Model Exploration

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Table of contents

Preface

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1 + 1
```

```
[1] 2
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1 Quantifying Art Historical Narratives, Chapter 1

1.1 Abstract

My project surveys the development of *Janson's History of Art* across its eight editions as well as *Gardner's Art Through the Ages* through its sixteen editions, looking particularly at the change in artist demographic through time. Additionally, this paper investigates which external variables such as artist gender, ethnicity, race, nationality, number of exhibitions at the Museum of Modern Art and The Whitney, and number of publications on WorldCat, if any, help predict the magnitude of an artist's inclusion in art history survey texts. I conduct data analysis to assess the demographic representation of artists through editions of *Janson's History of Art* and *Gardner's Art Through the Ages*, a proxy for the art history survey. I compare artist demographics through editions of Janson and Gardner. My findings indicate that coverage of minority artists (defined as non-white and/or Hispanic or Latinx and/or female) increases across editions of *Janson's History of Art* and *Gardner's Art Through the Ages*, but remains negligible compared to white male non-Hispanic or Latinx artists. Moreover, in *Janson's History of Art* through all editions, the percentage of artists who are white is 98.04%, the percentage of artists that are male is 92.47%, and the percentage of artists that are not Hispanic or Latinx is 92.04%. In *Gardner's Art Through the Ages*, through all editions, the percentage of artists who are white is 92.76%, the percentage of artists that are male is 90.47%, and the percentage of artists that are not Hispanic or Latinx is 90.94%. Both texts display a narrative of the history of art as being predominantly white, male, non-Hispanic or Latinx. Regarding nationality, in Janson, 81.52% of the artists are American, British, French, German, and Spanish, which is very similar to Gardner's 79.30% of those five same nationalities. I have chosen to run a linear mixed-effects model with a random effect of `artist_name`, to infer the magnitude of the ratio of space given to a particular artist, `space_ratio_per_page_total` in *Janson's History of Art* and *Gardner's Art Through the Ages,* using the predictor variables: `artist_race`, `artist_gender` , `artist_ethnicity` , `artist_nationality_other` , `moma_count_to_date` , `whitney_count_to_date`, and the two interaction variables of `artist_gender*moma_count_to_date` and `artist_nationality_other*moma_count_to_date`. With a log transformation applied to the outcome variable, `space_ratio_per_page_total` as it is heavily right-skewed, my linear mixed-effects model yields a conditional r squared of 53.21%. Such denotes that 53.21% of the proportion of total variance of the outcome variable,

`space_ratio_per_page_total` is explained through the fixed predictor variables as listed above and the random effect of `artist_name`.

JEL Numbers: C80, Y10, Z11

Key Words: Cultural Economics, Art History, Statistics, Historiography, Data Collection Methodology, Linear Mixed-Effects Modeling.

Data Preparation:

1.2 Introduction and Context

1.2.1 Inspiration for Research:

Heading into the second semester of my junior year, I scheduled a zoom meeting with my now undergraduate thesis advisor, Prof. Hans van Miegroet, to ask a few questions about my aspirations after college. He had been my professor for his course, "History of Art Markets," a learning experience at Duke that has permanently altered my worldview. The meeting began with me expressing my enjoyment of the course, and the appreciation of the discussion of transparency in the buying and selling of art. I asked his opinion of whether I should stick to studying architectural history with hopes of going to architecture school, or pivot to do further research under him in his graduate course, "Arts and Markets" that I had enrolled in for that Spring. Towards the end of the meeting, he asked me what I found most interesting about art, to which I replied, "Ever since I took my first Art History course, I've always been curious as to why I am introduced to the works I am. Who is choosing what I study versus what I don't study?" I explained to him. I had initially learned the story of art through Marilyn Stokstad's, *Art History* my final year of high school. At the end of that school year, I inquired to my teacher, Carolyn Paczkowska, in a class discussion, "Why are we studying the works that we have?" The class discussed gatekeepers of art and information and later ended in the conclusion of uncertainty. Prof. van Miegroet looked at me through the computer screen and stated I had found my research question for my Undergraduate Honors Thesis, that I had found my why.

My research began solely looking at how art history textbooks changed through time, then developed into looking at using a linear mixed effect model to infer which external variables would if at all work to predict the magnitude of space (of text and of figure of their work or works) given to an artist in a given book.

