# 60 Years of MoMA Exhibitions

## *W200 Spring 2018 | Project 2 Report*

*Joe Butcher, Anna Jacobson, and Mihir Sathe*

## 1 - INTRODUCTION

In the late 1920s, three progressive and influential patrons of the arts, Lillie P. Bliss, Mary Quinn Sullivan, and Abby Aldrich Rockefeller, were inspired to challenge the conservative policies of traditional museums by establishing an institution devoted exclusively to modern art, which they loosely defined as works created after 1880. In 1929, they, along with additional original trustees A. Conger Goodyear, Paul Sachs, Frank Crowninshield, and Josephine Boardman Crane, opened the Museum of Modern Art (MoMA) in New York City with its first exhibition *Cézanne, Gauguin, Seurat, Van Gogh*. MoMA's mission was to help people understand and enjoy the visual arts of the time and to establish MoMA as "the greatest museum of modern art in the world." The public's response was overwhelmingly positive.

Since its opening MoMA has presented more than 3,500 exhibitions of modern and contemporary art, architecture and design, photography, film, performance, and new media.[1]

*Fig. 1-1 - Opening day at MoMA's current location in Midtown Manhattan (1939).*

*Fig. 1-2 - MoMA's first exhibition, Cézanne, Gauguin, Seurat, Van Gogh (1929).*

The goals of our analyses are to explore MoMA's exhibiting artists' nationalities, ages, and genders, to look for trends between those demographics and MoMA's exhibitions, to provide political and economic context for the exhibitions, as well as to better understand the exhibitions themselves and how they have changed over time.

[1] The Museum of Modern Art history - https://www.moma.org/about/who-we-are/moma-history

# 2 - DATASET OVERVIEW

## A - Primary Data Source

MoMAExhibitions1929to1989

The MoMA exhibition dataset was compiled by a project team from the museum's archives. This research dataset lists the participants of 1,788 exhibitions, all of the known exhibitions held at the museum in the 60 years from its opening in 1929 through 1989. A total of 11,550 unique constituents are represented in this dataset, including all known curators and organizers, artists, and other participants for each exhibition. The total number of instances (rows) is 34,558.

The dataset includes the following data used in this analysis (see Fig. 2A-1).

| Field Name | Type | Description | Use |
|---|---|---|---|
| ExhibitionNumber | Number | A unique number that identifies exhibitions within the Museum's collection database. | To identify exhibition. |
| ExhibitionTitle | String | The formal full title of the exhibition. | To identify exhibition. |
| ExhibitionBeginDate | Date | The opening date of an exhibition when known. | To calculate run-time. |
| ExhibitionEndDate | Date | The closing date of an exhibition when known. | To calculate run-time. |
| ExhibitionRole | String | Role of each constituent in the exhibition. Includes Artist, Curator, Arranger, Designer, Preparer, Installer and Competition Judge. | To isolate information about artists only. |
| ConstituentID | Number | A unique number that identifies constituents within the Museum's collection database. | To identify artist. |
| ConstituentType | String | Type of constituent, usually Individual or Institution (organization) | To isolate individual artists. |
| DisplayName | String | The full proper reading format of a constituent name. | To identify artist. |
| Nationality | String | Accepted country of identification, often distinct from country of origin. | To analyze representation by nationality. |
| ConstituentBeginDate | Number | Birth year of an individual. | To determine age at time of exhibition. |
| ConstituentEndDate | Number | Death year of an individual. | To determine state at time of exhibition. |
| Gender | String | Gender identification of an individual. | To analyze gender split. |

*Fig. 2A-1 - MoMA Exhibitions dataset fields used in this analysis.*

## B - Additional Data Sources

Employment Status of the Civilian Noninstitutional Population, 16 Years and Older, by Gender, 1948–2015 - Table 2 provides the number of women in the workforce by year. Used in Section 4B.

| Field Name | Type | Description | Use |
|---|---|---|---|
| Year | Number | Year. | To match to year of exhibition. |
| Civilian_Pop_Total | Number | Total men and women employed in the civilian workforce. | To calculate percentage of women in the workforce. |
| Employed_Women | Number | Women employed in the civilian workforce. | To calculate percentage of women in the workforce. |

*Fig. 2B-1 - Employment Status of the Civilian Noninstitutional Population, 16 Years and Older, by Gender, 1948–2015 dataset fields used in this analysis.*

Balance of Power Between Congress and the Presidency - Provides the parties holding the White House, Senate, and House by year. Used in Section 4C.

| Field Name | Type | Description | Use |
|---|---|---|---|
| Year | Number | Year. | To match to year of exhibition. |
| President | String | The party of the President of the United States. | To identify political party in power. |
| Senate | String | The majority party in the United States Senate. | To identify political party in power. |
| House | String | The majority party in the United States House of Representatives. | To identify political party in power. |

*Fig. 2B-2 - Balance of Power Between Congress and the Presidency dataset fields used in this analysis.*

Dow Jones - 100 Year Historical Chart - Provides the Dow Jones Industrial Average percentage up or down by year. Used in Section 4C.

| Field Name | Type | Description | Use |
|---|---|---|---|
| Date | Date | Date of the last month of the year. | To match to year of exhibition. |
| DJClosingValue | Number | The closing value of the Dow Jones. | To quantify stock market performance. |

*Fig. 2B-3 - Dow Jones 100 Year Historical Chart dataset fields used in this analysis.*

U.S. GDP by Year – Provides the US GDP Growth Percentage by year.  Used in Section 4C.

| Field Name | Type | Description | Use |
|---|---|---|---|
| Year | Number | The year referenced. | To match to year of exhibition. |
| Nominal GDP (trillions) | Number | The Nominal GDP for a given year. | To quantify economic performance. |
| Real GDP (trillions) | String | The Real GDP for a given year, which takes inflation into account. | To quantify economic performance. |
| GDP Growth Rate | String | US GDP Growth Rate year over year. | To quantify economic performance. |

*Fig. 2B-4 - GDP Growth Rate dataset fields used in this analysis.*

# C - Data Cleansing & Validation

## I - MOMA DATA

1. The raw "MoMA" data includes a number of variables which are not required for our analyses, which we removed for clarity.

2. The raw "MoMA" data does not include the run time of the exhibition. We added a column for the data, which is calculated by subtracting the begin date (ExhibitionBeginDate) from the end date (ExhibitionEndDate).

3. The raw "MoMA" data does not include the years of the exhibition as a separate number. We added columns for the data, which is based on the last four digits of the opening date (ExhibitionBeginDate) and closing date (ExhibitionEndDate).

4. The raw "MoMA" data does not include the artists' age at the time of the exhibition. We added a column for this data, which is based on subtracting the artists' birth year (ConstituentBeginDate) from the year of the exhibition. If an artist's birth year is not included in the data, the artist's age is denoted as "Unknown".

5. The raw "MoMA" data does not include the artists' state at the time of the exhibition. We added a column for this data, which is based on comparing the artists' year of death (ConstituentEndDate) to the year of the exhibition. If an artist's year of death is not included in the data, the artist's state is denoted as "Unknown".

6. The raw "MoMA" data does not include the decade of the exhibition as a separate number. We added a column for the data, which is based on the second-to-last digit of the opening date (ExhibitionDecade).

7. The raw "MoMA" data included some incorrect data, which was manually corrected when identified.

8. Approximately 15% of raw "MoMA" data is missing the artist's gender. We manually input the majority of the missing information based on internet searches (e.g. Wikipedia) and deduction based on the artist's first name. See "MoMAExhibition_CleanData.csv".

9. We created a separate dictionary that summed yearly exhibition days for 1929 to 1989. This required pulling out the exhibition years into separate columns before processing the dictionary. We used this dictionary in a few parts of our analysis to plot the exhibition days per year against other metrics, such as the Party in Power and Dow Jones Index.

## II - EMPLOYMENT STATUS DATA

10. The raw "Employment Status" data was not available as a data file; we converted the web chart to a CSV.

11. The raw "Employment Status" data includes a number of variables which are not required for our analyses, which we removed for clarity.

12. The raw "Employment Status" data includes data for years after 1989, which we removed for clarity.

13. The raw "Employment Status" data does not include the variable for employed women as a percentage of total civilian population; we added a column for this data.

## III – BALANCE OF POWER DATA

14. The raw "Balance of Power" data includes data for years before 1929 and after 1989, which we removed for clarity.

15. The raw "Balance of Power" data includes only election years (i.e. even years). We filled in the missing years with the data from the prior year.

16. The raw "Balance of Power" data includes both the majority party and the number of seats held as a combined variable. We created two separate columns to show only the majority party for the House and Senate.

17. We created a new column that sums the "Party in Power" between the House, Senate, and President for a scale of -3 (all branches Republican) to 3 (all branches Democrat)

## IV – DOW JONES DATA

18. The raw "Dow Jones" data was not available as a data file; we converted the web chart to a CSV.

19. The raw "Dow Jones" data includes data for years before 1920 and after 1989, which we removed for clarity.

20. The raw "Dow Jones" data does not include the year as a separate number. We added a column for the data, which is based on the year of the closing date.

21. We added 5 year and 10 year rolling average columns to the table using the mean growth % of the past 5/10 years.

## V – GDP GROWTH PERCENTAGE DATA

22. The raw "GDP Growth %" data was not available as a data file; we converted the web chart to a CSV.

23. The raw "GDP Growth %" data includes data for years before 1920 and after 1989, which we removed for clarity.

24. The raw "GDP Growth %" had extra columns which we removed for clarity. We also cleaned up the % column by removing blank spaces and the "%" sign so it could be read as an integer.

# 3 - INITIAL DATA EXPLORATION & HYPOTHESES

## A - Exhibition Information

*Joe Butcher*

### I – RUNTIMES

In general, exhibition runtime is relatively stable over time (see Fig. 3AI-1). There does appear to be a moderate increase over time which is likely due to MoMA's comfort with the types of exhibitions and runtimes that their customer base prefer.

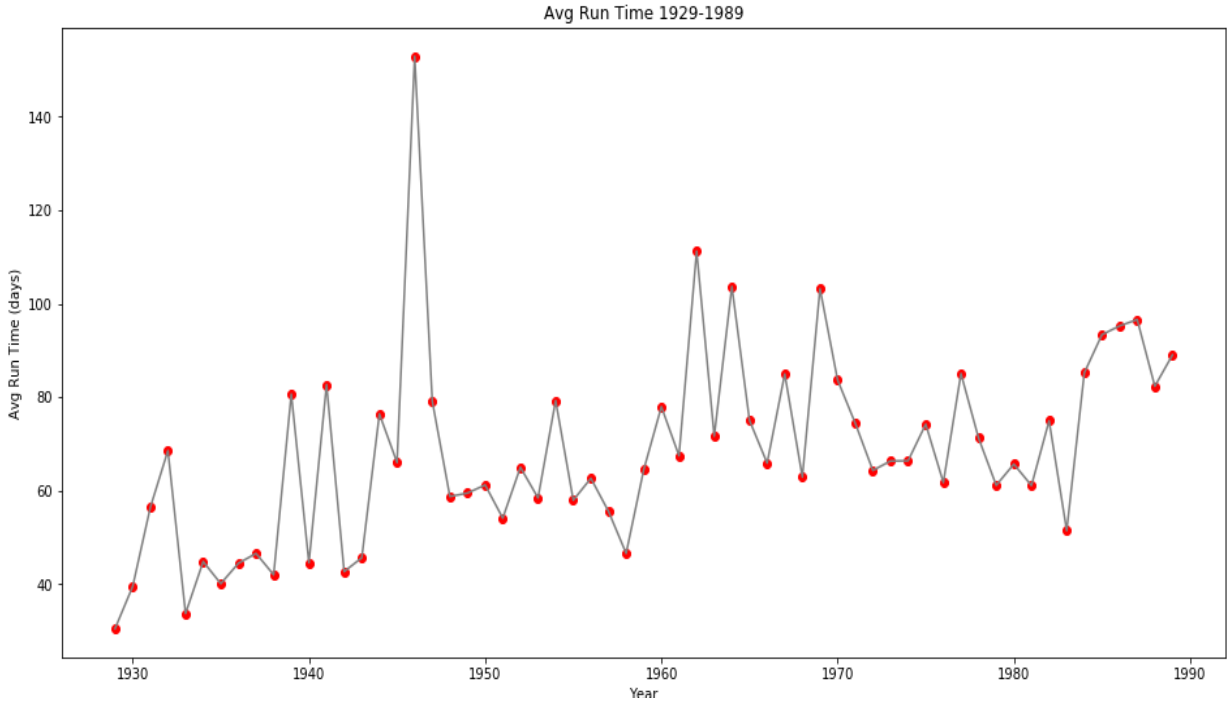


*Fig. 3AI-1- Average exhibition run time by year.*

There was a wider range in runtimes than expected (one day to over eight years). It was surprising to see five exhibitions that lasted longer than one year (particularly since the average runtime was only two months) (see Fig 3AI-2). Descriptive statistics include:  max - 2994 days, min - 1 day, mean - 71 days, median - 60 days.

| *Exhibitions with Runtimes Longer than One Year* | | | |
|---|---|---|---|
| **Exhibition Number** | **Start Date** | **End Date** | **Runtime (Days)** |
| 149 | 1941-09-30 | 1943-07-28 | 666 |
| 153 | 1941-10-21 | 1944-04-30 | 922 |
| 324 | 1946-07-02 | 1954-09-12 | 2,994 |
| - | 1960-11-01 | 1962-03-26 | 510 |
| 909 | 1969-11-05 | 1973-01-02 | 1,154 |

*Fig. 3AI-2- Exhibitions that ran longer than one year.*

**Paintings, Sculpture, and Graphic Arts from the Museum Collection**

July 2, 1946–September 12, 1954

*Fig. 3BI-3- Longest exhibition runtime in dataset (more than eight years).*

**International Council Fall Meeting Exhibition: Latin American and African Artists**

November 13–14, 1972

The Museum of Modern Art

*Fig. 3BI-4 - Shortest exhibition runtime in dataset (one day).*

**HYPOTHESIS: Runtimes will show a very moderate increase over time. A few exhibitions will run for an extremely short period of time (1-5 days) and a few will run much longer than average (> 1 year).**

## II - VOLUME

Volume (total number of days exhibited) increased over time. While the overall trend was positive there was a significant decline in the 1950s when it seems as if funding for art and/or cultural norms did not focus on modern art. (See Fig. 3BII-1.)

