Scientific American Illustrations

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Abstract

Under sponsorship of the American Antiquarian Society, this ongoing project has established and maintained an internet database of illustrations in *Scientific American* between 1845 and 1870, an extraordinary resource of well over 6,550 inventions patented and displayed in these years. The previous IQP groups established a website to allow access to this database, and as the eighth group to have participated, this team scanned the database for errors, identifying the issues not included in searches on the website. This team also created a spreadsheet of the website's information, with particular attention to analyzing the types of inventions which can be found in the shared drive for this project

Authorship

Abstract	**Foley**
Authorship	**Foley**
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Introduction

Beginning in the 2007-2008 academic year and under the sponsorship of the American Antiquarian Society, this series of IQPs have been working on creation and improvement of a website for systematic search of illustrations in the early issues of *Scientific America* through an underlying online database. Almost from its start in 1845, the weekly issues of this magazine focused on presenting inventions patented though the aid of its owners, Munn and Company, but after 1870 the magazine began to include an increasing proportion of academic and scientific content. *Scientific America* contains illustrations of newly-patented inventions in the mid-nineteenth century, materials which can be of great interest to historians of American technology and invention as well as scholars of visual culture. Nevertheless, despite the presence of the electronic copies of the magazine on the internet that allow text searching, locating the illustrations from the magazine's thousands of pages will be a serious problem for any interested researcher. This project's database, available on the web, seeks to make these thousands of illustrations easily available through the public interface of our website.

The database is designed to cover all issues of the magazine prior to and including 1870. For each illustration, the website has a corresponding entry that provides brief introductions on the drawing and a link to electronic copy of the volume it belongs to, provided via the *Making of America* online collection. We are the eighth group to work on the project. By the time of start of this IQP, the main portion of website and database had already been completed.

Background and Previous IQP work

This project series was initially started in 2007, with six teams working over the following years. As defined in the first years, the goal was to establish an accessible archive of the thousands of illustrations in the weekly publications of *Scientific American*, allowing historians an easily accessible resource for research.

The first team worked entirely on the creation of the database and setting up the public front of the website for further expansion by later groups. The second team picked up where the first left off, where it was found that the website was inaccessible to any other than the student who had hosted it on their own private server. Transferring over the database and site to a MySQL server run on WPI resources was their next step, followed by some simplification of the headings for the data allowing for easier organization. In 2010, the third group began to optimize the user experience of the database, adding more visual aspects beyond a simple, nearly blank page with a basic search function, as well as increased security through allowing only authorized users to edit the data. The fourth group struggled with administrative privileges and accessing the database, which upon being resolved by contacting previous groups, led to their work consisting mostly of data indexing for various volumes of the publication.

The fifth group began work on indexing the new series of *Scientific American*, as well as implementing a more advanced search function for easier access to specific illustrations. Additionally, after a shift in links to a publicly available run of the magazine, many of the links on the site were broken, so this group began the process of relinking the database to the new site where the images were hosted. The sixth group again struggled with accessing the database, but followed up by cataloguing issues through 1869, which was all that the host site contained.

The seventh and final group prior to the current implemented an option to edit entries to the database after more struggles with access. This group also decided not to continue past 1869 for data collection. After 1869, *Scientific American* was spending less time on inventions and more on scientific discoveries and general science-related news, so no data is indexed for the year of 1870.

Results/Current IQP Work

As the eighth group to work on this project, we decided to identify and fix errors in the current version of website. We encountered difficulty in accessing the underlying MySQL database due to insufficient experience, and so we used the website as the basis of our work as opposed to the database itself. In the first week, access to the website was also unavailable for four days due to unknown reason. In the meantime, we studied the reports by past teams to get a good understanding of current condition of the website. Once the connection was restored, we started by browsing through the entries and search for potential errors.

The first problem we discovered was within the "Browse" functionality. A display error seemed to exist when a user tried to search for entries by year. Although each page was supposed to show twenty-five of the search results, starting from the second page, every page contained a

repetition of part of the content of its previous page, resulting in unusually long lists of results, while additional pages with identical content appeared after the page that ought to be the last page. We suspect this disorder is caused by errors in responsible code, but neither of us has a strong background of working with webpages and online databases. Nevertheless, we do not recognize it as a huge issue since it had not caused real problems to our browsing.

By scanning the entries, we also found a number of possible date errors and missing dates. Some dates did not seem to be correct, given that the magazine was issued weekly, while some dates that shall present seemed to be missing. Since the same error appeared when we browsed entries by subject instead of date, this problem probably lies in the online database. A list of possible date errors and missing dates was created and checked against the original issues of magazine on the *Making of America* database in order to distinguish between actually correct entries and erroneous or missing entries. Our findings are presented in the table below.