1.2.2 Why *Gardner's Art Through the Ages:*

1.2.2.1 Discourse of Authorship:

1.2.2.2 Literature Review:

(Discourse of dominance through time of the text, find and add sources and if available sales information through time)

REACH OUT FOR SALES DATA TO PUBLISHERS

Britannica

- The lack of a comprehensive single-volume textbook on art history prompted Gardner to write one herself, and the resulting Art Through the Ages (1926) far surpassed other available works in readability, breadth of coverage, and wealth of illustration. It remained a widely used text for decades. In 1932 she published Understanding the Arts, aimed at a wide general audience. A second edition of Art Through the Ages, greatly expanded, appeared in 1936; **the first two editions sold more than 260,000 copies.** Gardner had been named an assistant professor in the Art Institute school in 1929, and in 1933 she became a professor and head of the department of art history. She retired from the Art Institute school in 1943. Despite declining health she managed to complete work on the manuscript of a third edition of Art Through the Ages (published in 1948).

Sources Found to Looking Into:

- Franciscono, Marcel.

  1977. "History, Textbooks, and Art: Reflections on a Half Century of Helen Gardner's"Art through the Ages"." Critical Inquiry 4 (2) (Winter): 285. https://login.proxy.lib.duke.edu/login?u rl=https://www.proquest.com/scholarly-journals/history-textbooks-art-reflections-on-half-century/docview/1297337757/se-2?a ccountid=10598.

- Jaffee, Barbara. "9."Gardner" Variety Formalism: Helen Gardner and Art through the Ages" In Partisan Canons edited by Anna Brzyski, 203-224. New York, USA: Duke University Press, 2007. https://doi.org/10.1515/9780822390374-010.

Table 1: Edition Number, Year of Publication, Title, Authorship, and Publisher Over Time of All Cataloged Editions of Gardner's Art Through the Ages.

Edition	Year of Publication	Author(s)	Title	Publisher (as listed per Edition)
1	1926	Helen Gardner	Art through the ages; an introduction to its history and significance	New York, Brace, Harcourt
2	1936	Helen Gardner	Art through the ages; an introduction to its history and significance	New York, Brace, Harcourt
3	1948	Helen Gardner	Art through the ages	New York, Brace, Harcourt
4	1959	Helen Gardner; revised by Sumner M. Crosby and the Dept. of the History of Art, Yale University	Art through the ages	New York, Harcourt, Brace
5	1970	Revised by Horst de la Croix, Richard G. Tansey	Gardner's art through the ages	New York, Harcourt, Brace
6	1975	Helen Gardner; revised by Horst de la Croix, Richard G. Tansey	Gardner's art through the ages	New York: Harcourt Brace Jovanovich
7	1980	Helen Gardner; revised by Horst de la Croix, Richard G. Tansey	Gardner's art through the ages	Harcourt Brace Jovanovich, New York
8	1986	Horst de la Croix, Richard G. Tansey	Gardner's art through the ages	Harcourt Brace Jovanovich, San Diego, CA
9	1991	Horst de la Croix, Richard G. Tansey, Diane Kirkpatrick	Gardner's art through the ages	San Diego: Harcourt Brace Jovanovich
10	1996	Richard G. Tansey, Fred S. Kleiner	Gardern's art through the ages	Fort Worth, TX: Harcourt Brace
11	2001	Fred S. Kleiner, Christin J. Mamiya, Richard G. Tansey	Gardner's art through the ages	Fort Worth TX: Harcourt College Publishers
12	2005	Fred S. Kleiner, Christin J. Mamiya	Gardner's art through the ages	Thomson/Wadsworth, Belmont, CA
13	2009	Fred S. Kleiner	Gardner's art through the ages: a global history	Boston, Thomson/Wadsworth

Edition	Year of Publication	Author(s)	Title	Publisher (as listed per Edition)
14	2013	Fred S. Kleiner	Gardner's art through the ages: a global history	Australia ; United States : Wadsworth, Cengage Learning
15	2016	Fred S. Kleiner	Gardner's art through the ages: a global history	Boston, MA : Cengage Learning
16	2020	Fred S. Kleiner	Gardner's art through the ages: a global history	Boston, MA, US : Cengage Learning