**HYPOTHESIS: Volume will steadily increase over time as MoMA gains in popularity.**

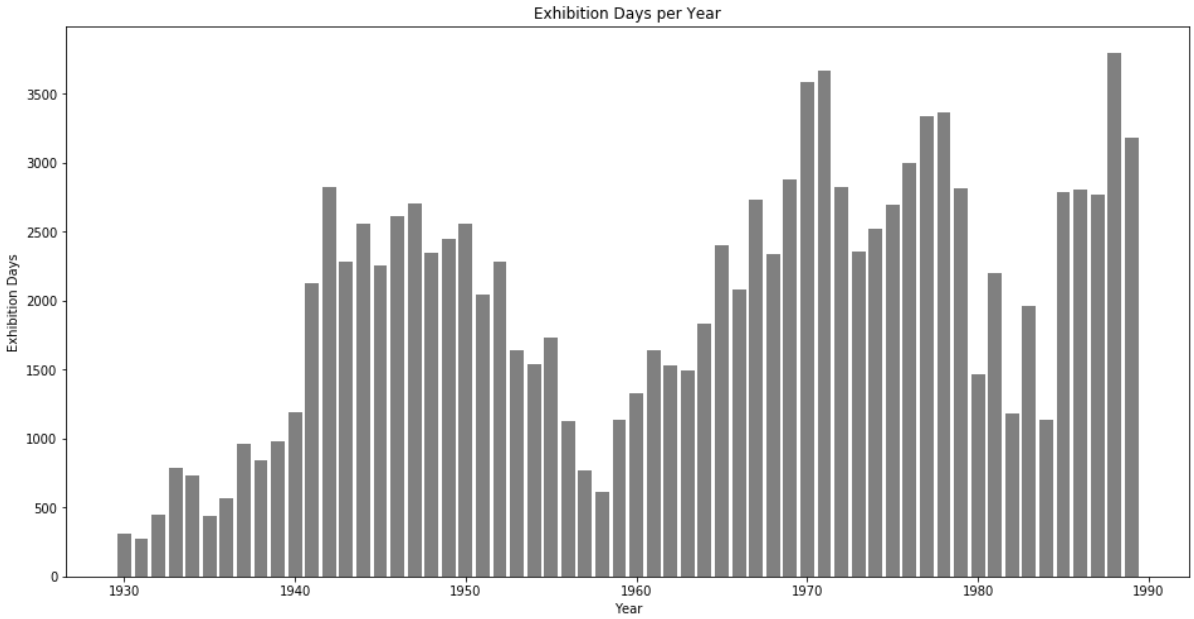


*Fig. 3BII-1- Total exhibition volume (days per year) over over the entire time period.*

## III - NUMBER OF ARTISTS

**HYPOTHESIS: Number of artists exhibited will remain relatively consistent over time with a few, more popular artists making regular appearances. Analysis included in Section 4AIII.**

## IV - NUMBER OF EXHIBITIONS THEMED BY ART FORM

**HYPOTHESIS: Paintings will be the most popular art form. Analysis included in Section 4AIV.**

# B - Artist Demographics

*Anna Jacobson*

**This exploration looks at the MoMA exhibiting artists' demographics (states (living or deceased), ages, nationalities, and genders). The data includes only those constituents whose role in the exhibition is identified as "Artist" (other roles such as Curator are not included) and who are identified as "Individual" (not Institution or Company).**

## I – STATE

This analysis examines the state of the exhibiting artist at the time that his/her exhibition opened by comparing the year the exhibition opened to the artist's year of death. For the purposes of this analysis, "state" is defined as living, deceased (i.e. the artist was exhibited posthumously), or unknown (i.e. the artist's year of death is not included in the dataset). This analysis considers each instance of an exhibiting artist; the same artist may have been living at the time of an earlier exhibition and deceased at the time of a later exhibition.

16,910 artists were living at the time of their exhibitions, while 7,724 artists were deceased at the time of their exhibitions. (See Figs. 3BI-1 and 3B1-2).

| ***Number of Artists by State at Time of Exhibition*** | |
|---|---|
| **State at Time of Exhibition** | **Number of Artists** |
| Living | 16,910 |
| Deceased | 7,224 |
| Unknown | 5,997 |
| Total | 30,130 |

*Fig. 3BI-1 - Number of artists of each state at time of exhibition.*

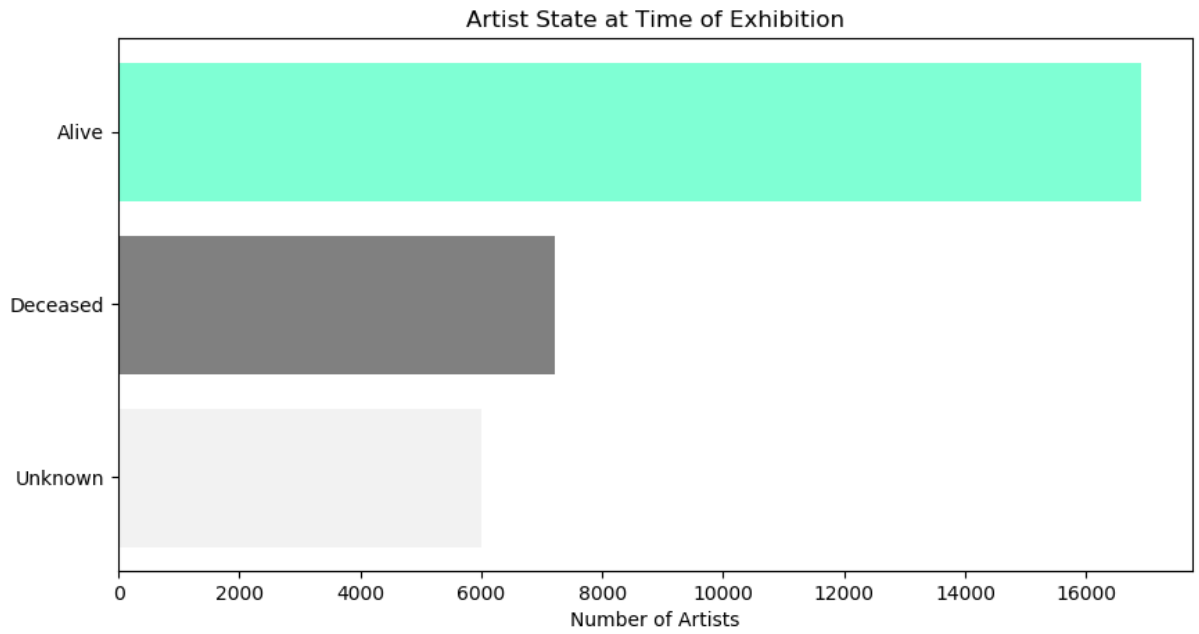


*Fig. 3BI-2 - Number of artists of each state at time of exhibition.*

More than half (56%) of the total artists were living at the time of their exhibition. Just under one-quarter (24%) of the total artists were deceased at the time of their exhibition. (See Fig. 3BI-3).

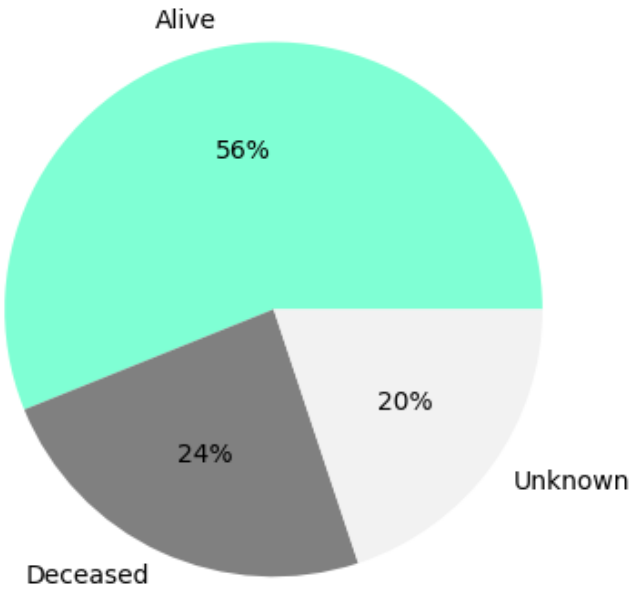


*Fig. 3BI-3 - Artists by state at time of exhibition as a percentage of total artists exhibited.*

The lowest number of deceased artists as a percentage of total artists (excluding those of unknown state) is 10% in 1930, while the highest is 47% in 1976 (see Fig. 3BI-4).

| *Descriptive Information about Artist State by Year (1929-1989)* | | | | | | |
|---|---|---|---|---|---|---|
| | **Year - Number of Living Artists** | | **Year - Number of Deceased Artists** | | **Year - Percentage of Artists Exhibiting Posthumously** | |
| Mean | 277 | | 118 | | 28.53% | |
| Lowest | 1929 | 19 | 1929 | 4 | 1930 | 9.93% |
| Highest | 1960 | 501 | 1979 | 343 | 1976 | 47.46% |

*Fig. 3BI-4 - Number of artists of each state at time of exhibition.*

Two exhibitions used the state of the exhibiting artists as a theme (*Paintings by 19 Living Americans* in 1929 and *Painting and Sculpture by Living Americans* in 1930). Other exhibitions exclusively showed the work of deceased artists without making it explicit (e.g. *Cézanne, Gauguin, Seurat, Van Gogh* in 1929, *Paul Burlin (1886-1969): The Last Paintings* in 1970).

**HYPOTHESIS: Because it is likely that the earlier modern artists who continued to be frequently shown throughout the timeframe of the dataset were increasingly exhibited posthumously over time, and because there were no exhibitions devoted to living artists after 1930, the proportion of posthumous exhibitions will increase over the time period.**

## II – AGE

The analysis examines the age of the exhibiting artist at the time of his/her exhibition opened by subtracting the artist's year of birth from the year the exhibition opened. This analysis considers each instance of the exhibiting artist, as the same artist may have exhibited at different ages. Artists whose age at the time that their exhibition opened is unknown (i.e. their birth year is not included in the dataset) are excluded from the analysis.

For living and deceased artists combined, both the median and mean ages at time of exhibition are higher than for living artists only (see Fig. 3BII-1), which indicates that the deceased artists tended to be older at the time of their deaths. Among the living artists, the median and mean ages are very close, showing that the distribution of age around the median age is almost symmetric.

| ***Median & Mean Artist Age at Time of Exhibition by State*** | | |
|---|---|---|
| **State at Time of Exhibition** | **Median Age at Time of Exhibition (Years)** | **Mean Age at Time of Exhibition (Years)** |
| Living and Deceased | 56 | 64 |
| Living Only | 47 | 49 |

*Fig. 3BII-1 – Median and mean ages of living and deceased and living only artists exhibited.*

Seven exhibitions used the age of the exhibiting artists as a theme (e.g. *46 Painters and Sculptors under 35 Years of Age* in 1930, *Three Young Photographers* in 1947, *Young American Printmakers* in 1953). Not surprisingly, the year of *46 Painters and Sculptors under 35 Years of Age* is also the year of the lowest mean artist age (see Fig. 4BII-2).

**HYPOTHESIS: Because artists who were exhibited earlier in the time period of the dataset were of much more advanced age by the end of the dataset, and because there were no exhibitions devoted to younger artists after 1953, the average exhibiting artist age will increase over time.**

## III – NATIONALITY

The analysis examines the nationality of the exhibiting artist, considering both each instance of an exhibiting artist and unique artists only, depending on the specific analysis. Artists whose nationality is unknown (i.e. their nationality is not included in the dataset) are excluded from the analysis.

The artists' nationalities with highest representation in the exhibitions, ranked highest to lowest, shows the prevalence of American and Western European artists (see Fig. 3BIII-1, left side). The artists' nationalities with lowest representation in the exhibitions, ranked lowest to highest, shows a mixture of very small countries and countries that no longer existed by the 20th century, as well as groups that could be considered subsets of other nationalities (see Fig. 3BIII-1, right side).

| *Artist Nationalities with Highest Representation* | | | *Artist Nationalities with Lowest Representation* | | |
|---|---|---|---|---|---|
| **Rank (Highest)** | **Nationality** | **Total Number of Unique Artists** | **Rank (Lowest)** | **Nationality** | **Total Number of Unique Artists** |
| 1 | American | 2,432 | 1 (tie) | Bosnian | 1 |
| 2 | French | 397 | 1 (tie) | Slovene | 1 |
| 3 | German | 312 | 1 (tie) | Latvian | 1 |
| 4 | British | 310 | 1 (tie) | Milanese | 1 |
| 5 | Italian | 240 | 1 (tie) | New Zealander | 1 |
| 6 | Japanese | 200 | 1 (tie) | Sudanese | 1 |
| 7 | Swiss | 108 | 1 (tie) | Panamanian | 1 |
| 8 | Dutch | 80 | 1 (tie) | South African | 1 |
| 9 | Russian | 77 | 1 (tie) | Venetian | 1 |
| 10 | Canadian | 68 | 1 (tie) | Native American | 1 |
| 11 | Mexican | 66 | 1 (tie) | Russian-Lithuanian | 1 |
| 12 | Spanish | 63 | 1 (tie) | Romanian | 1 |
| 13 | Austrian | 58 | 1 (tie) | Tanzanian | 1 |
| 14 | Swedish | 50 | 1 (tie) | Luxembourgish | 1 |
| 15 | Polish | 48 | 1 (tie) | Georgian | 1 |
| 16 | Argentine | 45 | 2 (tie) | Croatian | 2 |
| 17 | Belgian | 42 | 2 (tie) | Rhodesian | 2 |
| 18 (tie) | Brazilian | 35 | 2 (tie) | Bolivian | 2 |
| 18 (tie) | Danish | 35 | 2 (tie) | Netherlandish | 2 |
| 19 | Chilean | 24 | 2 (tie) | Canadian Inuit | 2 |

*Fig. 3BIII-1 – Artists' nationalities with highest (left) and lowest (right) representation in the exhibitions.*

Of the top five most-represented nationalities (American, French, German, British, and Italian), the following are the mean number of exhibiting artists per year, as well as the years and numbers of the least and most exhibiting artists by year (see Fig. 3BIII-2).

| *Annual Number of Artists by Nationality (Mean, Fewest, and Most 1929-1989)* | | | | | | |
|---|---|---|---|---|---|---|
| **Rank** | **Nationality** | **Mean Annual Number of Artists** | **Year - Fewest Artists** | | **Year - Most Artists** | |
| 1 | American | 212 | 1931 | 6 | 1979 | 398 |
| 2 | French | 62 | 1929 | 3 | 1960 | 150 |
| 3 | German | 29 | 1943 | 3 | 1987 | 72 |
| 4 | British | 19 | 1935 | 1 | 1977 | 56 |
| 5 | Italian | 14 | 1930 | 2 | 1954 | 51 |

*Fig. 3BIII-2 - Analysis of top five most-represented artists' nationalities, showing mean annual number of artists exhibited for each nationality, the year and number of the fewest artists shown for each nationality, and the year and number of the most artists shown for each nationality.*

Many exhibitions used the nationality of the exhibiting artists as a theme (e.g. *German Painting and Sculpture* in 1931, *Persian Fresco Painting* in 1932, *New Horizons in American Art* in 1936, *Recent Japanese Posters from the Collection* in 1989). "America" and "United States" appear in a total of 95 unique exhibition titles.

**HYPOTHESIS: Because the world became increasingly globalized during the timeframe of the dataset, the representation of artists from the United States and Western Europe will decrease over time.**

## IV – GENDER

The analysis examines the gender of the exhibiting artist, considering both each instance of an exhibiting artist and unique artists only, depending on the specific analysis. For the purposes of this analysis, "gender" is defined as male, female, or unknown (i.e. the artist's gender is not included in the dataset).