Volume	**Erroneous Dates**	**Missing Dates**
vol.1	Publication *Scientific American* began on 08/29/1845, but there are entries dated as early as January of 1845	03/05/1846, 06/11/1846

vol.3		02/15/1847 – 09/16/1847 (end of vol.3)
vol.5		the whole volume, from 09/22/1849 to 09/14/1850
vol.10		09/16/1854 (start of vol.10) – 01/06/1855, 02/03/1855 – 05/12/1855, 07/07/1855 – 09/08/1855 (end of vol.10)
vol.11		12/08/1855, 02/09/1856 – 04/12/1856, 06/21/1856, 08/16/1856 – 09/06/1856 (end of vol.11)
vol.12		09/13/1856 (start of this vol.12) – 10.04/1856, 12/20/1856 – 12/27/1856, 02/14/1857, 05/23/1857 – 07/25/1857, 08/15/1857 – 09/05/1857 (end of vol.12)
vol.13		09/12/1857 (start of vol.13) – 10/03/1857, 02/27/1858 – 05/15/1858, 07/24/1858 – 09/04/1858 (end of vol.13)
vol.14		The whole volume, from 09/11/1858 to 06/25.1859
ns.vol.1	11/21/1859	07/30/1869 – 08/06/1859, 12/10/1859 –

		12/24/1859 (end of ns.vol.1)
ns.vol.2		05/19/1860 – 06/23/1860 (end of ns.vol.2)
ns.vol.3	10/15/1861, 10/22/1861, 10/29/1961	09/15/1860 – 09/29/1861, 10/20/1861
ns.vol.4	05/28/1861	05/25/1861
ns.vol.8	01/01/1863	01/03/1863 (start of ns.vol.8)
ns.vol.13	01/20/1865, 02/17/1865, 03/03/1865	07/08/1865, 07/29/1865 – 08/12/1865, 08/26/1865
ns.vol.16	01/01/1867	

Figure 1: List of Missing Volumes and Issues

According to our findings, a significant number of issues are missing from the database. The missing dates show no apparent pattern, with both individual dates and series of successive dates missing across almost the entire timespan under coverage. Nevertheless, missing issues seem to concentrate in volumes 10-14, and two whole volumes are absent (vol.5 and vol.14). On the other hand, incorrect dates concentrate in entries for the new series, especially in NS.vol.3 and NS.vol.13. This may be due to teams responsible for cataloging illustrations in these volumes having experienced difficulties in finding the source or simply making errors when entering data into the database.

The data collected entails a couple of key characteristics. First, the names of each entry were recorded, followed by the date of publication and the specific category to which the inventions belonged. From this basic idea, an analysis of the various types of inventions which were illustrated is possible. In the construction of a spreadsheet of said data, it quickly became evident that a significant number of entries were simply repeated iterations, or additional figures of the illustrated invention. For the sake of examining the inventions themselves, the decision

was made to exclude the majority of these sequels and as many of the repeated entries as possible from the spreadsheet. Specifically, any entry which was labelled "Fig. [2]" or a higher number, most notably a sixty-part series on Hydraulics, or any entry which had the same details as one previously published would be left out so as to isolate novel inventions and improvements and their illustrations.

Of note in the database, the entries in the span of time from September 27th of 1846 to September 9th of 1854 are missing most of their data outside of illustration title and publication date, making them unsuitable for the analysis planned. To this end, these entries were catalogued, but left out of the graphical portion, and otherwise worked around.

The following is an excerpt from the spreadsheet compiled from the database, located in the shared drive associated with this project.

Statistical Analysis of SciAm articles 1845-1870

Article Name	Artist	Subject	Date pub.
	1845		
Peet's Gate		Hydraulics and Pneumatics	1-Jan
Riggs' Sorghum Evaporator		N/a	1-Jan
Wood, Carpenter, Measure, Ruler, Cut		Lumber	1-Jan
Cronk's Spring Bed		Furniture	1-Jan
Zweibel's Improved Universal Joint		Metallurgy	4-Apr
Signor Muzio Muzzi's Travelling Balloon		Land Conveyance	28-Aug
Pictoral History of the American Revolution		Misc.	28-Aug
Improved Rail-Road Cars		Land Conveyance	28-Aug
The Steam Ship Great Britain		Navigation	28-Aug
A Plan of the City of Jungo		Architecture	4-Sep
First Principles of Mechanics - Pendulum		Misc.	4-Sep
The Nautilus, or Improved Life Preserver		Navigation	4-Sep
The Self-Regulating Windmill		Mills	4-Sep
Improved Cars		Land Conveyance	11-Sep
First Principles of Mechanics - Miniature		Misc.	11-Sep
The Quadruple Invention		Steam and Gas Engines	11-Sep
First Principles of Mechanics - Equilibrium		Misc.	18-Sep
Segment Rule		Misc.	18-Sep

Springfield Depot		Land Conveyance	18-Sep
The Travelling Balloon	Charles	Navigation	18-Sep

Figure 2: Example of Spreadsheet Data and Format

Analysis

As a result of the aforementioned issues and volumes missing, the spreadsheet is incomplete, but a numerical analysis of the illustrated inventions and their intended purpose was completed with what data was available. Comparing the data charts crafted from the spreadsheets, there do not appear to be significant trends across the entire database. There are a few categories of inventions that tend to be more populated, but even Agriculture, the category with the most entries across the entire website does not have the highest number of entries in every year. In some years, said category is overshadowed by the more nebulous Miscellaneous which contains everything from shovels to ice cream makers, while in others, it is overshadowed by household furniture as well as weaponry.

