 4,773 patents were issued to male patents in 1860 alone,” (Khan, B. Zorina) so the attention from the paper is vastly important. The first spotlight was in the second volume by Mrs. Frances Carter for an improvement on uterine supporters. It was a small and simple patent, given the same amount of space as the other inventions on the page. In my research, they also provided columns about Sarah Collier’s folding bedstead (“Folding Bedsted”), Laurence Bellinger’s self-lighting fire kindlers (“Self-Lightning Fire-Kindlers”), and Nancy Brashcar’s sugar making machine (“Sugar Making Machine”). Along with these smaller patent descriptions, the paper also elevated women contributions in lengthy articles. Mary Carpenter’s self-setting sewing need got a full center column in volume 23 detailing the complexities of the sewing machine attachment, as well as where to contact to purchase one. The invention obviously impressed the paper; “it is the invention of a woman and displays a great deal of ingenuity and inventive capacity. The neatness of the device, and its freedom from complications will at once impress practical minds.” (“The Carpenter Self-Threading...”). Mrs. Carpenter went on to file a total of 17 patents in her lifetime, profiting off a good number of them. *Scientific American*’s publicity most likely helped her brand. The paper was obviously thrilled to include these excerpts, often lamenting that “[ladies] do not exercise their ingenuity as much as they ought” (“Rights of Minors”). Their attitude towards women inventors was always supportive and these spotlight articles early in the paper’s runtime showed a commitment to this attitude.

Overall, *Scientific American* valued the contributions of women in science. They acknowledged some of the societal forces pushing woman away from technology. They wanted to encourage woman to push past or break down some of these barriers. Nonetheless, they were not perfect. Next, we will investigate how *Scientific American* reinforced many of the same old societal barriers.

Stuck In the Context of The Time

An important thing to note about *Scientific American* was their aversion to politics. Rufus Porter, the original founder, made it clear early on he would avoid politics as much as possible because he believed it was just another distraction from the pursuits of a self-made man. To Porter, politics were frivolous fruitless discussions, a hobby, like fashion or decorating. The following owners kept this anti-politics philosophy for slightly different reasons; “to the eminently practical Munn, it was the ideal way to avoiding the controversial or politically sensitive issues of the day, specifically any mention of the South’s ‘peculiar institution’” (Borut, Michael 15). Even when the civil war broke out, *Scientific American* chose not to take any sides, saying “what possible good we would do by expressing our views upon agitating and perplexing question that now harass the public mind?” (“Our Succession Troubles”). In my opinion, a small denouncement of slavery would have been warranted and helpful at the time, but the paper was not willing to risk losing southern audiences. This avoidance of opinion also often extended to the issue at hand, women’s rights. Although their comments in favor of working women were much appreciated, the editors rarely took a strong stance. This means any examination of social

topics within the paper will be inherently blunted. *Scientific American* was an inventor's paper first and political paper last. Their progressive pushes would rarely push further than the norm as any progressive suggestions could risk a dip in sales. Luckily, as illustrated above, they did take a stand in favor of working women, but, sadly, their view on these women was still routed in social views of the time.

Social views were clearest in the early editions of the paper due to comedy column. In later editions, this column was phased out to focus on the science and invention, but the second volume edition included many telling quips, including this poem;

“When Eve brought woe to all mankind
 Then Adam called her wo-man
 But when she woo'd with love to kind
 He then pronounced her woo-man
 But now with folly and with pride
 Their husband's pockets trimming,
 The ladies are so full of whims
 That people call them whim-men” (“Female Appellation”)

This poem is an excellent display of wordplay and sexism. *Scientific American* may have been progressive for the time but the poem through today's perspective paints a different picture. This poem paints women as frivolous thinkers and avid shoppers for a quick joke. The comedy section was filled with little remarks relying on well-known stereotypes from the time, although they were not as egregious as they could have been. This was a scientific paper after all. Most of the following evidence will be from these early comedy and opinion sections but still reflect the attitudes of later parts of the paper as well. *Scientific American* did not denounce any of their previous comedy columns as social movements were not focused on challenging stereotypical speech from the time. Nineteenth century feminists had to focus on tangible changes to women's lives (owning property, voting, etc.), and social attitudes would change later.