The number of artists by gender shows the prevalence of male artists over female artists, particularly when the analysis includes all instances (see Figs. 3BIV-1, 3BIV-2, 3BIV-3, 3BIV-4, and 3BIV-5).

| *Number of Artists by Gender (All Instances and Unique)* | | |
|---|---|---|
| **Gender** | **Number of Artists (All Instances)** | **Number of Artists (Unique)** |
| Male | 25,988 | 7,185 |
| Female | 2,911 | 1,162 |
| Unknown | 1,232 | 1,043 |
| Total | 30,130 | 9,390 |

*Fig. 3BIV-1 - Number of artists exhibited by gender for all instances and unique artists only.*

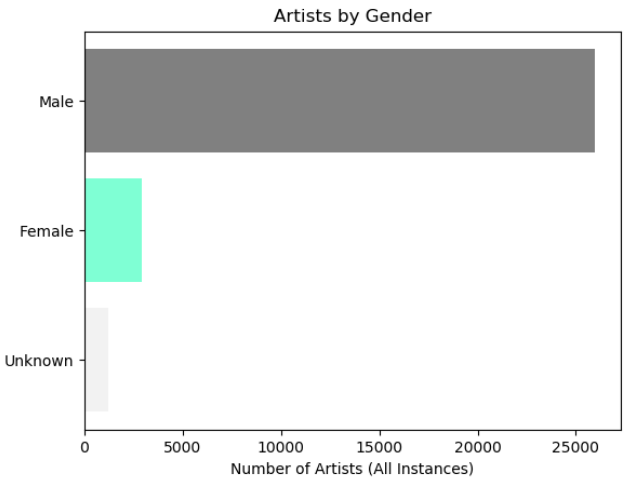


*Fig. 3BIV-2 - Number of all artists by gender.*

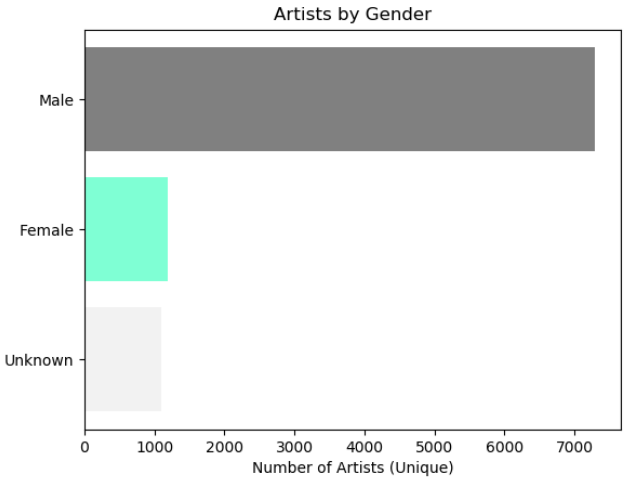


*Fig. 3BIV-3 - Number of unique artists by gender.*

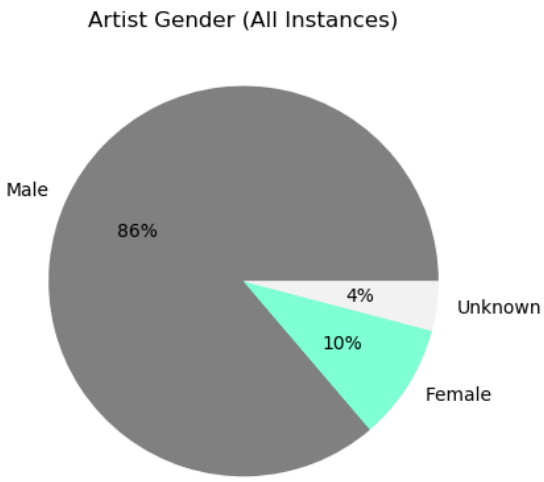


*Fig. 3BIV-4 - Artists by gender as a percentage of total artists.*

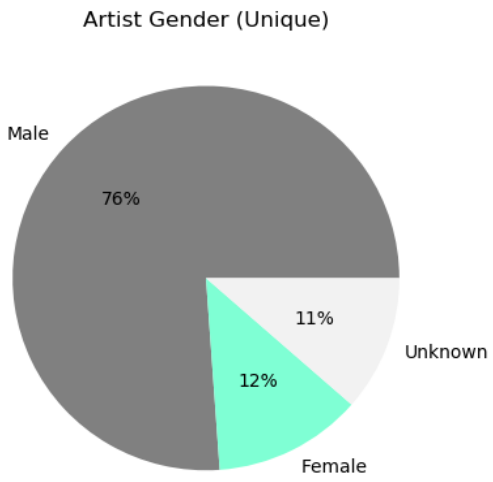


*Fig. 3BIV-5 - Unique artists by gender as a percentage of total unique artists.*

Two exhibitions used the gender of the exhibiting artists as a theme (e.g. *Extraordinary Men* and *Extraordinary Women*, both in 1977).

**HYPOTHESIS: The male/female artist split will become less skewed over time; however, it will not reach parity.**

# C - Political & Economic Context

*Mihir Sathe*

## I – POLITICS

**HYPOTHESIS: More liberal power in the Federal Government will correlate with an increase in the number of exhibition days at MoMA.**

Our thought here is that if there are more Democrats in office between the President, Senate, and House of Representatives, the arts will gain more emphasis and funding, leading to more total exhibition days per year at MoMA.

## II – ECONOMY

**HYPOTHESIS: As the American economy grows, the general population will have more disposable income, leading to philanthropic funding for the arts, such as exhibitions at MoMA. Therefore, there will be more exhibition days during upticks in the economy.**

We chose to measure the US economy based on the growth rate of the Dow Jones Industrial Average, which roughly tracks the overall US Stock Market. We thought that as people gain affluence, more funding will pour in for the arts, leading to more and longer exhibitions at MoMA.

# 4 - KEY FINDINGS

## A - Exhibition Information

*Joe Butcher*

### I – RUNTIMES

In order to further understand trends in runtime data over time, analysis was conducted across a few different dimensions.

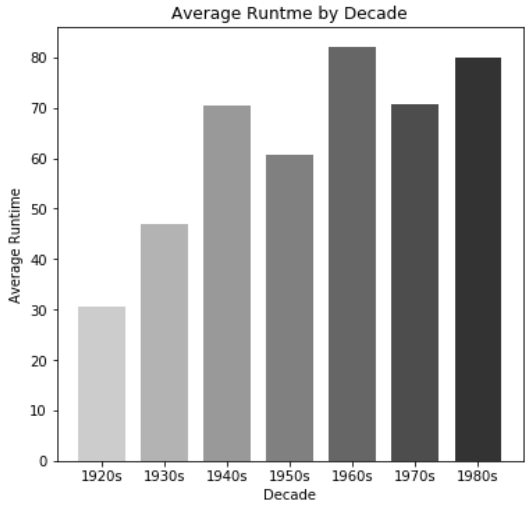


*Fig. 4AI-1 - Average exhibition runtime by decade.*

First, we looked at average runtime by decade to further understand this dynamic. Fig. 4AI-1 clearly shows the increase discussed during the initial exploration phase (reference Section 3AI). However, it is important to note that the runtime decreased in the 1950s (the same period of time we noticed a decline in volume; reference Section 3AII).

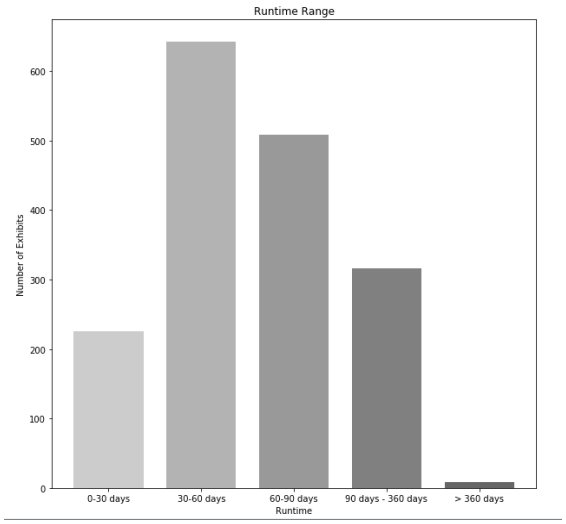


*Fig. 4AI-2 Average runtime by decade shows increase over time.*

In addition to looking at runtime across decades, analysis was also conducted to analyze exhibition runtime across distinct ranges of exhibition length (see Fig. 4AI-2). For this analysis, we analyzed runtime across five ranges (0-30 days, 30-60 days, 60-90 days, 90-360 days, and >360 days).

In examining these ranges, analysis was conducted to see if certain artists nationalities were present for different ranges. As displayed in Fig. 4AI-3 below, there was not a noticeable difference in the number of times artists of different nationalities were shown. The ranking of each artist nationality remained very stable across each range.

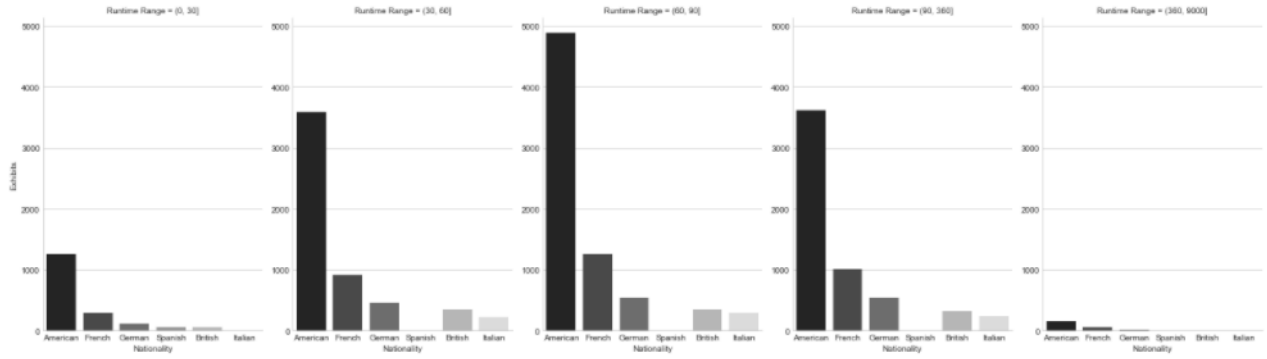


*Fig. 4AI-3 - Artist nationality displayed across five ranges of exhibition runtime.*

Finally, the five runtime ranges were analyzed across time to determine the popularity of short versus long runtime across the entire time period (see Fig. 4AI-4). Not surprising, short run was very popular at the very beginning of the time period. It is interesting to see the 60-90 day runtime range to increase significantly during the last two decades of the time period. Again, this trend aligns with our earlier analysis which discussed that MoMA likely became more comfortable with showing slightly longer exhibitions over time.

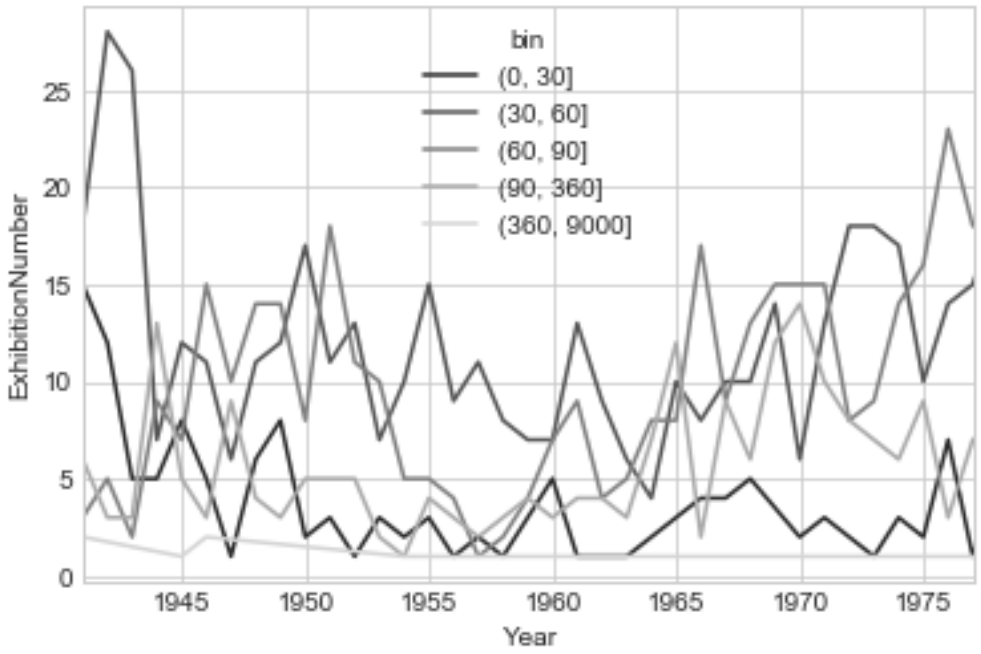


*Fig. 4AI-4 - Runtime range trend lines across time.*

## II - VOLUME

While we analyzed volume as the total number of days exhibited during the initial data exploration (reference Section 3AII), we also felt it was important to analyze the total number of unique exhibitions per year. Comparing number of exhibitions (see Fig. 4AII-1) and number of days of exhibitions (see Fig. 4AII-2) tells us that there is no material difference in the overall trend for unique number of exhibitions per year and cumulative runtime days per year. Furthermore, testing this hypothesis across two different volume methodologies gives us confidence in our conclusion that volume increased over time (with the noticeable drop in the 1950s, as previously discussed).

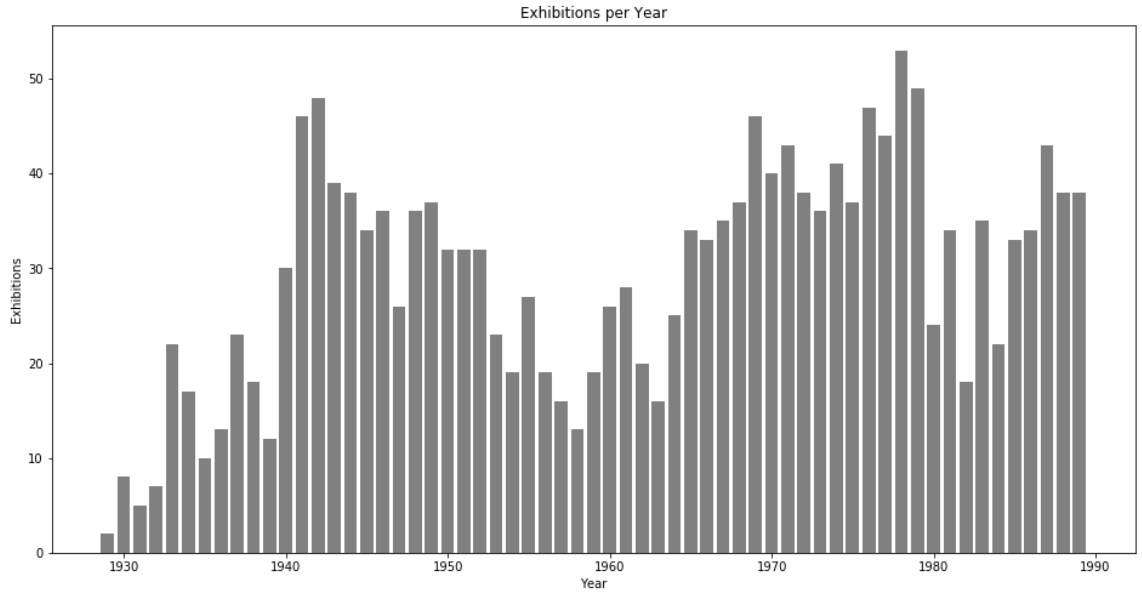


*Fig. 4AII-1 - Exhibitions per year across the entire time range.*

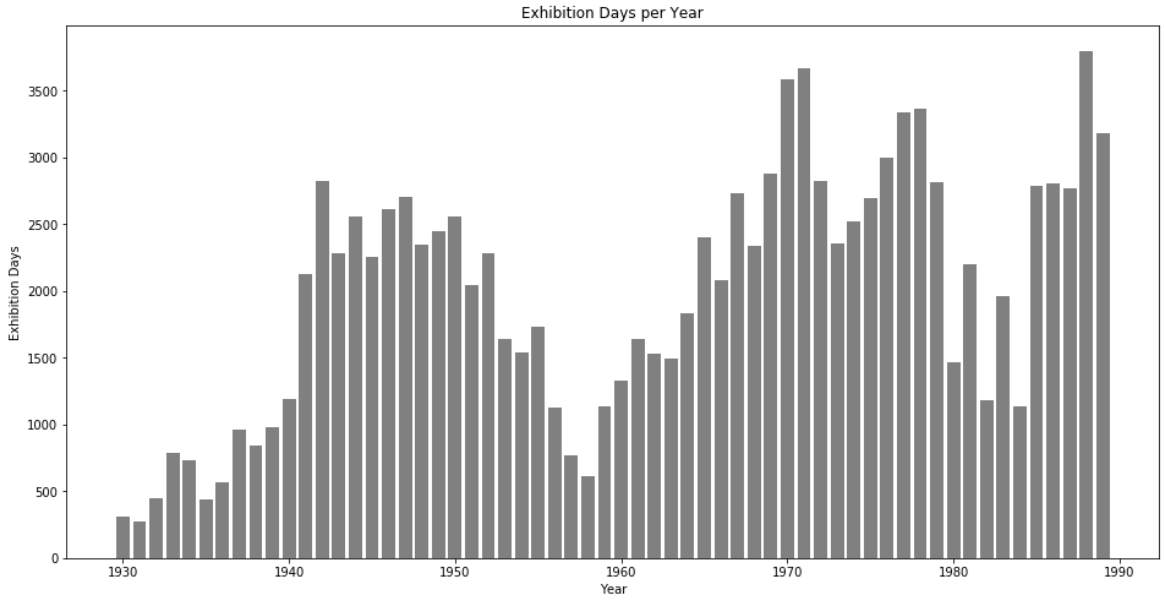


*Fig. 4AII-2 - Total runtime days across the entire time range.*

## III – NUMBER OF ARTISTS

As anticipated, the number of artists displayed per year mostly remained in the 400–800 range across time, with a few exceptions (see Fig. 4AIII-1).