Conspicuously, the year in which fire-arms and weaponry-based developments are most prominent is 1861, the first year of the American Civil War. This is the beginning of an uptick in the number of such developments featured in the magazine compared to earlier years, but it spikes in that year and proceeds to feature strongly until the end of the database. This is very clearly a result of said war and the tendency of war to fuel research into new developments.

The most popular of all invention types was Agriculture, with the most entries of the entire site, with Household Furniture, Mechanical Power, and Land Conveyance making strong showings, in addition to the catch-all category of Miscellaneous consistently featuring prominently. Additionally, as noticed by the previous IQP group during their analysis of the Agricultural illustrations detailed by *American Scientific*, there is not a category with a consistent

number of entries, nor with a continuous trend of climbing or decreasing numbers across the whole database. There are spikes and dips, but no noted specific trends to be expounded upon. Even comparing groups of years or on a year to year basis, there appears to be no overall tendency with the numbers. A graph of each category's datapoints would essentially display random noise, rather than a true correlation.

Recommendations for Future Teams

During the course of this IQP, we identified a number of problems within the website that need to be fixed. These issues, together with some of the suggestions by the seventh group, should hopefully be addressed by future teams.

First, a significant number of issues are absent in the website, along with date errors in a number of entries. Some of the entries also appear to have text errors, including spelling mistakes and incomplete sentences, and missing fields. Fixing all the errors in entries and adding missing entries will be a laborious task, but it is important to ensure that the entries provide correct and complete information to the users.

Second, as pointed out by the seventh team, the website is poorly protected from unauthorized login and hacker attacks. It seems that the password and username of authorized editors are directly printed to the URL of this website, which is stored in a global field as a means of checking the validity of user's identity. Fixing this problem requires extensive knowledge on html and python, but it will be a worthy attempt for confident teams.

Third, the links to electronic copies of *Scientific American* in the website entries are currently broken, as a result of a change in the image hosting party from Cornell University to Hathi Trust. Although this should not be a great problem as long as users are correctly informed

about the locations of illustrations, the linkages can be updated by modifying the code if a certain pattern behind new URLs can be figured out. Apart from Making of America, electronic copies of the magazine are also available on Internet Archive, JSTOR digital library, and the publisher's

website (the latter two require subscription), so there is a wide range of sources to choose from. Otherwise, updating all linkages by hand will be too big a task.

The display issue in the "Browse" functionality, as described before, can probably be fixed by debugging the code responsible for the search-by-year feature. Although this is not a big issue, it should not be too hard to fix with an adequate understanding of html and python, given the obvious pattern of disorder. Teams with programming knowledge can try to fix this problem for better browsing experience of users.

Lastly, the design of website can be changed to make it more appealing and easier to read. For instance, we recommend more vivid colors instead of the current combination of red and grey. The layout of web pages can also be modified to make them more user-friendly and less outdated, and the footer banner can be made to stay at a certain position on each page to make the pages look more consistent.

Conclusion

Over the course of our term working on this project, this group worked mainly on sweeping the database for errors and checking to make sure that everything was in working order, as neither of the group members were particularly proficient in coding and thus thought it prudent to not meddle where we could severely damage the functionality of the site. To this end, we set out to find as many hiccups, mistakes and areas that needed touching up as possible so that a later group who could more successfully fix such issues would have a simple list of items to work on and could get right to work, rather than waste time seeking. This was successful, as a list of errors such as the oddities in the displaying of search results, the mysterious week-long

crash that resolved itself, and the various missing issues has been included in this report.

In addition to setting out to set up troubleshooting, this group also set out to make an analysis of trends in the types of inventions illustrated in the *Scientific American* publication. This venture was slightly less successful than the troubleshooting, due to the missing data on the website and trouble connecting to the MySQL database. First and foremost, the database being incomplete led to an incomplete analysis, which combined with the fact that there were few significant trends in the data, led to an uneventful analysis. Perhaps if there was a complete set of available data for the missing eight and a quarter years, there could be more fruitful and meaningful conclusions drawn, but this is unlikely as the data appears to lack correlation with time based on the trends, or lack thereof, observed in the data surrounding the gap.