Although *Scientific American* deeply valued working women, they did not believe women were fit for all jobs. Women were still viewed as weaker and more delicate than men. In 1870, a lengthy article titled “Female Inventive Talent” was published. At its core, it is just like articles mentioned in the previous positive section of this paper as it advocates for women as inventors, but, first, lays out where women do not belong; “One shrinks in disgust at the idea of female soldiers and coal heavers... We do not like to think of women in connection with dirt and the sweat of physical toil... Men also shrink from seeing women in positions and occupations which... call for the exercise of courage, intrepidity, the faculty of combativeness, or the exercise of keen satire, as at the bar or in the forum” (“Female Inventive Talent”). To the editors of this article, women should still be relegated to a gentle lifestyle. Physical labor, fighting, and crude humor should be saved for the men. The reasoning for this exclusion was a masculine attractive ideal; “Gentleness, both in disposition and manner, is a thing indispensable to a refined masculine taste. Any occupation which is likely to decrease this feminine quality, will be repugnant to men in general” (“Female Inventive Talent”). The article goes on posit that women can work as inventors as that career does not damage the cultivation of attractive qualities in women and it further celebrates woman inventors who worked with their patenting office. Even though the encouragement for scientific woman was progressive, *Scientific American* was still grappling with remaining social differences between the sexes. The attractiveness of women to men was still a huge factor for social roles. Marriage was an expectation for women. Only about 8 percent of women born between 1845 and 1849 stayed unmarried throughout their life (Khan, B. Zorina 162). Women’s roles were often reduced to that of the wife or the mother, both roles that rely on the opinion of men. Throughout the rest of the periodical, gentleness, delicacy, and

attractiveness in woman are clearly important, regardless of scientific achievement. The editors try to stay as objective as possible, but these opinions on “proper” women glimmer through.

The paper had many opinions on the most important qualities in women. In one article, they claim that “one of the most important female qualities is sweetness of temper. Heaven did not give to women insinuation and persuasion in order to be surly; it did not make them weak to be impervious; it did not give them a sweet voice to be employed in scolding” (*Scientific American*, vol 3). In another section they claim; “The gem of all others which enriches the coronet of woman’s character, is unaffected piety. Nature may lavish much on her person; the enchantment of her countenance, the grace of her mind, the strength of her intellect, yet her loveliness is uncrowned till piety throws around the whole the sweetness and power of its charms” (“Female Piety”). Many of the descriptions of women echoed these themes; sweet temper and piety. The general expectations for women were always pointed towards being polite, modest, and good role models. These ideals may have been expected by men as well, but not to the extent they were for women. *Scientific American* reinforced these expectations in their writings. A woman could be scientific, but not harsh or bold. It may have been common sense that women should work, but they still should behave just like a good mother, wife, and role model outside their household. These social standards for women were another barrier preventing them from joining the ranks of men. When the *Scientific American* reinforced these ideas, they may have discouraged some aspirational women, as they might not feel well versed enough in politeness to represent their gender.

Attractiveness to men was not only limited to character, but also to the physical beauty standards. In 1849, Elizabeth Blackwell became the first woman in American to receive a medical degree. Shortly after graduating, she decided to travel to Europe to continue her studies

in accepting hospitals. *Scientific American* gladly reported on this, hoping to defend her from critics by adding these descriptions of her; “Some of them are certain that Miss Blackwell is a socialist of the most furious class... Others who have seen her say that there is nothing very alarming in her manners; that on the contrary, she appears modest and unassuming and talks reasonably on other subjects. She is young and rather good looking; her manner indicates great energy of character; and seems to have entered on her singular career from motives of duty” (“An American Doctress in France”). To discredit her opposition, the editors call upon her humbleness, and admirable motivations, as well as her youth and attractive looks. Miss Blackwell’s appearance was deemed important to her role as a doctor. *Scientific American*’s support of the doctress was most likely much appreciated, as her search for a hospital in Europe was one with much sexist rejection, but still employed persuasion based on physical merits that would be deemed unimportant today. Her “rather good looks” did not affect her work as a doctor but did affect her perception by her peers. Women were judged based on the standards of wives, even if those standards did not affect their work.