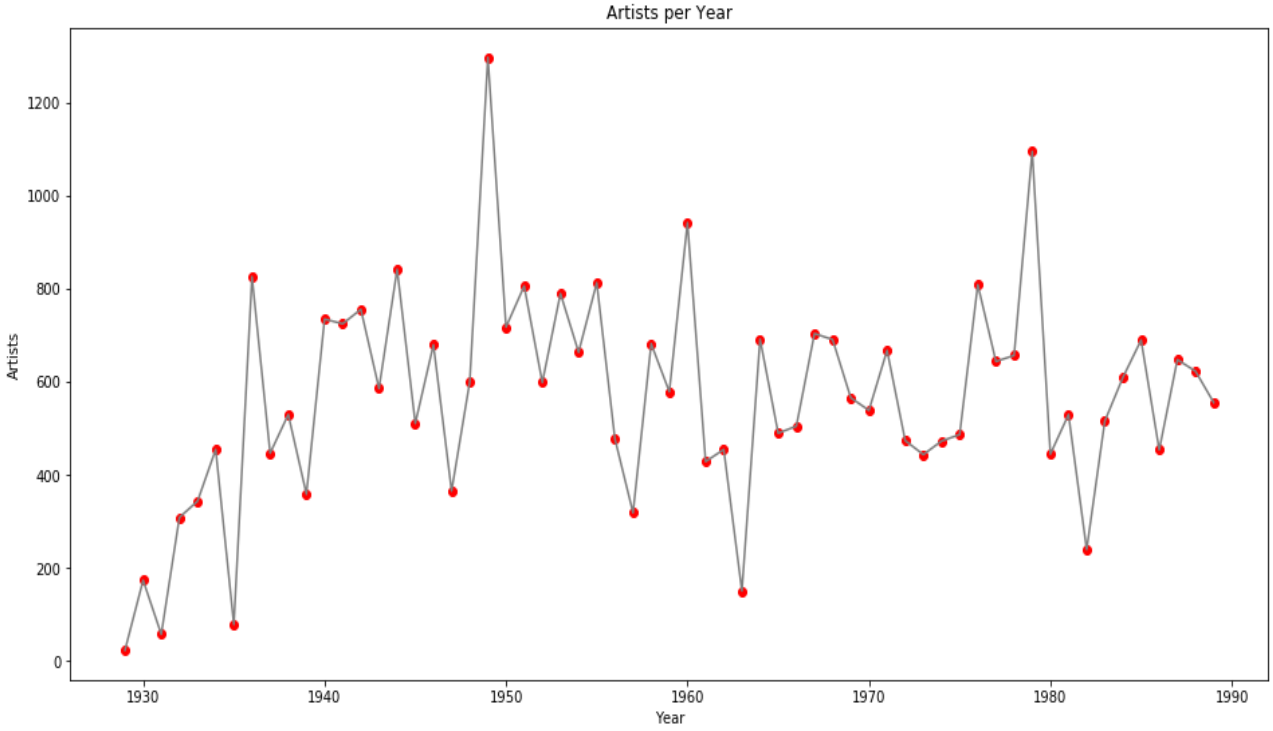


*Fig. 4AIII-1 – Artists per year across time remains relatively stable.*

As discussed earlier, the average number of artists per exhibition was just under 20. However, there were 581 solo exhibitions (i.e. one artist), as well as nine exhibitions that each included over 250 total artists (see Fig. 4AIII-2).

| ***Exhibitions with More Than 250 Artists*** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Exhibition Number** | 1250 | 401 | 52 | 567 | 569 | 636 | 637 | 76a | – |
| **Number of Artists** | 321 | 300 | 284 | 262 | 252 | 274 | 259 | 256 | 315 |

*Fig. 4AIII-2 – Nine exhibitions featured more than 250 artists.*

## IV – NUMBER OF EXHIBITIONS THEMED BY ART FORM

Art form type was often used as a theme of the exhibitions, sometimes alone (e.g. *Naive Paintings* in 1970) and sometimes in combination with other art forms (e.g. *Painting and Sculpture from 16 American Cities* in 1933). The top ten art forms used as exhibition themes are shown below (see Fig. 4AV-1).

| ***Top Ten Art Forms Used as Theme by Number of Exhibitions*** | | |
|---|---|---|
| **Rank** | **Art Form** | **Total Number of Exhibitions (1929–1989)** |
| 1 | Photography | 124 |
| 2 | Painting | 123 |
| 3 | Sculpture | 81 |
| 4 | Print | 79 |
| 5 | Drawing | 77 |
| 6 | Video | 57 |
| 7 | Architecture | 53 |
| 8 | Design | 51 |
| 9 | Poster | 34 |
| 10 | Furniture | 10 |

*Fig. 4AIV-1 – Top ten art forms used as exhibition themes by number of exhibitions, ranked from highest to lowest.*

Other exhibition themes included works by a specific artist or group of artists and/or various artist demographics (see Section 4B).

# B - Artist Demographics

*Anna Jacobson*

**This analysis looks for trends between the MoMA exhibitions and the exhibiting artists' demographics (states (living or deceased), ages, nationalities, and genders). The data includes only those constituents whose role in the exhibition is identified as "Artist" (other roles such as Curator are not included) and who are identified as "Individual" (not Institution or Company).**

## I – STATE

In order to test the hypothesis that the proportion of posthumous exhibitions increased over the time period, we first looked at the deceased artists as a percentage of total artists exhibited each year. Although there is a lot of year-over-year fluctuation, the proportion of posthumous exhibitions appears to generally increase over time (see Fig. 4BI-1).

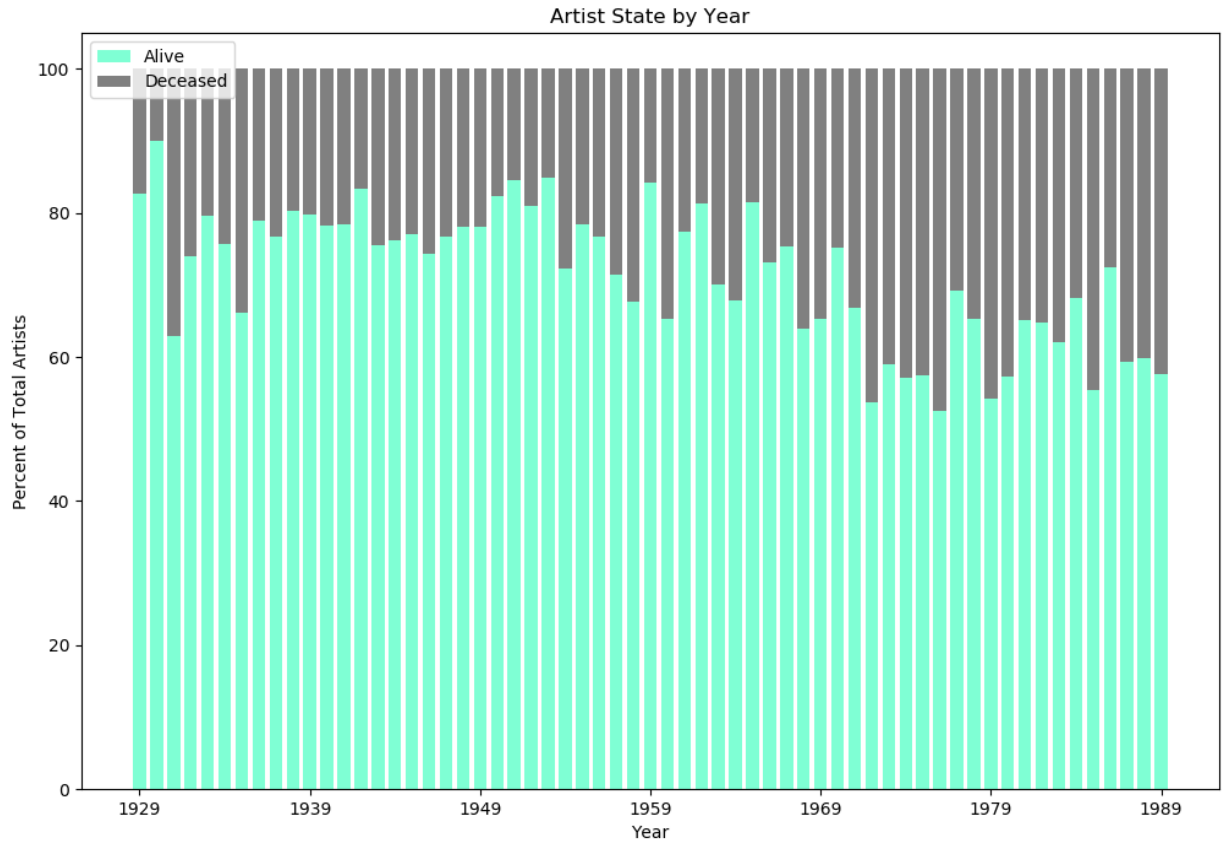


*Fig. 4BI-1 - Living and deceased artists as percentages of total artists exhibited by year.*

The increase in proportion of posthumous exhibitions over time is also seen in the analysis by decade (see Fig. 4BI-2), from 17% in the 1920s to 38% in the 1980s.

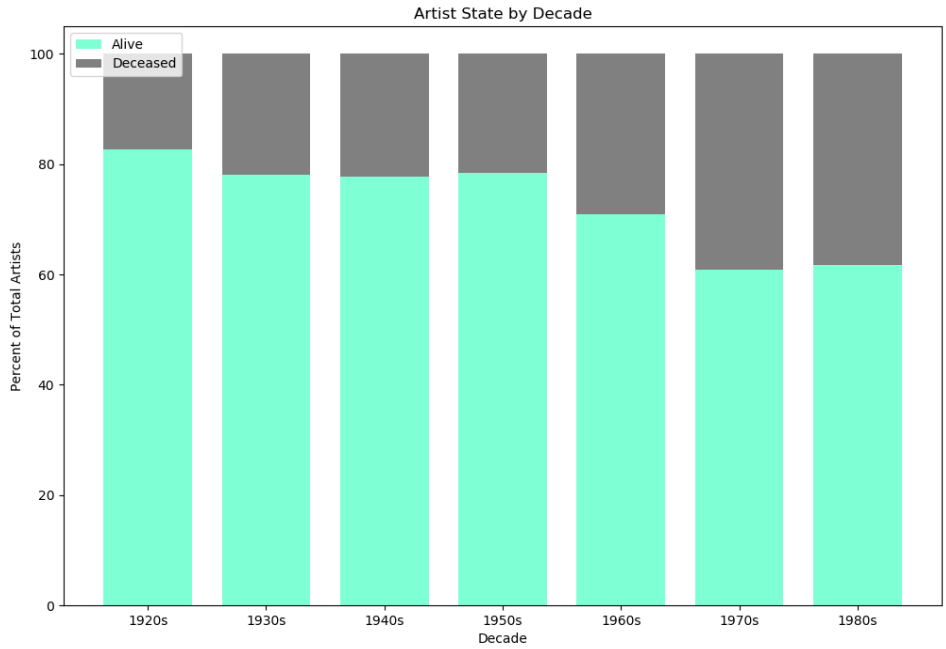


*Fig. 4BI-2 - Living and deceased artists as percentages of total artists exhibited by decade.*

We tested the idea that posthumous exhibitions were more likely to be solo exhibitions and therefore solo exhibitions would show the same increase over time as posthumous exhibitions, but we found that the number of living solo artists per year increased much more dramatically over time, while the deceased solo artists did not show a noticeable increase (see Fig. 4BI-3).

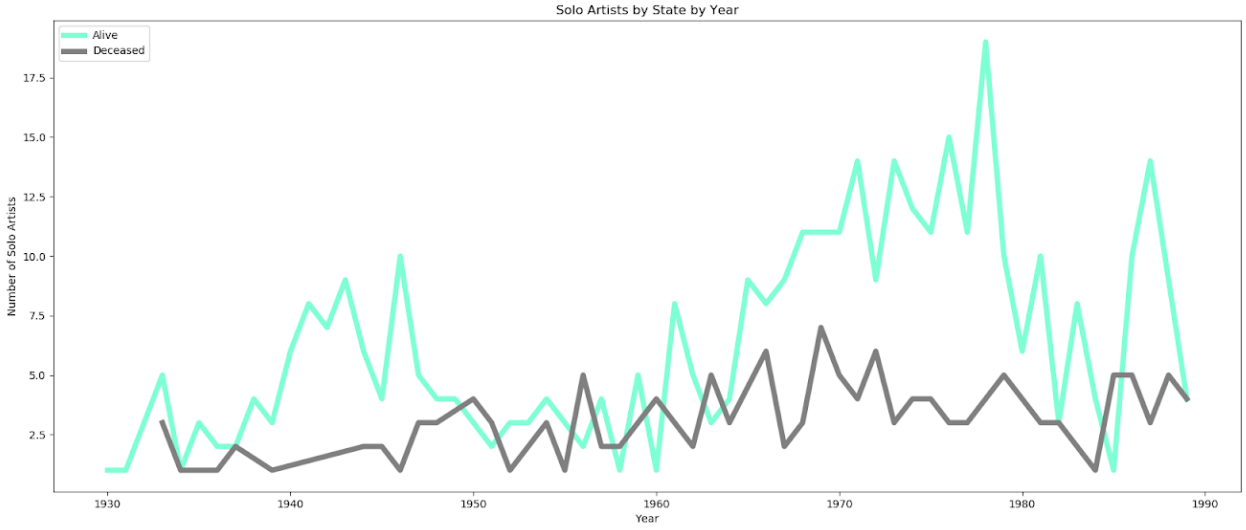


*Fig. 4BI-3 - Living and deceased artists as percentages of total artists exhibited by decade.*

## II - AGE

In order to test the hypothesis that the average exhibiting artist age increased over time, we first looked at mean artist age at the start of exhibition by year. The youngest mean artist age by year was 48 years old in 1930 and the oldest mean artist age by year was 77 years old in 1980. Although there are fluctuations year over year, the mean artist age exhibits a clear upward trend over time. (See Fig. BII-1)