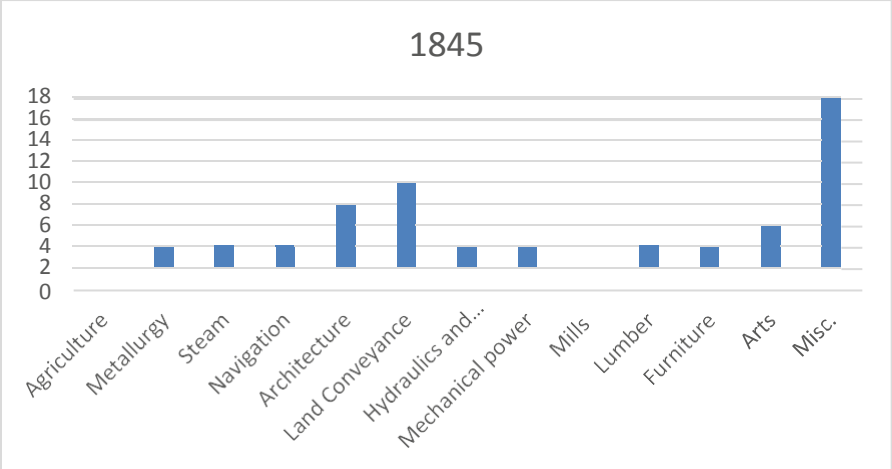
Throughout the database, very few entries have credited the artist of the relevant illustration. Notably, the names “Charles,” Ten Eyck, L. Seitz, and “Tuttle” recur through the years, with the occurrence of a labeled artist becoming more prominent as time goes on, with naught but one credited artwork to Charles in 1845, as opposed to eight credited artworks in January of 1869. The reason for this is unclear, but it is worth noting that when a signature is present, but unreadable, the entry is marked “Illegible,” so it follows that either no artist was detailed in the publication, that that piece of information was lost in the digitization, or perhaps

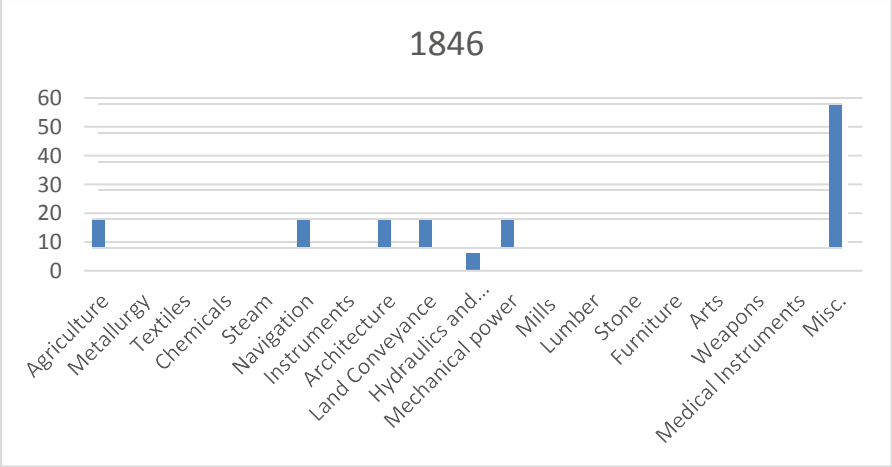
that the inventor did the illustration of the design himself.

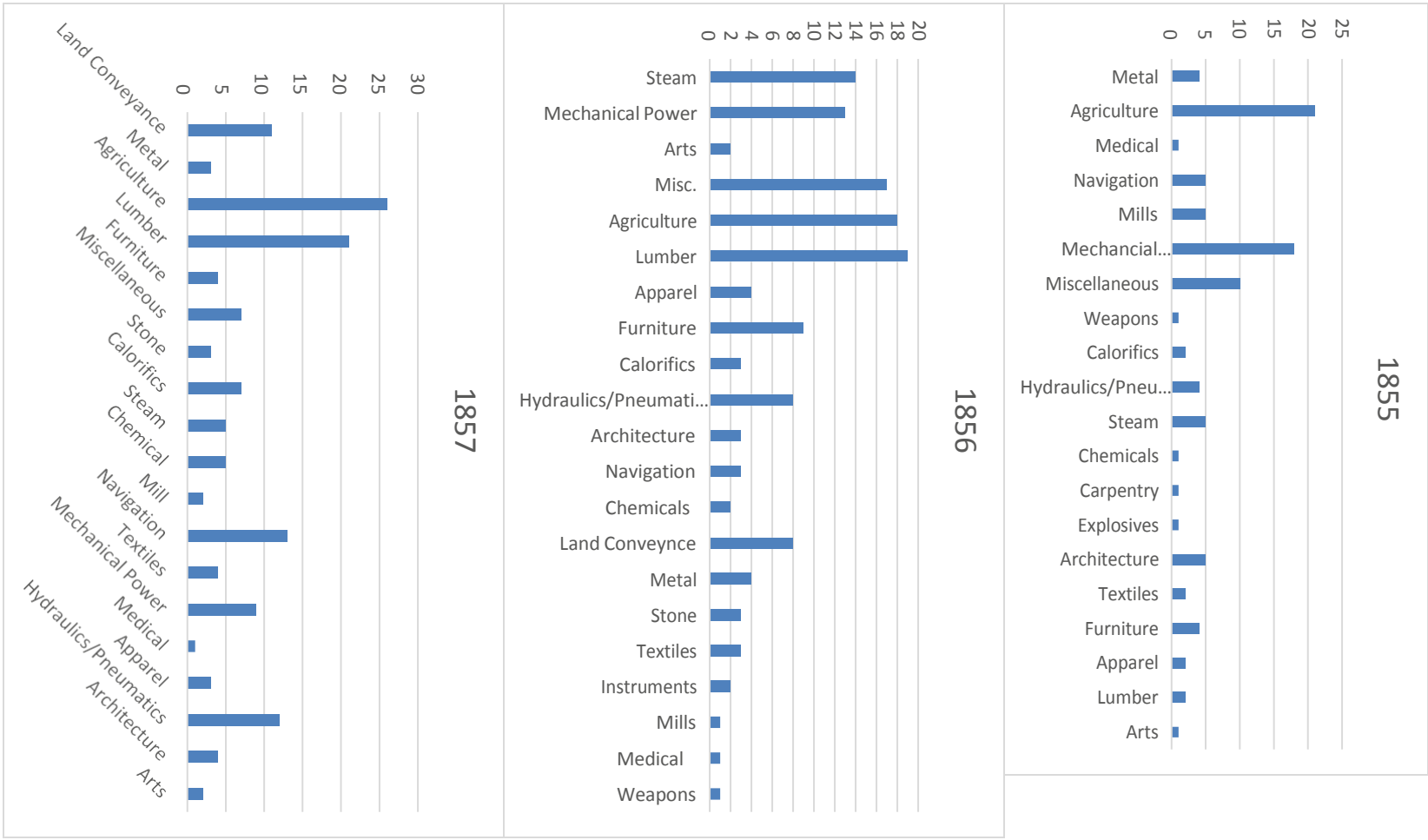
The spreadsheet developed by this group, however, will allow future groups to more easily perform analyses in more depth than our group was able to, as the full list of data already separated out will be available without having to figure out MySQL, an obstacle that has stymied many groups in the past, including ours. A more in-depth analysis of the exact trends for individual types of inventions would be far more accessible for later teams, since numerical data has been collected and aggregated as well.