The magazine included other articles which discussed womanly appearances without any connection to science at all. They held the opinion that “a woman should always look as soft to the touch as a flower, and as pure. All her garments should be made of the finest and softest material possible” (“The Female Dress”). This plays into the previously mentioned “delicacy” idea. The standard for beauty expected woman to be soft and modest. Small waists were also highly valued at the time, with many woman using corsets to artificially shrink their waists, but the editors were not fans of this practice. The paper praises Italian woman for their fuller bodies and laments that “our ladies should persist in that ridiculous notion that a small wait is, and per necessita, must be beautiful. Why, many an Italian lady would cry with vexation, if she

possessed such a waist as some of our ladies acquire only by a long and most painful process” (Headly, J. T). The practice of waist shrinking taxed the body too much to justify the looks. This sort of thinking extended to their judgement of the Chinese practice of foot binding (“The Feet of Chinese Women”). The paper was also interested in beauty standards of other countries, writing a lengthy article about various body modifications (“Facts for the Curious”). For a scientific paper that was explicitly uninterested in fashion, the paper discussed the standards for the female form more often than expected. These discussions were honest reflections of their view of womanly beauty. *Scientific American* was never grossly sexual and never completely reduced woman to just their looks but couldn’t help but write about it as it was important during the time. These articles were written with a general respect for women, while still reinforcing their role as attractive future wives. The paper did not mention male beauty standards was much as female ones, as this was the norm.

Interestingly, even when discussing physical beauty standards, the paper found ways to highlight their adoration of working women. An article submitted to the paper titled “The Women of California” discussed the beauty of western women, as well as their work ethic. *Scientific American* add their own remarks at the end; “we hope that when California comes into the possession of the United States, that the dignity given to labor by the matrons of the west, will not give place to the insipid prejudice with which labor is looked upon by too many of our republican dames” (“The Women of California”). Most of the article focused on the physical appearance of Californian women, by the papers own remarks focused to the real highlight for them; good work ethic.

Conclusion

Human beings are all products of their time. Today, we can discuss difficult topics like sexism and racism with accepting minds and hearts. We are more aware of implicit biases and work as a society to combat them. It is rare, immoral, and illegal for anyone to concretely lose opportunities due to their race or gender. This was not always the case. We can critique humans from the nineteenth century for their deep dives into prejudice, but we must give them credit for laying the stones for our future today. *Scientific American* at times reinforced the oppressive social structures by not challenging their views on women, but other times broke the mold by encouraging them to step into the world of science and mechanics. Their “commonsense” view on working women made exclusion seem silly, even if they still believed on some selective exclusion. The editors took one step forwards in support of woman. Today, we can critique where they failed to see our progress, but we still owe it to them and other members of the scientific community for the uplifting of women into financial freedom.

Spotlight on Maria Mitchell

Born in Nantucket, MA on August 1st, 1818, Maria Mitchell was undoubtedly the most important female figure for the *Scientific American* of the 1800s. Although they certainly highlighted many industrious women, they gave much more attention to Maria Mitchell, and not without reason. On December 9th, 1848, the *Scientific American* reported in an untitled announcement Mitchell’s breakthrough achievement; “the King of Denmark has directed the

Comet Medal... to be awarded to Miss Maria Mitchell of Nantucket, for her discovery of the telescopic comet of 1st of October 1847” (*Scientific American*, vol 4). Telescopic comets are comets that cannot be seen with the naked eye, so spotting one in the 1840s with a small telescope was a major achievement, let alone charting the orbit as she did. The *Scientific American* obviously thought this short announcement was not enough, as they dedicated a paragraph to Miss Mitchell in their retrospective for 1848 (“A Retrospective Glance”) and published a full article on March 31st, 1849 (“Eminent Female Astronomer”) further detailing her achievement.

This achievement made Maria Mitchell famous. Before this, she worked as a humble librarian (and occasional lecturer) at the Nantucket Atheneum by day and a vigilant astronomer at night. Shortly after, she became the first woman elected to the American Academy of Arts and Sciences and one of the first women in the American Philosophical Society and the American Association for the Advancement of Science (Britannica, The Editors of Encyclopedia). The fame brought Mitchell into many scientific circles, and even some anti-slavery and suffrage movements. In 1856, she left the Atheneum to travel in Europe and America to meet with many other famed scientists and dedicated herself further to the astronomical arts. While she was being dazzled by European minds, the “Women of America” gathered around \$3000 to purchase a new telescope as a testimonial to her character (“Testimonial to Miss Maria Mitchell”), which was delivered to her when she returned in 1858. The telescope was obviously very impressive for the time, as it warranted a lengthy article in the *Scientific American* detailing the precision and noting its containing observatory was modest, constructed to “merely shelter the instrument” (“Miss Mitchell’s Telescope”). She used it to continue her studies, authoring articles and reports for various journals and societies.