Discourse of Authorship Through Editions: NEEDS TO BE ADDED

Table 4: Authors of Gardner's Art Through the Ages: NEEDS TO BE ADDED

Literature Review: NEEDS TO BE ADDED

1.2.3 Why *Janson's History of Art*:

Such a text is claimed to be the most influential art history survey through time by myriad art historians such as Jeffery Wiedman, Zoë Ingalls, John Russell, Alexandra Peers, Elizabeth Sears and Charlotte Schoell-Glass to name a few. Alexandra Peers in her publication for ARTnews.com in February of 2006, claims that "it was Janson who, more than any other art historian, pioneers the 'in and out' celebrity model of art history. There were artists who matter, he argued, and those who didn't."[1] Janson's formation of his history of art is not only arguably the most dominant art history survey over time, but also he holds a reputation of being a gatekeeper of art history. He states at the end of his introduction in the first and second editions that after having read his text, one "shall have joined the active minority that participates directly in shaping the course of art in our time."[2] He recognizes his role as an individual who shapes the narrative of the history of art, while convincing the reader that after having read his text, one has the agency to be a gatekeeper alongside him . Such agency is only granted once one understands his digestion of the most important works and artists through time .

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[1] Alexandra Peers, "Canon Fodder," Artnews.com, (February 1, 2006), https://www.artnews.com/art-news/news/canon-fodder-135/.

[2] H. W. Janson and Dora Jane Janson, (1963), History of Art: A Survey of the Major Visual Arts from the Dawn of History to the Present Day, First Edition, Second Printing, New York: Harry N. Abrams: 17.

It would be most comprehensive if we were to have access to the total number of sales per edition of Janson's History of Art, to use as tangible data to show the relevance and importance of the text through time. Both publishers, Harry N. Abrams and Prentice-Hall (now Pearson Prentice-Hall) have declined sharing sales information in the aggregate. By leafing through various scholarly publications, there is imperfect data of sale information worth noting when discussing the dominance of Janson's History of Art through time. The text was at its height of sales between when it was initially released in 1962 through H. W. "Peter" Janson's death in 1982 (refer to Table 1 for complete information of each edition). Art historian, Patricia Hills cites in her publication in Artforum, "in 1973 the Janson text had 46% of the market, while Gardner's 5th edition had 24%, followed by Gombrich's, 8.5%, Cleaver with 3% and miscellaneous 'other' with 18.5%."[3] At the time such a report had been made, the first edition (1962), the first edition revised and enlarged (1969) had been released. Additionally, it was written by John Russell of the New York Times in October of 1982 that "well over two million copies have been sold."[4] Russell does not specify whether these sales numbers are solely the first edition of Janson's History of Art, or the first edition as well as the first edition revised and enlarged and the second edition (1977) . He also added that the text had been "translated in 14 languages and is widely regarded as both an essential teaching instrument and a book that can be read and looked at with continuous enjoyment."[5] Here, Russell perpetuates the significance of Janson's survey, as well as providing information about the breadth of Janson's text, reaching more than solely English-reading audience s.

Conversely, Zoë Ingalls in a publication in August of 1995 discussing Janson's relevance through time, cites that "the first edition sold more than a million copies."[6] Though there are informational discrepancies, it is clear that Janson's History of Art was prolific as a survey text of art for over 20 years. The narrative remained significant from the third (1986) through the fifth edition (1995), which were all revised by Anthony "Tony" F. Janson, son of Peter and Dora Jane. Ingalls states that "the fourth edition, published in 1991, sold 21,000 copies the first year and an average of 11,000 copies a year in the past four years. The new fifth edition, has sold more than 13,000 copies since its March release."[7] She continues, "Although its sales

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[3]Market Research Report on Introductory Art History, dated March 15, 1972, prepared for McGraw-Hill College Textbook Division and Follow-up Report, dated Spring, 1973. Citation from Patricia Hills, "Art History Textbooks: The Hidden Persuaders," Artforum, (Summer 1976), https://www.artforum.com/print/197606/art-history-textbooks-the-hidden-persuaders-69128.

[4]John Russell, "Prof H. W Janson is Dead at 68; Wrote Best-Selling 'History of Art,'" The New York Times, (October 3, 1982), https://www.nytimes.com/1982/10/03/nyregion/prof-h-w-Janson-is-dead-at-68 -wrote-best-selling-history-of-art.html.

[5]John Russell, "Prof H. W Janson is Dead at 68; Wrote Best-Selling 'History of Art,'" The New York Times, (October 3, 1982), https://www.nytimes.com/1982/10/03/nyregion/prof-h-w-Janson-is-dead-at-68 -wrote-best-selling-history-of-art.html.