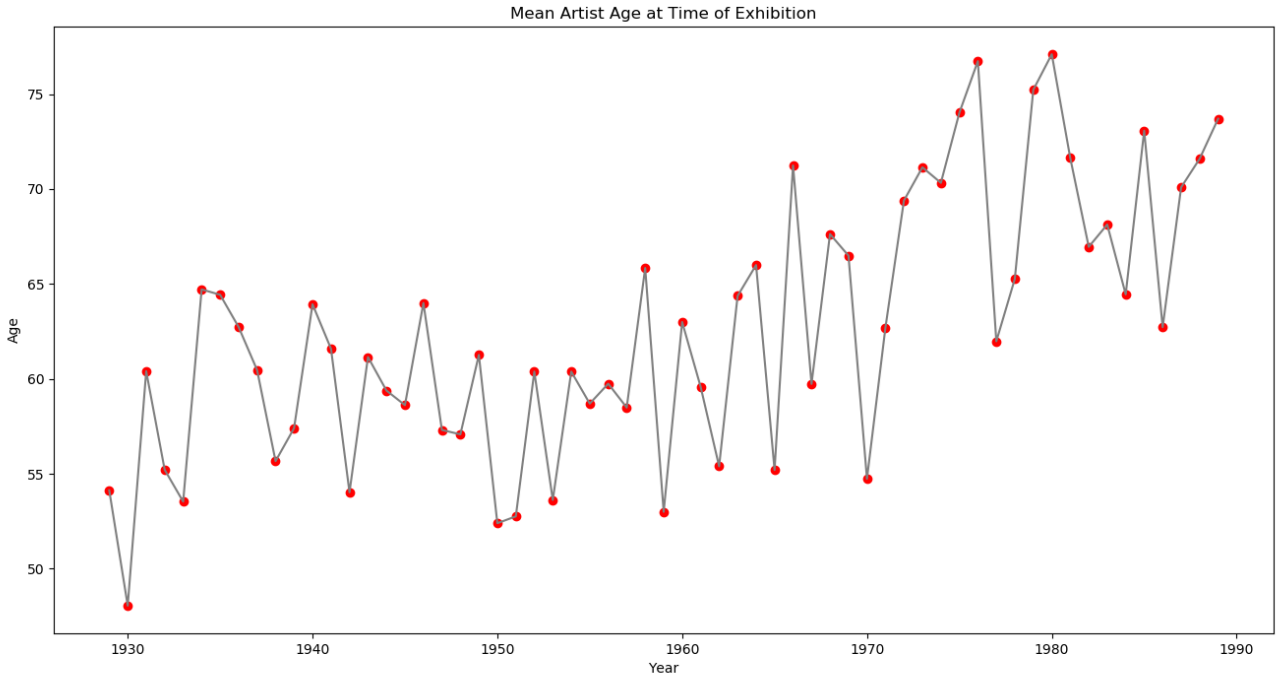


*Fig. 4BII-1 - Mean artist age at time of exhibition by year.*

By decade, the mean artist age shows a similar upward trend over time, from 54 years old in the 1920s to 70 years old in the 1980s, with a slight dip in the 1950s (see Figs. 4BII-2 and 4BII-3).

| *Mean Artist Age by Decade* | |
|---|---|
| **Decade** | **Mean Age (Years)** |
| 1920s | 54.13 |
| 1930s | 58.63 |
| 1940s | 59.94 |
| 1950s | 57.54 |
| 1960s | 63.30 |
| 1970s | 68.48 |
| 1980s | 70.15 |

*Fig. 4BII-2 - Mean artists' ages at time of exhibition by decade.*

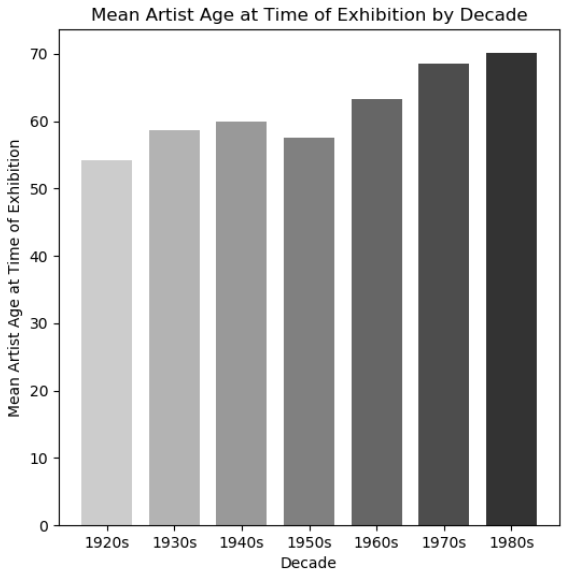


*Fig. 4BII-3 - Mean artists' ages at time of exhibition by decade.*

The increase in mean artist age over time suggests another question: which generation of artists was shown the most at MoMA? For the purposes of this analysis, "generation" is defined as a twenty year period. By analyzing the exhibiting artists' years of birth, the generation born between 1880 and 1899 can be clearly observed to be the most exhibited (see Fig. 4BII-4), with 7,191 exhibitions (more than 2,000 more than the next most-exhibited generation).

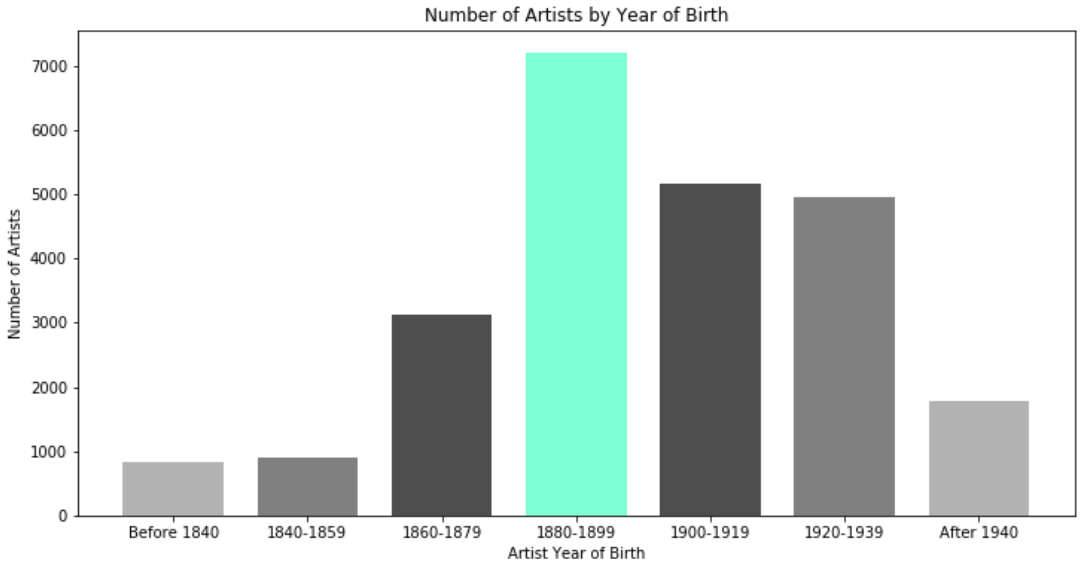


*Fig. 4BII-4 - Number of artists by year of birth.*

In examining the generational breakdown by decade, the 1880 generation appears to have been most popular in the 1930s and 1940s (with a resurgence in the 1970s), while the next generation (born 1900-1919) was shown the most in the 1950s, and the next generation after that (born 1920-1939) dominated the 1960s, 1970s, and 1980s. (see Fig 4BII-5.)

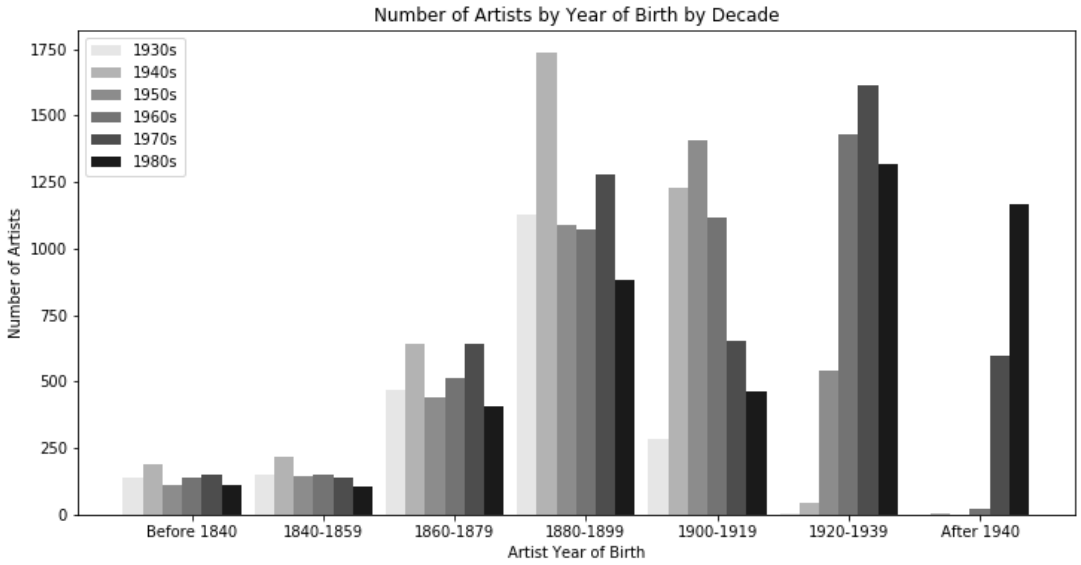


*Fig. 4BII-5 - Number of artists by year of birth, by decade.*

## III - NATIONALITY

The top two most-represented exhibiting artist nationalities, American and French, comprise more than half of the total number of artists when including those who exhibited multiple times (all 30,130 instances) (see Fig. 4BIII-1). However, when analyzing only unique artists, American and French nationalities are less dominant (see Fig. 4BIII-2).

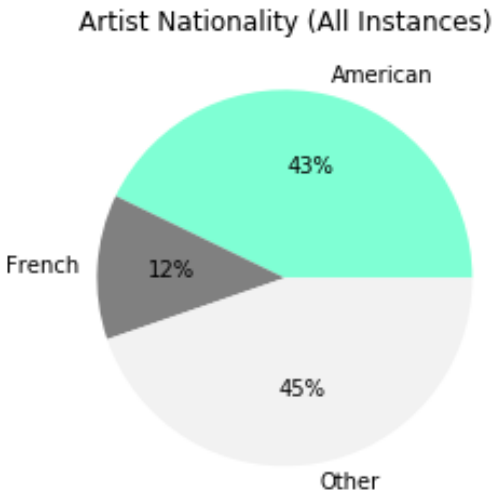


*Fig. 4BIII-1 - American, French, and all other artists by nationality as a percentage of total artists exhibited.*

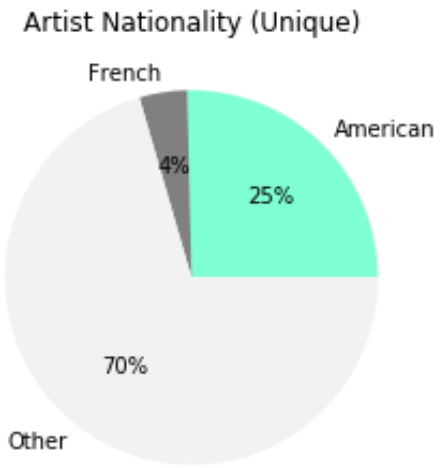


*Fig. 4BIII-2 - American, French, and all other artists by nationality as a percentage of total unique artists exhibited.*

The decrease in representation of American and French artists when analyzing only unique artists reflects the phenomenon that unique artists of these two nationalities had average numbers of exhibitions that were disproportionately high compared to other nationalities. Unique American and French artists averaged 5.3 and 9.5 exhibitions per artist respectively, while all other nationalities combined averaged 2.1 exhibitions per artist (see Fig. 4BIII-3).

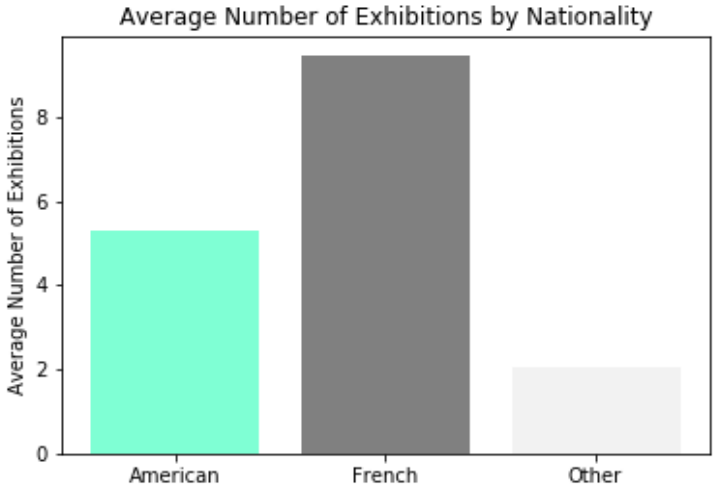


*Fig. 4BIII-3 - Average number of exhibitions of American, French, and all other artists by nationality.*

Of the top five most-represented nationalities (American, French, German, British, and Italian), all showed fluctuation in the number of artists exhibited year over year, and all trended slightly upward between 1929 and 1989 (see Fig. 4BIII-4).