In 1862, Vassar Women's College offered her a job as one of the founding professors, along with residence in Vassar's first building; an observatory equipped with the 3rd best telescope in America at the time. The civil war slowed the opening of the school until September 1865. Maria Mitchell was an excellent teacher, encouraging her students to do hands-on astronomy work. In 1869, she took her students all the way to Iowa to see the total solar eclipse, where the students took accurate observations of the phenomenon that were published in the American Ephemeris and Nautical Almanac. Few colleges of the time, woman inclusive or not, went on fields trips of that capacity and were able to make papers of such high caliber, but Miss Mitchell encouraged greatness from her students.

Not only did she use her observatory for scientific teachings, but also for feminist ones. Since she was a professor for a woman's college, she felt it was her duty to discuss feminism when possible. Her observatory was a rather large room, so it was used for some social gatherings as well as scientific ones. "On May 10, 1875, Julia Ward Howe, Maria Mitchell's guest (and composer of the Civil War anthem "The Battle Hymn of the Republic") lectured in the observatory on 'Is Polite Society Polite?'" (Vassar Historian). Lectures like Howe's were not uncommon, and more informal gatherings, including poetry competitions, gave the women of the college a space to study hard and have fun. Miss Mitchell knew how lucky she was to have a supporting family that let her explore her love of science, so she used her power and luck to encourage other woman to join her. She gave an important speech during the nation's centennial year in 1876 entitled "The Need for Women in Science." (Michals, Debra) calling for more women in her field. Mitchell also was a leader in the formation of the American Association for the Advancement of Women (AAW) (Michals, Debra). Work with this group and others helped

push women further into the realm of equality. Miss Mitchell was a wonderful role model to her students, helping them understand science and the need for a more accepting society.

In 1873, she started a re-occurring column in the *Scientific American* titled “Astronomical Notes,” where she detailed the current state of the planets and other important astronomical findings, with the help of her students. Mitchell is likely the “only female contributor to the *Scientific American* on a series type basis.” (Borut, Micheal). This column often included discussion on sunspots, as Mitchell was exploring the hypothesis that the spots were cavities in the sun rather than clouds on the surface. These investigations were one of the first series of regular photographs of the sun. Along with these observations, measurements of the planet’s locations were published to encourage aspiring astronomist to look up the stars themselves. Many of the measurements were recorded by her students, further encouraging these women with hands on work. The column ran until 1880 with 1-4 submissions of the column in each volume.

Throughout her life, Maria Mitchell was a strong female figure who had profound effects on astronomy and the role of women in stem. She was rightly celebrated by periodicals like the *Scientific American* during her life. It is a shame that she isn’t more well known today, as she laid the groundwork for female scientists today just by dedicating herself to her love of the stars. The next time her comet comes around, science and the role of women will have advanced even further than today. The comet will fly by as a reminder of the progress made since Maria Mitchell’s time as well as the progress Mitchell made by herself.

Recommendations for Future Groups

There is still much work to be done on this project. Most importantly, the database needs to be reconnected to the images. The database is searchable, but the images are not visible directly on the page. This slows the research, as the indexed images cannot be viewed without extra work. The addition of the pictures right on the page would improve user experience massively. Sadly, this will most likely be a manual process. Links to the Haithi Trust may be helpful but will still need manually addition unless a better method is deduced. An automatic processor could be developed using the information currently in the database, but it is currently unclear exactly how the automation would run.

Furthermore, the website is currently running on Python 2.7 and Django 1.11. These are old versions that should be updated to ensure the best code quality. The newest versions are currently Python 3.10 and Django 4.0.2. Minor code changes are likely with the update, although this switch shouldn't be the hardest change. Any lost functions will have safer and better replacements in newer versions.

Other improvements have been suggested by previous IQP teams such as advanced filters and an API. I heavily recommend reading the recommendations by the two previous IQP groups to get their perspective on these changes. Overall, the website is in good shape, but could use a couple polishes in terms of UI. For example, the detail page from the search occasionally has boxes that seem out of alignment. Future groups should preform user studies to see what Scientific American researchers are using the tool for to ensure the best user navigation experience.