In terms of advice to give to the next group, most certainly consult the list this group put together of ideas for the next group to work on, as well as working quickly to get MySQL figured out. Consulting previous IQP reports will provide insight into mistakes made in the past so that they can be avoided in the future, as well as contacting previous IQP group members for their input or for checking how some action was accomplished.

Appendix A: Analysis of Invention Types



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Metal
Agriculture
Medical
Navigation
Mills
Mechancial...
Miscellaneous
Weapons
Calorifics
Hydraulics/Pneu...
Steam
Chemicals
Carpentry
Explosives
Architecture
Textiles
Furniture
Apparel
Lumber
Arts
0
5
10
15
20
25
1856
Steam
Mechanical Power
Arts
Misc.
Agriculture
Lumber
Apparel
Furniture
Calorifics
Hydraulics/Pneumati...
Architecture
Navigation
Chemicals
Land Conveynce
Metal
Stone
Textiles
Instruments
Mills
Medical
Weapons
0
2
4
6
8
10
12
14
16
18
20
1857
Land Conveyance
Metal
Agriculture
Lumber
Furniture
Miscellaneous
Stone
Calorifics
Steam
Chemical
Mill
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Architecture
Arts
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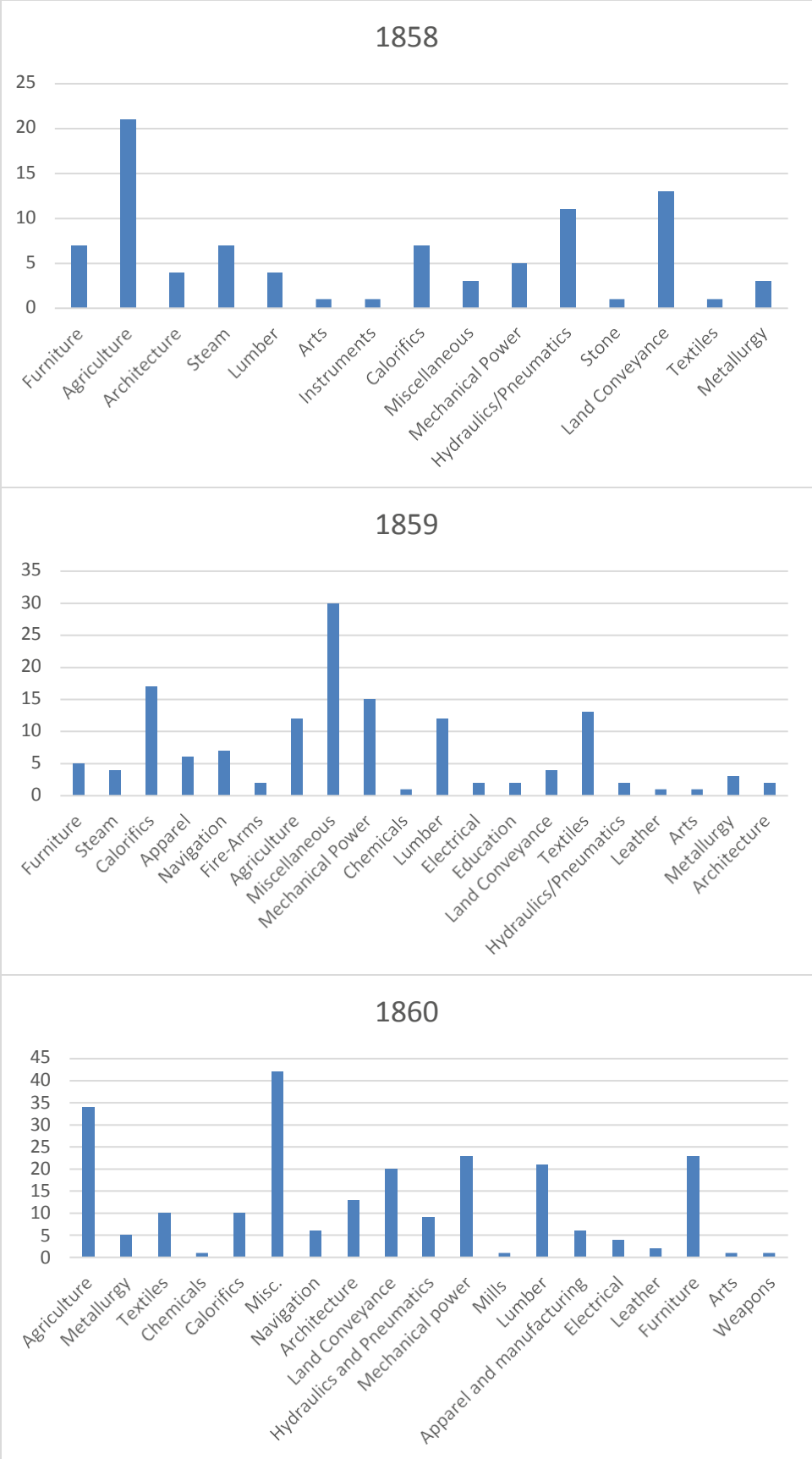
20
25
30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Furniture
Agriculture
Architecture
Steam
Lumber
Arts
Instruments
Calorifics
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Mechanical Power
Hydraulics/Pneumatics
Stone
Land Conveyance
Textiles
Metallurgy
1859
35
30
25
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15
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Furniture
Steam
Calorifics
Apparel
Navigation
Fire-Arms
Agriculture
Miscellaneous
Mechanical Power
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Electrical
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Land Conveyance
Textiles
Hydraulics/Pneumatics
Leather
Arts
Metallurgy
Architecture
1860
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35
30
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5
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Agriculture
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Textiles
Chemicals
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Misc.
Navigation
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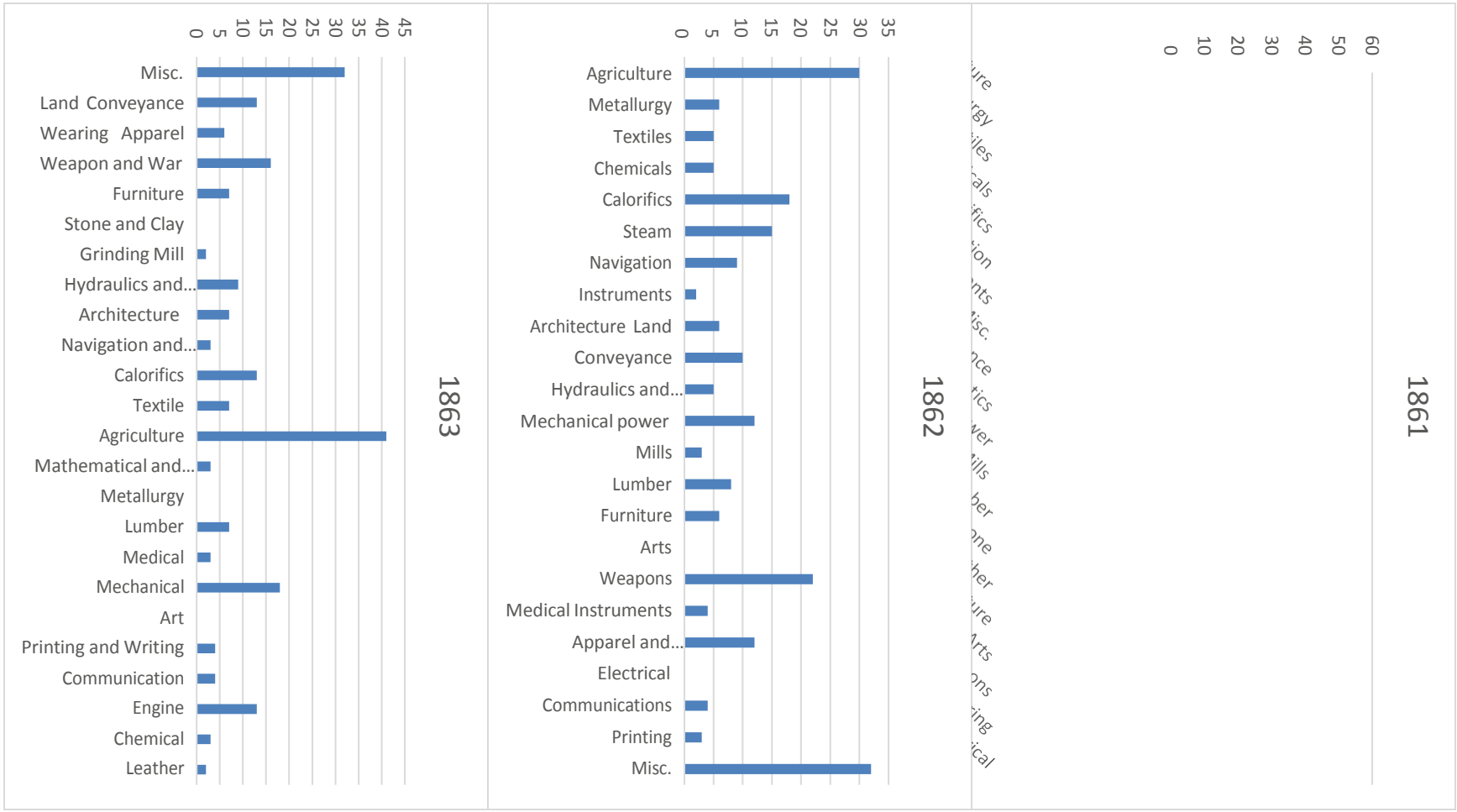
Leather
Furniture
Arts
Weapons