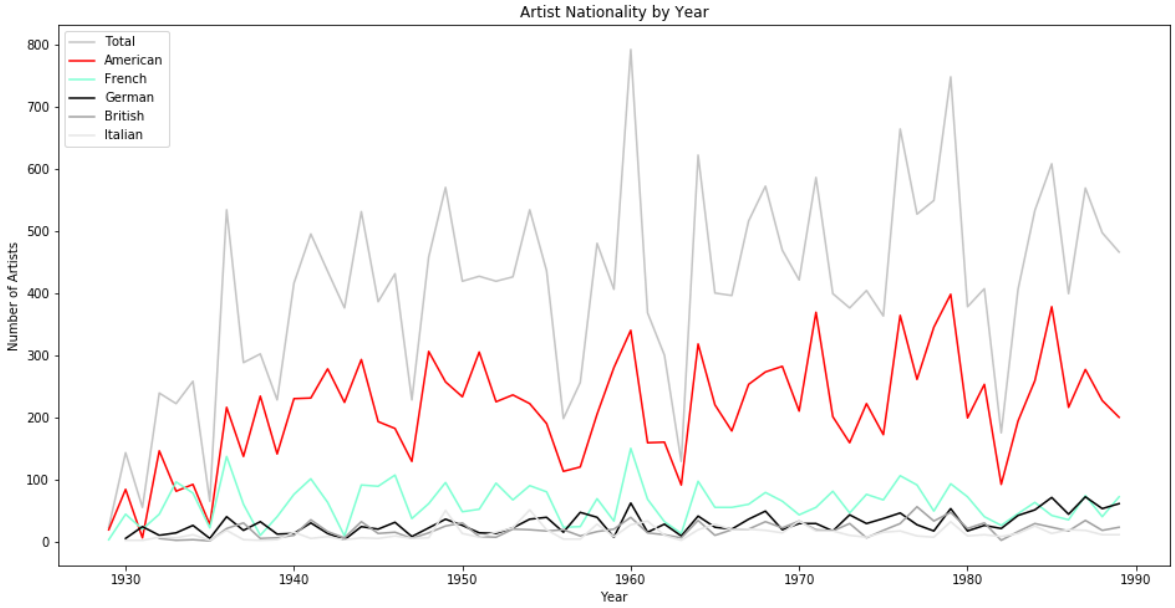


*Fig. 4BIII-4 - Number of artists exhibited by year for the top five most-represented nationalities.*

In order to test the hypothesis that the representation of American artists decreased over time, we looked at the percentage of American artists compared to all other artist nationalities. Contrary to the hypothesis, by decade there is consistent representation for American artists over time, approximately 50%, with the exception of the 1920s (see Figs. 4BIII-5 and 4BIII-6). The 1920s can be discarded as an outlier in this analysis as this decade included only two exhibitions, which exhibited a total of 23 artists (19 Americans).

| ***Percentage of American Artists by Decade*** | | |
|---|---|---|
| **Decade** | **American (%)** | **All Other Nationalities (%)** |
| 1920s | 82.61% | 17.39% |
| 1930s | 49.87% | 50.13% |
| 1940s | 53.70% | 46.30% |
| 1950s | 53.21% | 46.79% |
| 1960s | 49.82% | 50.18% |
| 1970s | 53.62% | 46.38% |
| 1980s | 51.71% | 48.29% |

*Fig. 4BIII-5 - American artists and all other artists as a percentage of total artists exhibited by decade.*

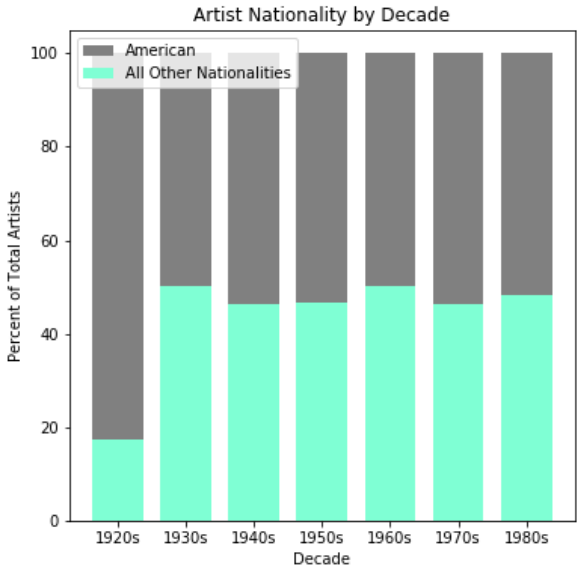


*Fig. 4BIII-6 - American artists and all other artists as a percentage of total artists exhibited by decade.*

In order to test the hypothesis that the representation of Western European artists decreased over time, we looked at the percentage of foreign artists by nationality. Contrary to the hypothesis, by decade, the percentage of foreign artists by nationality exhibited shows fairly consistent aggregate representation over time from the 1940s to the 1980s for the top five non-American artist nationalities (French, German, British, Italian, and Japanese), approximately 60%-70% total (see Fig. 4BIII-7). The 1920s can be discarded as an outlier in this analysis as this decade included only one exhibition showing foreign artists (three French and one Dutch).

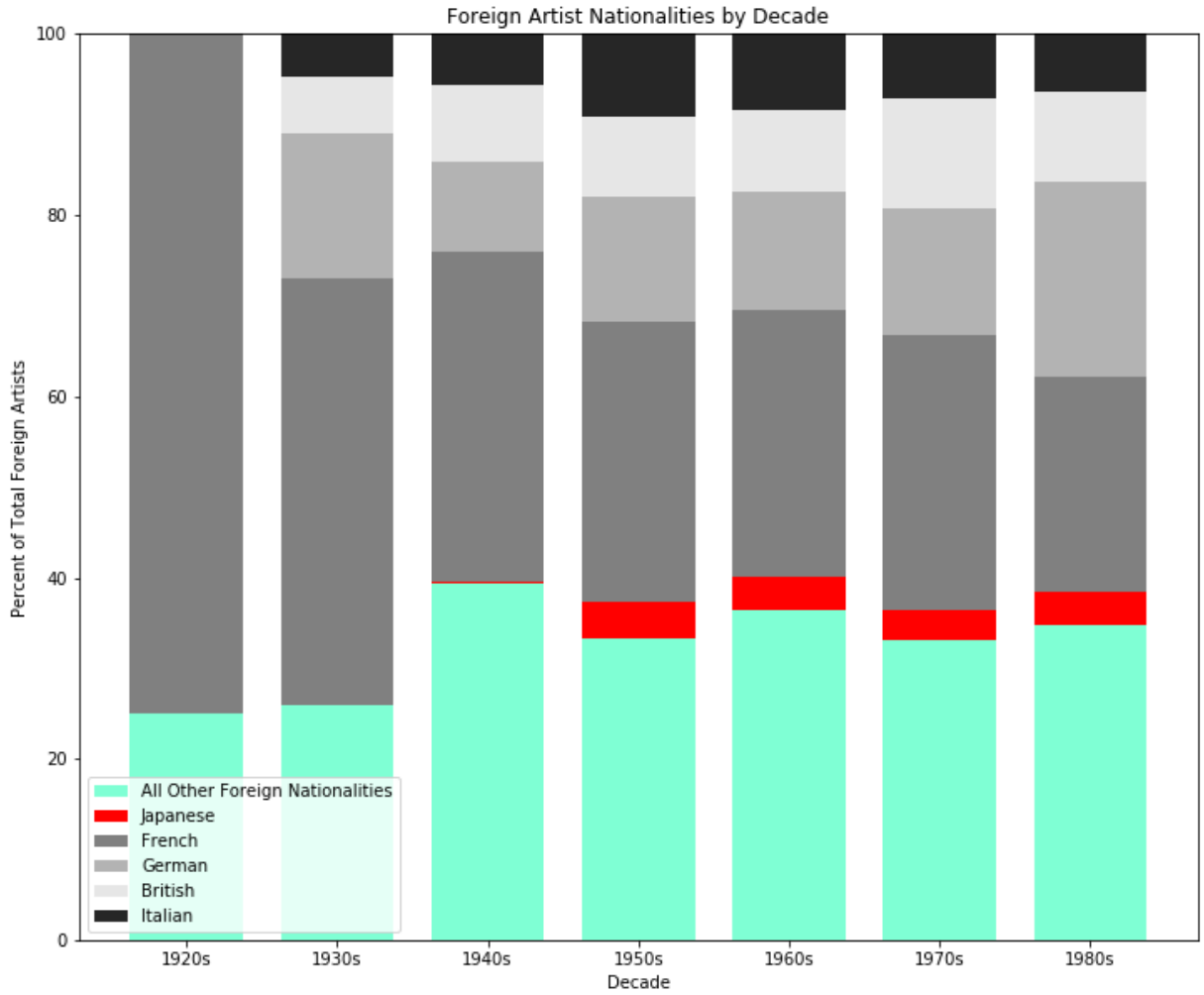


*Fig. 4BIII-7 - Foreign artists exhibited by decade for the top five most-represented non-American nationalities.*

French representation declined each decade, from 47% of foreign artists in the 1930s to 24% in the 1980s. German representation was lowest in the 1940s (at 10% of foreign artists), when the United States was at war with Germany, and increased dramatically in the 1980s (to 21%), when the German art scene exploded with "Die jungen Wilden" (the young wild ones) exhibiting their works under the term "heftige Malerei" (fierce painting)[2]. British and Italian representation increased modestly over time, with some minor intermediate fluctuations.

Low but statistically significant representation of non-Western European nationalities began in the 1950s, with Japan's representation consistently at about 4% of foreign artists through the 1980s.

[2] http://www.dw.com/en/art-in-the-80s-how-the-wild-decade-looks-on-canvas/a-18614480

## IV - GENDER

To test the hypothesis that the male/female artist split became less skewed over time but did not reach parity, we explored a number of different dimensions.

The following are the mean number of exhibiting artists per year by gender, as well as the years and numbers of the least and most exhibiting artists in that year by gender (see Fig. 4BIV-1).

| *Annual Number of Artists by Gender (Mean, Least, and Greatest)* | | | | | | |
|---|---|---|---|---|---|---|
| **Rank** | **Gender** | **Mean Annual Number of Artists** | **Year - Fewest Artists** | | **Year - Most Artists** | |
| 1 | Male | 426 | 1929 | 22 | 1949 | 891 |
| 2 | Female | 48 | 1929 | 1 | 1977 | 92 |

*Fig. 4BIV-1- Analysis of male and female artists, showing mean annual number of artists exhibited for each gender, the year and number of the fewest artists shown for each gender, and the year and number of the most artists shown for each gender.*

Both genders showed fluctuation in the number of artists exhibited year over year (see Fig. 4BIV-2). These numbers do not exhibit a clear upward or downward trend over time.

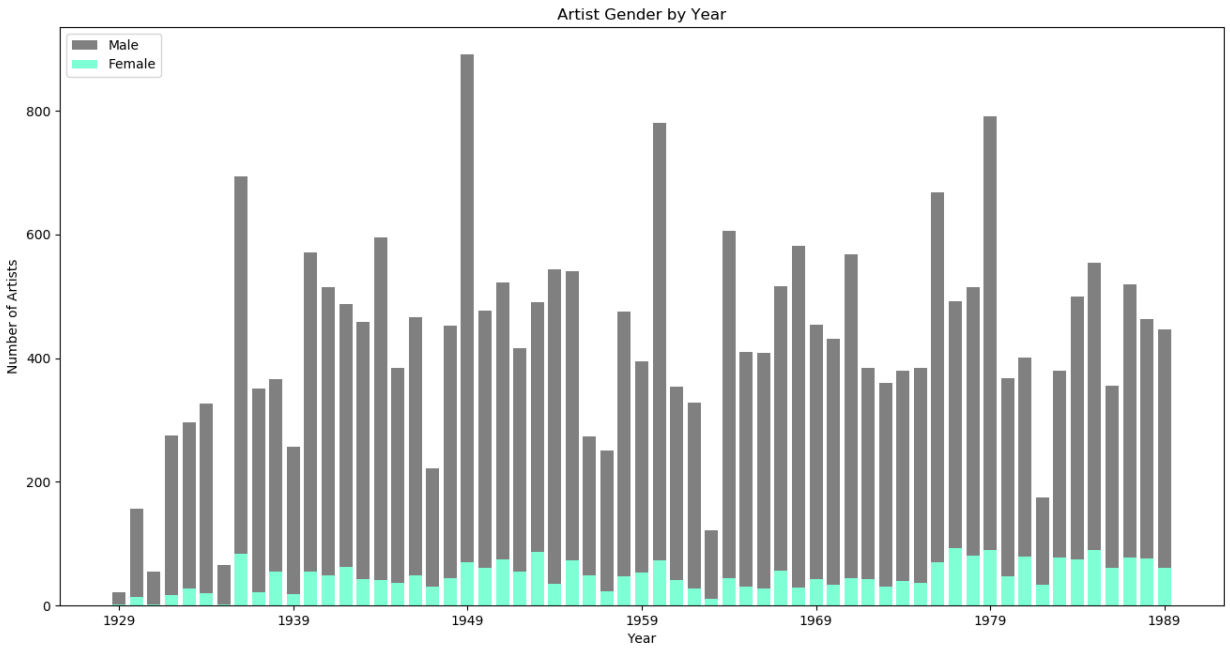


*Fig. 4BIV-2 - Number of artists by gender by year.*

However, the analysis of absolute numbers of artists by gender by year (see Fig. 4BIV-2) may mask or distort trends as the total absolute number of artists varied from year to year, from 24 to 1,297. The proportion of male and female artists per year is a better measure of gender disparity. The following are the years and percentages of the lowest and highest gender disparities of the exhibiting artists (see Fig. 4BIV-3).

| *Lowest and Highest Percentage of Total Artists by Gender by Year* | | | | | |
|---|---|---|---|---|---|
| **Rank** | **Gender** | **Year - Lowest Percentage** | | **Year - Highest Percentage** | |
| 1 | Male | 1983 | 83% | 1935 | 97% |
| 2 | Female | 1935 | 3% | 1983 | 17% |

*Fig. 4BIV-3 - Analysis of male and female artists, showing the year and lowest percentage of artists shown for each gender and the year and highest percentage of artists shown for each gender.*

The percentage of artists exhibited by gender fluctuated year over year (see Fig. 4BIV-4). The chart does not demonstrate a clear upward or downward trend over time, although it shows an increase from beginning to end.

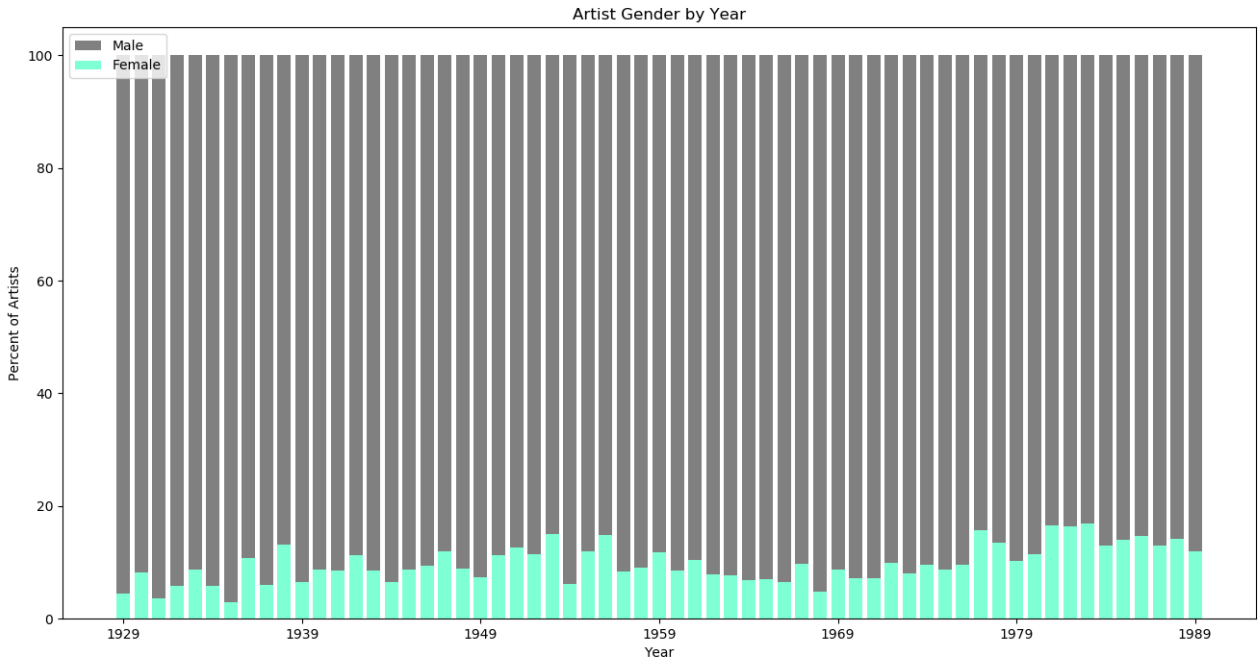


*Fig. 4BIV-4 - Artists by gender as a percentage of total artists exhibited by year.*

By decade, it is easier to see that the percentage of artists by gender exhibited does show an upward trend in female artists' representation over time, from 8% in the 1930s to 14% in the 1980s, with a relatively large dip (3%) in the 1960s, and male artists' representation shows a corresponding downward trend over time, from 92% in the 1930s to 86% in the 1980s. (See Figs. 4BIV-5 and 4BIV-6.)

| *Percentage of Artists by Gender by Decade* | | |
|---|---|---|
| **Decade** | **Male (%)** | **Female (%)** |
| 1920s | 95.65% | 4.35% |
| 1930s | 91.58% | 8.41% |
| 1940s | 91.36% | 8.64% |
| 1950s | 88.76% | 11.23% |
| 1960s | 92.25% | 7.75% |
| 1970s | 89.90% | 10.10% |
| 1980s | 86.03% | 13.97% |