Appendix A: Setting Up SciAm Locally

Welcome to the Scientific American Illustrations IQP! To get started digging into the code you will need a few things:

- Python – The language the website is written in
 - Download Here: <https://www.python.org/downloads/>
 - Note: The version currently being used on the server’s python virtual environment is 2.7.17. This should eventually get updated to a newer version.
- Django – The python web framework used to build and run the website
 - Install on the command line with “pip install Django”
 - Extra tutorials for how to use Django can be found here:
<https://www.djangoproject.com>
 - Note: The version currently being used on the server’s python virtual environment is 1.11.16. This should eventually get updated to a newer version.
- djangoestframework – a python package that is vital to our Django website
 - Install on the command line with “pip install djangoestframework”
- sqlparse – a python package that supports the data base
 - Install on the command line with “pip install sqlparse”
- A Code Editor (Ex. VSCode, IntelliJ) – Somewhere to edit the website code
 - Download VSCode Here: <https://code.visualstudio.com/download>
- Git – A version control software to keep track of codebase changes
 - Download Here: <https://git-scm.com/downloads>

- Access to the GitLab Repository
 - Download the Global Protect VPN. To access WPI's gitlab servers, you must be on the WPI network by connecting to the vpn. IT has tutorials on The Hub (ex. <https://hub.wpi.edu/article/444/globalprotect-vpn-client-configuration>)
 - Email IT (its@wpi.edu) and ask to be added to the Sciam/sciam gitlab repository. John P. Eismeier and Ermal Toto helped in 2021-2022 and would most likely be able to help in future years.

There are also a couple **optional** things to install

- virtualenv – an expanded virtual environment tool to control modules. This allows the developer to run different python programs with different pip modules. If you set this up, you can mimic the virtual environment from the server to reproduce errors easier. This is *strongly recommended*, but not required.
 - Install using “pip install virtualenv”
 - Tutorial on how to setup here:
<https://www.youtube.com/watch?v=N5vscPTWKOk>
- WinSCP – previous IQPs used this FTP client to transfer files to the server. If the database needs to be reloaded, this client can be used to transfer the csv file. If is unnecessary unless you need to transfer files to the server.
 - Download it here: <https://winscp.net/eng/download.php>
- PuTTY – previous IQPs used this ssh client to connect to the server. This tutorial connects through the command line instead.

- If you want to use PuTTY and refer to older IQP tutorials, download it here:

<https://www.putty.org>

Once all this is installed, it is time to get into the code! To download the gitlab repository you first need to generate a ssh key. Run the following command in your command line:

```
ssh-keygen -t ecdsa -b 521 -C "descriptive comment ex. youremail@wpi.edu"
```

Copy the outputted public key. In GitLab, go to Preferences -> Ssh keys. Paste the key, give it a title, and save it. Now your machine will be valid for a gitlab clone.

The best way to start editing the code would be to download the repo directly through VSCode. Open VSCode and click the "Version Control" symbol on the left toolbar and then "Clone Repository." Use the SSH or HTTPS links to the gitlab repo to clone it. Once it is downloaded, it should be all set up and good to go! To run the server, open the VSCode command line with `ctrl+`` (or a command line in the location of the repository) and run the command `"python manage.py runserver."` These should launch the full website locally at 127.0.0.1!

The last thing to do is to set up the database locally. Included in the submission of this IQP is a backup zip of the repository in case the gitlab repository is lost. Included in this archive is `db_dump.csv` which contains the dump of the database information. Download this backup and move the dump to the SciAm repository. Run `"python manage.py import db_dump.csv"` to import the data. This same command can be used on the server in case the live database falls into disrepair. It will take a little while to load and will not show any progress until it is done. For

local testing purposes, the full import process does not need to be completed and can be cancelled after a minute or so. Once it is imported, the full local website should be ready for development! Run the server again and go to the “browse” page to ensure entries are visible.

Once code development begins, make sure to create a development branch off master. It is best practice to keep master as only tested working code that is running live. Test the code from the development branch on the live server before merging it into master.

Appendix B: Connecting to the SciAm Remote Server

Contact IT to get an account set up on the server. They will set you up with an environment and password. Ask the team to copy the virtual environment from opt to your user to ensure the virtual environment is the same. If you update the packages and python versions within your development user, make sure to get the environment updated on opt. Once you have an account, some useful commands are:

- Sign in: ssh username@sciam.wpi.edu
- Activate the virtual environment: source virtualSciam/bin/activate
 - o This will ensure the server is run using the current python version and packages. Currently, if you run the server without the virtual environment activate, the server will not launch as it defaults to a Python 3 version that is incompatible with the current code base.
- Move to the opt folder from home: cd ../../opt/
 - o This folder is where the live website is stored.
- Start and stop the service running sciam.wpi.edu: service sciam stop/start
 - o To pull in new code changes from git, the service must be stopped.
- Start a development run on sciam.wpi.edu:8000: python manage.py runserver 0:8000

- The permissions may need to be updated to allow this. If it doesn't work, contact IT.
- Switch branch on git: git checkout development

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