1863
Misc.
Land Conveyance
Wearing Apparel
Weapon and War
Furniture
Stone and Clay
Grinding Mill
Hydraulics and...
Architecture
Navigation and...
Calorifics
Textile
Agriculture
Mathematical and...
Metallurgy
Lumber
Medical
Mechanical
Art
Printing and Writing
Communication
Engine
Chemical
Leather
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1862
Agriculture
Metallurgy
Textiles
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Calorifics
Steam
Navigation
Instruments
Architecture Land
Conveyance
Hydraulics and...
Mechanical power
Mills
Lumber
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Printing
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1861
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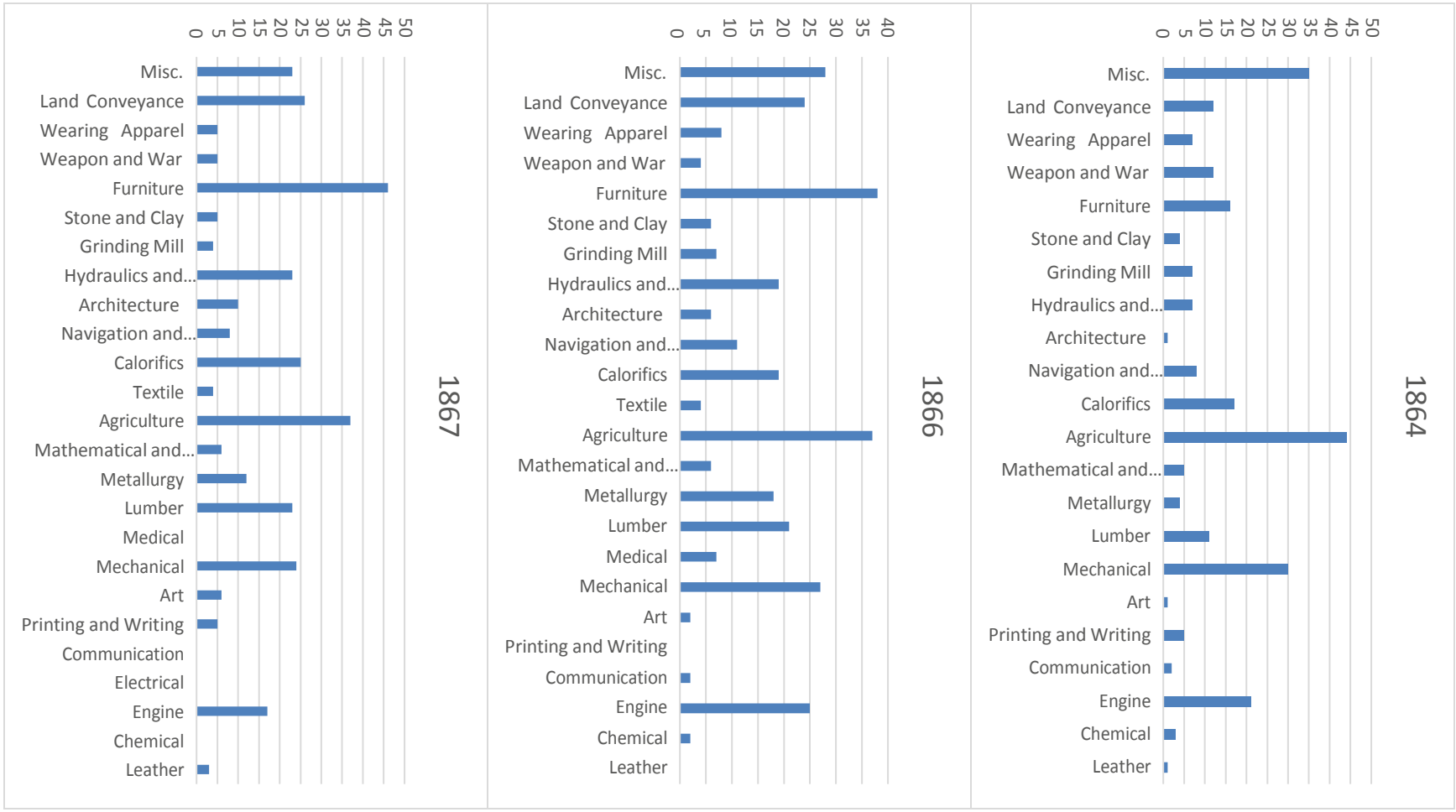
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Architecture
Navigation and...
Calorifics
Textile
Agriculture
Mathematical and...
Metallurgy
Lumber
Medical
Mechanical
Art
Printing and Writing
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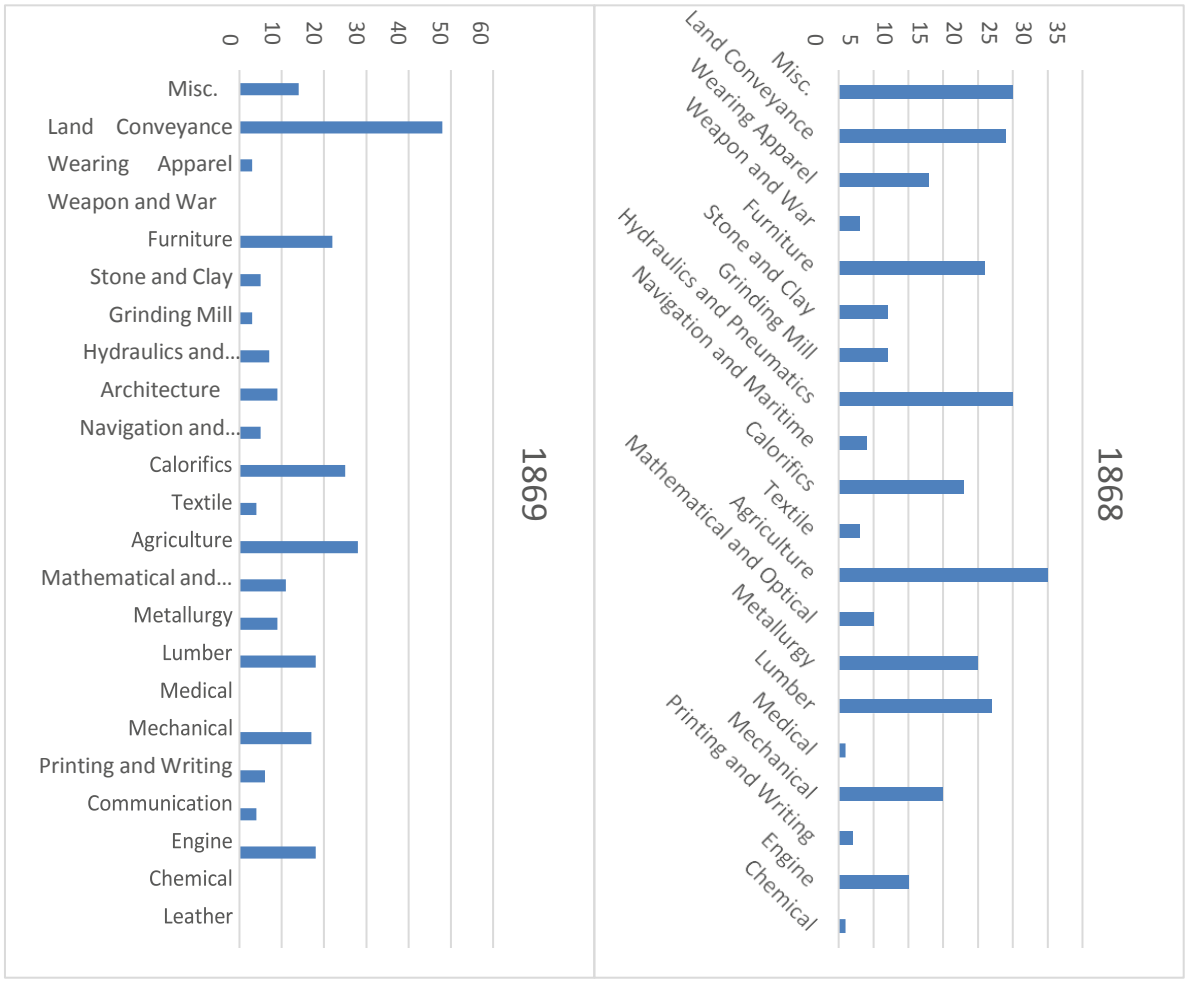

Figure 3: Charts of Invention Type by Year