*Fig. 4BIV-5 - Artists by gender as a percentage of total artists exhibited by decade.*

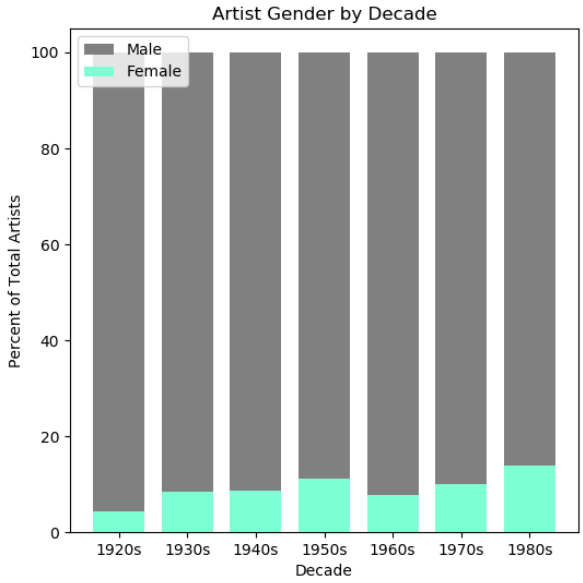


*Fig. 4BIV-6 - Artists by gender as a percentage of total artists exhibited by decade.*

Since the gender split among the exhibiting artists clearly did not track with the gender split of the overall population, we examined the correlation with women's representation in the American workforce as a whole. In comparison to the representation of women in the overall civilian workforce in the United States (16-28% from 1948 (the earliest year for which the employment data is available) to 1989 (the latest year for which the MoMA data is available)), representation of female artists in MoMA's exhibitions is quite low at 5-16% (see Fig. 4BIV-7).

| *Descriptive Information about Female Representation by Year (1948-1989)* | | | | |
|---|---|---|---|---|
| | **Year - Percentage of Women in the US Workforce** | | **Year - Percentage of Female Artists Exhibited at MoMA** | |
| Mean | 21.39% | | 10.27% | |
| Lowest | 1948 | 16.10% | 1968 | 4.60% |
| Highest | 1989 | 28.40% | 1983 | 16.38% |

*Fig. 4BIV-7 - Descriptive information about female artists as a percentage of total artists exhibited to women workers as a percentage of total U.S. workforce, by year.*

In addition, female participation in the overall workforce steadily increased over the time period between 1948 and 1989, while female participation in MoMA's exhibitions shows much more fluctuation, with 1968 – almost the exact midpoint of the dataset's time period – being the year of lowest female representation. (See Fig. 4BIV–8.)

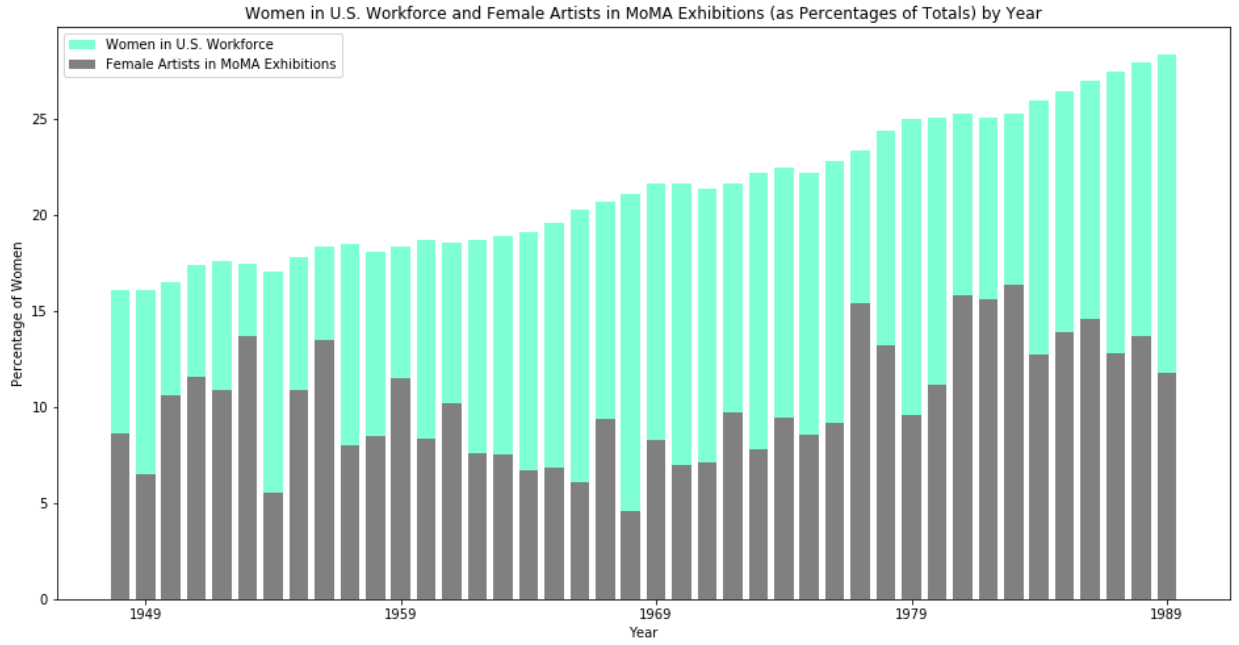


*Fig. 4BIV–8 – Comparison of female artists as a percentage of total artists exhibited to women workers as a percentage of total U.S. workforce, by year.*

An amplifying factor in the gender imbalance is that female artists were less likely than male artists to have multiple exhibitions; the average number of exhibitions for a unique male artist was 3.6 between 1929 and 1989, while the average number of exhibitions for a unique female artist during the same period was 2.4 (see Fig. 4BIV–9). For comparison, the overall average number of exhibitions per unique artist was 3.14.

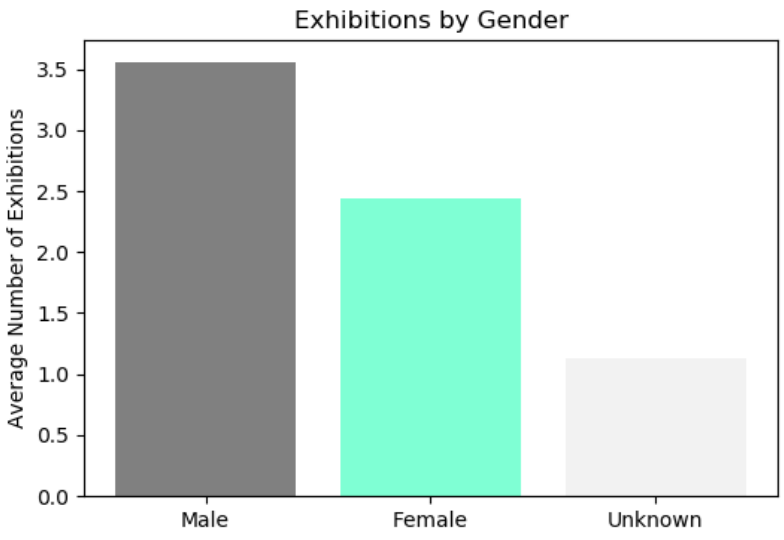


*Fig. 4BIV–9 – Average number of exhibitions by gender.*

This fact is also illustrated by a comparison of the most-exhibited artists by gender (see Fig. 4BIV-10); the most-exhibited male artists were shown four to six times more often than the most-exhibited female artists.

| *Top Ten Artists by Number of Exhibitions by Gender* | | | | |
|---|---|---|---|---|
| **Rank** | **Male Artist** | **Total Number of Exhibitions (1929-1989)** | **Female Artist** | **Total Number of Exhibitions (1929-1989)** |
| 1 | Pablo Picasso | 234 | Berenice Abbott | 43 |
| 2 | Henri Matisse | 185 | Georgia O'Keeffe | 41 |
| 3 | Joan Miro | 140 | Helen Frankenthaler | 36 |
| 4 | Paul Klee | 135 | Helen Levitt | 30 |
| 5 | Fernand Leger | 111 | Dorothea Lange | 29 |
| 6 | Georges Braque | 105 | Marie Laurencin | 27 |
| 7 | Jasper Johns | 101 | Agnes Martin | 25 |
| 8 | Marc Chagall | 96 | Lisette Model | 24 |
| 9 | Max Ernst | 94 | Louise Nevelson | 24 |
| 10 | Paul Cezanne | 91 | Julia Margaret Cameron | 23 |

*Fig. 4BIV-10 - Top ten artists by total number of exhibitions, by gender, ranked from highest to lowest.*

In addition, the data shows that male artists consistently had more solo exhibitions than female artists (see Fig. 4BIV-11). The average annual number of solo exhibitions featuring male artists was 8.6, while the average annual number of solo exhibitions featuring female artists was 2.0. The only year in which the numbers were equal was 1981, which is also the year of the highest number of female solo exhibitions (six).

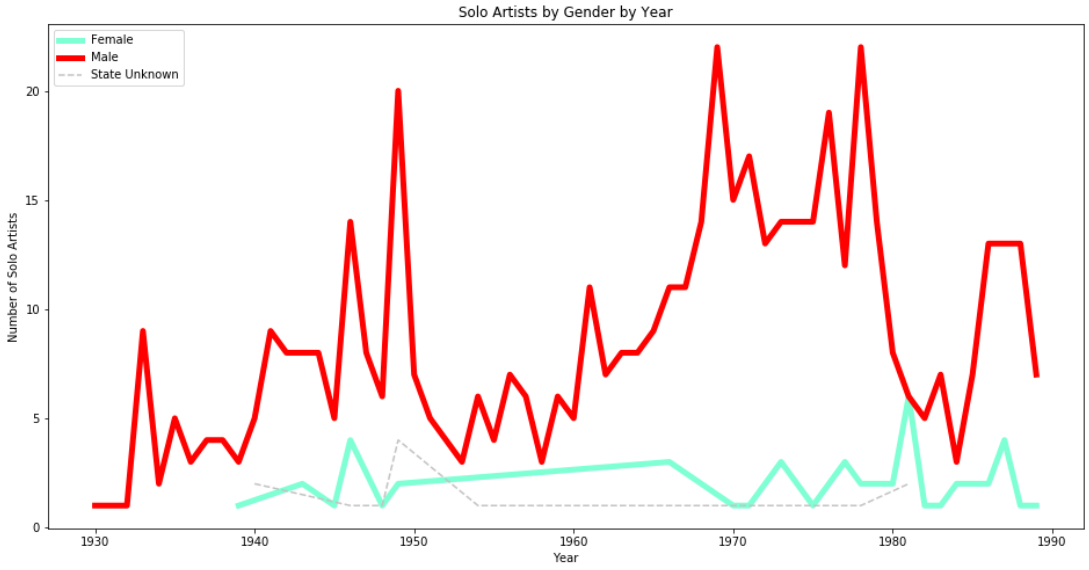


*Fig. 4BIV-11 - Number of solo artists exhibited by gender by year.*

# C - Political & Economic Context

*Mihir Sathe*

## I – POLITICS

Here we examined the relationship between number of exhibition days per year and the balance of power in the United States Federal Government (White House, Senate, and House of Representatives). We used a scale of -3 to +3 to quantify the balance, where +1 point was given for each branch held by a Democrat and -1 point was given for each branch held by a Republican; -3 indicates that all three branches are held by Republicans and +3 indicates that all three branches are held by Democrats. Fig. 4CI-1 below shows that we found some relationship between Democrats in office and an increase in the exhibition days per year. We think that this is due to more liberals in office leading to a greater emphasis on the arts, releasing more funding for exhibitions at MoMA. We can see below that most time periods where the balance of power is positive (Democratic), there is positive growth in the exhibition days per year.

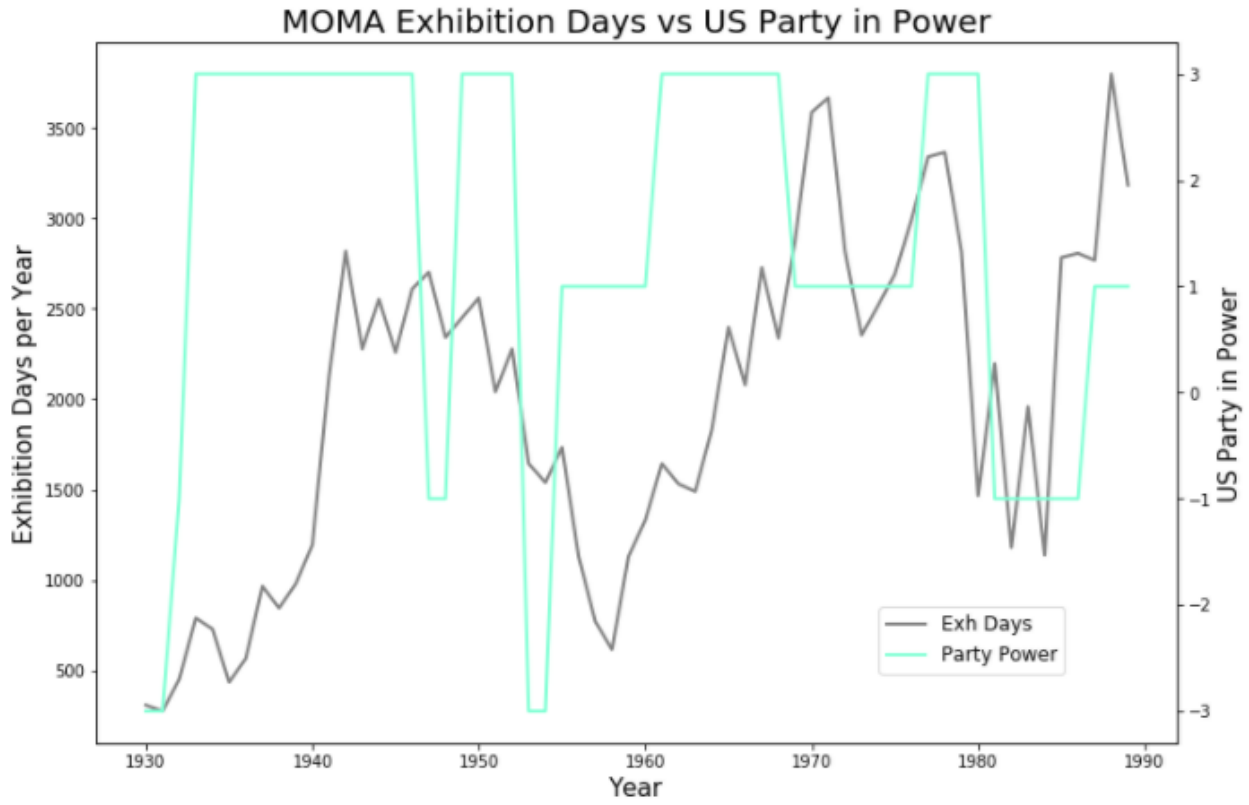


*Fig. 4CI-1 - Exhibition Days/Year against balance of power in the U.S. Federal Government.*

## II - ECONOMY

We examined the relationship between economic prosperity in the United States and the number of exhibition days in each year from 1930 to 1989. Fig. 4CII-1 below compares the 10 year rolling average of the change in the Dow Jones Industrial Average, inflation adjusted, against the number of exhibition days at MoMA.

Our initial hypothesis, that a positive trend in the Dow Jones would correlate with more exhibition days, proved to be directly incorrect, as per the results in our graph. The exceptions are around 1940 and after 1980. Our thought here is that if there is a relation between economic prosperity and exhibition days, there may be a delay between economic prosperity, funding for the arts, and the opening of an exhibition (which can take years to plan). Additionally, the Dow Jones stock fluctuation may not be a good measure of economic prosperity in a given year since speculation is a significant factor in stock price.

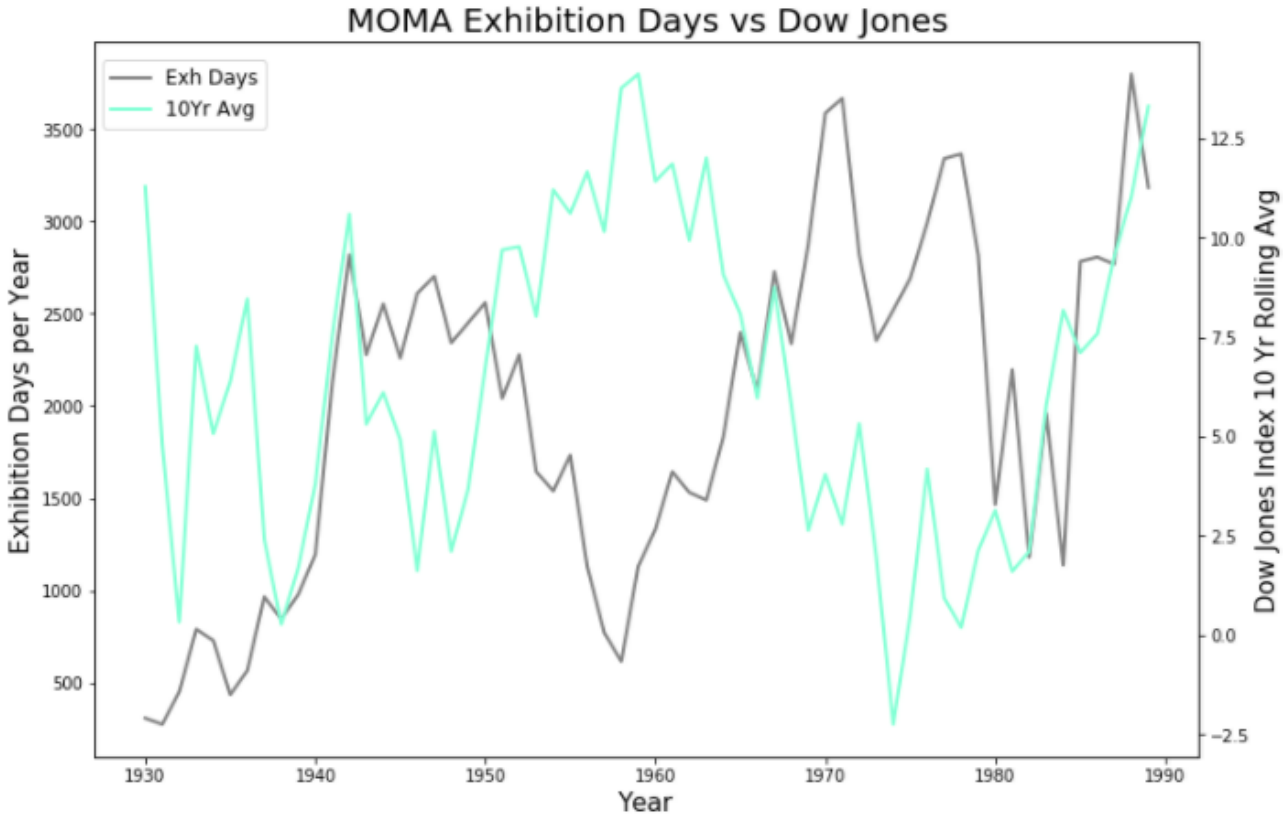


*Fig. 4CII-1 - Exhibition Days/Year against Dow Jones 10 Year Rolling Average.*

We conducted additional analysis by comparing U.S. GDP Growth Rate against MoMA exhibition days, thinking that GDP Growth may be a better measure of a given year's economic standing than the Dow Jones (see Fig 4CII-2). There is slightly more correlation between the two as compared with the above, but they still do not line up the way we hypothesized they would. There is still a chance that there is simply a lag as described above.

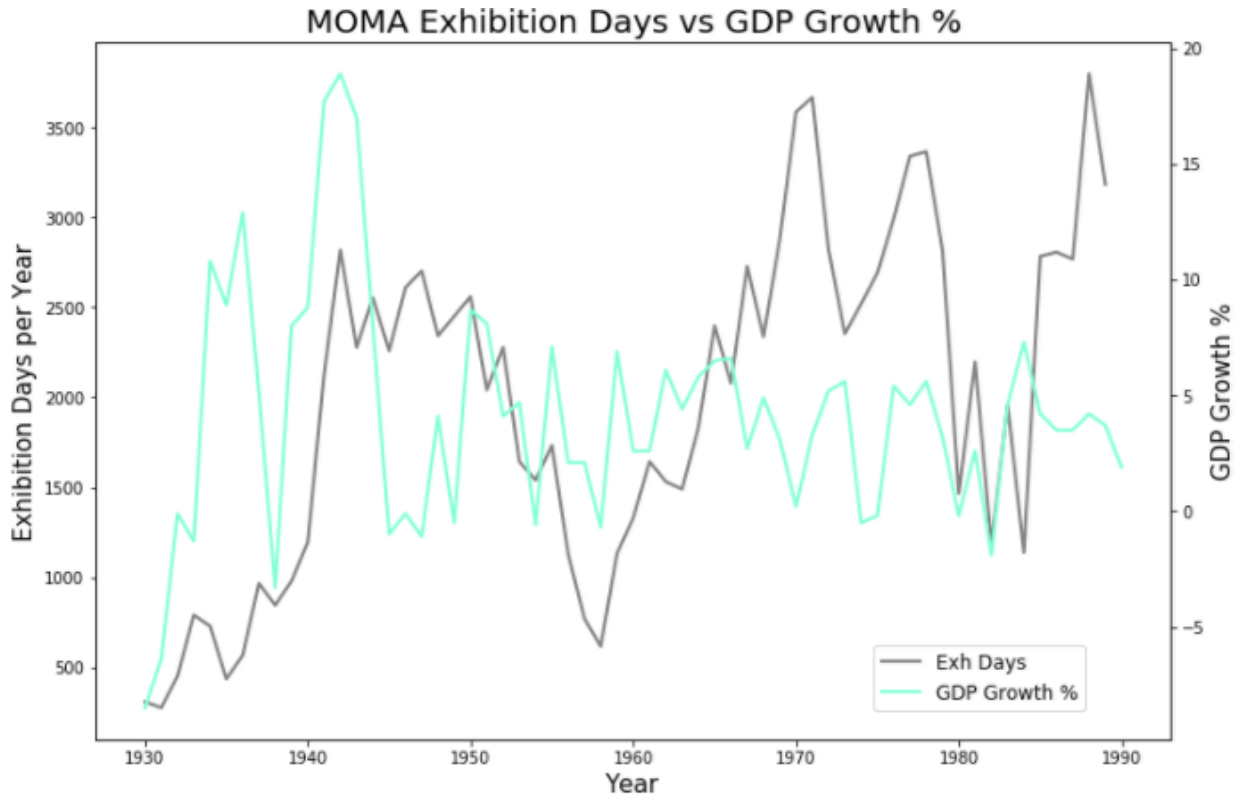


*Fig. 4CII-2 - Exhibition Days/Year against GDP Growth %.*

# 5 - CONCLUSIONS

## A - Exhibition Information

Runtime for exhibitions covered an extremely wide range (one day to more than eight years). However, the average runtime per year remained relatively stable with only a modest increase over time; the average remained slightly longer than two months. Different constituent characteristics (e.g. nationality) did not seem to be an important factor in how long the exhibition ran.

As MoMA became more popular over time, the volume of exhibitions steadily increased. This held true across different metrics (total days of runtime and exhibitions per year). There was, however, a noticeable decrease in volume (as well as runtime) during the 1950s. The bottom of this dip was in 1958 and may have been related to a major fire that severely damaged the museum in April of that year[3]. However, since the decline started several years prior, it may have been due to a more holistic phenomenon, such as the new pop art movement which presented a challenge to the more traditional modern art previously exhibited at MoMA[4].

Number of artists exhibited per year and number of artists per exhibition both remained relatively stable over time. While the average number of artists per exhibition was only twenty, there were nine exhibitions that featured more than 250 artists. Surprisingly, photographs were used as an exhibition theme more often than paintings (124 to 123).

Overall, MoMA's exhibitions gained in volume and (slightly) in runtime likely due to MoMA's growth in popularity and status. MoMA likely improved its ability to feature well-known artists (e.g. Pablo Picasso) and optimize runtimes (roughly two months) to maximize both the exhibitions' attendance and revenue.

## B - Artist Demographics

The typical artist exhibited at MoMA from 1929 to 1989 was a middle-aged, American or Western European male who was living at the time of his exhibition.

More than half of all artists exhibited were living at the time of their exhibitions, while just under one-quarter were exhibited posthumously (the state of the remainder is unknown). The dominance of living artists is to be expected in a modern art museum, since the time period of this dataset coincides approximately with the last 60 years of the modern art period. However, the proportion of posthumous exhibitions increased over the time period, which was likely due to increasing numbers of deaths of earlier modern artists who continued to be frequently shown (and this trend is likely to continue to the present day).

Similarly, the average artist age showed an upward trend over this time period. One probable explanation is that some of the earliest modern artists, such as Pablo Picasso and Henri Matisse, were exhibited hundreds of times (see Section 4BIV), which may have contributed to driving up the average age over time. Another conclusion that may be drawn from the upward trend is that as MoMA became a more established institution, it showed more established artists, who tend to be older. In further support of these theories, analysis of the exhibiting artists by generation showed that artists born between 1880 and 1899 were by far the most frequently shown. Not surprisingly, this generation includes some of the most popular and well-known modern artists of all time,

[3] https://en.wikipedia.org/wiki/Museum_of_Modern_Art#1958_fire

[4] http://www.theartstory.org/movement-pop-art.htm

including Pablo Picasso, Joan Miro, Georges Braque, Marc Chagall, Georgia O'Keeffe, and Diego Rivera. Interestingly, each of the three most popular generations (1880–1899, 1900–1919, and 1920–1949) dominated three consecutive periods (1930s and 1940s; 1950s; and 1960s, 1970s, and 1980s, respectively). This would suggest that the mean artist age should have been more consistent over the decades. However, it appears that there were enough of the earlier artists shown in the later exhibitions to overcome this trend and escalate the average age over time.

MoMA's exhibitions during this time period overwhelmingly featured American artists, who were shown at more than six times the frequency of the next most represented nationality (French). As MoMA is an American museum, the United States has a much larger general population than most of the other countries represented, and American artists were very active in modern art movements, this is unsurprising, Ten of the top 20 most represented nationalities were Western European, which is also unsurprising since the region is widely considered to be the birthplace of modern art[5]. By decade, Americans consistently made up approximately 50% of all exhibiting artists and Western Europeans consistently made up 60–70% of foreign exhibiting artists; even as the world became increasingly globalized, the representation of non-American and non-Western European artists did not significantly increase.

Female artists were dramatically under-represented in the exhibitions considering they make up almost half of the overall population. The much lower likelihood of female artists to be exhibited multiple times and to receive solo exhibitions indicates that female artists were not only at a numerical disadvantage, but also lacked the status and recognition given to their male peers.

There are many possible explanations for this phenomenon; it is likely that a combination of different factors contributed to the disparity. One explanation is that there may have been fewer female artists practicing during this time period, which is a logical assumption since there were fewer women than men in almost all professions during this time. However, representation of female artists in the exhibitions was much lower than representation of female workers in the overall civilian workforce in the United States and did not show similar year-over-year improvement. Another explanation is that since the museum administration was mostly made up of men, they may have been consciously or unconsciously biased toward selecting male artists to exhibit (though it was founded by a group of women, MoMA has never had a female director). A third explanation is that both the development of artists and the works of art themselves are determined by social institutions, including art academies, systems of patronage, and cultural norms, which historically have strongly favored male artists and rejected female ones.[6]

Surprisingly, the decade of the highest representation of female artists before the 1980s is the 1950s, a decade that is notorious for its gender inequality in American culture. Also surprisingly, the decade of the lowest representation of female artists after the 1920s is the 1960s, the decade of the Women's Liberation Movement. If the exhibitions were influenced by overall cultural attitudes toward gender equality, it is possible that these effects were not reflected in the artist selections until some years later, which might have pushed their numbers into the next decade.

The data shows a modest trend of improvement in the gender imbalance over the decades, which is consistent with the many societal improvements in gender equality that took place during this time period. However, gender disparity in the visual arts is still a major issue today; of 590 major exhibitions by nearly 70 institutions in the United States from 2007 to 2013, only 27% were devoted to female artists.[7]

[5] http://www.visual-arts-cork.com/modern-art.htm#beginning

[6] *Women, Art and Power and Other Essays*, Westview Press, 1988 by Linda Nochlin.

[7] https://nmwa.org/advocate/get-facts

## C - Political & Economic Context

There is some relationship between the volume of exhibitions (number of days per year) and the political party in power in the White House, Senate, and House of Representatives, but with our current analysis we are unable to determine how strong that relationship is.

We did not find a strong relationship between the volume of exhibitions (number of days per year) and economic indicators (the performance of the stock market and GDP growth) in a given year.

# 6. SUGGESTIONS FOR FUTURE RESEARCH

Other avenues of research that would complement the analyses in this report are as follows:

## A - Overall

1. Analysis of all data for the last 27 years of MoMA's exhibitions (1990-present).
2. Analysis of similar exhibition data from competing institutions such as the Whitney Museum of American Art and the Solomon R. Guggenheim Museum to explore similarities and differences.
3. Further analysis of MoMA's exhibitions in the 1950s, which was shown to be a decade of changing trends for a number of different variables.

## B - Exhibition Information

4. Further analysis of the trends in the exhibitions, such as which exhibitions were organized by a particular curator or which artists are most frequently exhibited with another artist.
5. Analysis of data about the specific content of the exhibitions to look at trends over time (e.g. which artistic movements are least and most represented, least and most well-attended, exhibited for the least and most amount of time, etc.).

## C - Artist Demographics

6. Analysis of data about artist ethnicity. It would be interesting to look specifically at the distribution of the American artists' ethnicities as compared to the ethnic breakdown of the general population in the United States to determine if there is proportional representation.
7. For the American artists, analysis of specific residence data (i.e. city or state) in order to explore which regions in the U.S. hosted modern art activity at different times.

## D - Political & Economic Context

8. Analysis of sources of funding for MoMA's exhibitions, in order to further explore whether there is a link between economic prosperity and/or political influence and funding for the arts.

## E - MoMA's Operations

9. Qualitative research through interviews with MoMA staff and modern art historians to understand more about their processes/policies regarding exhibition design and artist selection.
10. Analysis of data about MoMA's attendance (general and exhibition) to understand how the exhibitions impact museum visitor traffic.
11. Analysis of data about MoMA's merchandise sales revenue to understand how the exhibitions impact sales.
12. Analysis of data about the cost of each exhibition to examine correlations with other variables,

including number of artists exhibited, exhibition run time, and exhibition content.

13. Analysis of data about exhibition sponsors to examine correlations with other variables.
14. Analysis of data about MoMA's endowment by year to examine correlation with the volume of exhibitions in that year.
15. Analysis of non-artist constituents such as curators, directors, and trustees to examine their demographic makeup and to look for correlations with artist demographics.