[6]Zoë Ingalls, "A Son Revises His Father's Classic Art-History Textbook," The Chronicle of Higher Education, (August 11, 1995), https://www.chronicle.com/article/a-son-revises-his-fathers-classic- art-history-textbook/.

[7]Zoë Ingalls, "A Son Revises His Father's Classic Art-History Textbook," The Chronicle of Higher Education, (August 11, 1995), https://www.chronicle.com/article/a-son-revises-his-fathers-classic- art-history-textbook/.

have been eclipsed over the last 10 years by another perennial favorite, R.H. Gardner's Art Through the Ages, Janson is still the standard in many people's minds."[8] Notably, she does not mention any total sales information about Gardner's survey text, just that over the past decade (1985-1995), its sales trumped that of Janson' s.

After the sixth edition (2001) and the sixth edition revised (2004) the last with authorship by Tony Janson, Harry N. Abrams and Prentice Hall were unsatisfied by the total sales, as well as the overall structure and content of the text as they were criticized for having lost touch with young readers.[9] At the same moment, Harry N. Abrams sold all rights to the newly formed Pearson Prentice Hall, who recruited new authorship of six various art historians across the United States: Penelope J. E. Davies, Walter B. Denny, Frima Fox Hofrichter, Joseph Jacobs, Ann M. Roberts, and David L. Simon (refer to Table 2). Such change was received negatively by art historians, which is reflected in the text's further decline in sales. [10] It has been estimated by Bookauthority.com (a cite whose source for this information is very unclear) that the eighth edition revised, published in 2015 has had 2,000 total copies sold, while competing art historical narratives such as Marilyn Stokstad and Micheal W. Cothren's History of Art Vol . 1 has had an estimated 10,000 copies sold since its release in 2017 .[11] Such has left Janson's History of Art as a minor player in art historical narratives toda y.

Table 2: Edition Number, Year of Publication, Title, Authorship, and Publisher Over Time of All Cataloged Editions of Janson's History of Art.

Edition Number	Year of Publication	Authors	Title	Publisher (as listed per Edition)[12]
1	1963[13]	H.W. Janson with Dora Jane Janson[14]	History of Art: A Survey of the Major Visual Arts from the Dawn of History to the Present Day	Harry N. Abrams, Inc., New York

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[8]Zoë Ingalls, "A Son Revises His Father's Classic Art-History Textbook," The Chronicle of Higher Education, (August 11, 1995), https://www.chronicle.com/article/a-son-revises-his-fathers-classic- art-history-textbook/.

[9]Alexandra Peers, "Canon Fodder."

[10]Jeffrey Weidman, "Many Are Culled but Few Are Chosen: Janson's History of Art, Its Reception, Emulators, Legacy, and Current Demise." Journal of Scholarly Publishing 38, no. 2 (January 2007): 96. https://muse.jhu.edu/article/209994/pdf.

[11]"100 Best-Selling Art HIstory Books of All Time," Book Authority, https://bookauthority.org/books/best-selling-art-history-books.

Edition Number	Year of Publication	Authors	Title	Publisher (as listed per Edition)[12]
1 (Revised and Enlarged)	1969	H. W. Janson with Dora Jane Janson	History of Art: A Survey of the Major Visual Arts from the Dawn of History to the Present Day	Prentice-Hall Inc., Englewood Cliffs, New Jersey and Harry N. Abrams, Inc., New York.
2	1977	H. W. Janson with Dora Jane Janson	History of Art: A Survey of the Major Visual Arts from the Dawn of History to the Present Day	Harry N. Abrams, Inc., New York.
3	1986	H. W. Janson; Revised and Expanded by Anthony F. Janson	History of Art	Harry N. Abrams, Inc., New York and Prentice-Hall Inc., Englewood Cliffs, New Jersey.
4	1991	H. W. Janson; Revised and Expanded by Anthony F. Janson	History of Art	Harry N. Abrams, Inc., New York.
5	1995	H. W. Janson; Revised and Expanded by Anthony F. Janson	History of Art	Harry N. Abrams, Inc., New York.
6	2001	H. W. Janson and Anthony F. Janson	History of Art	Harry N. Abrams, Inc., New York.
7	2007	Penelope J. E. Davies, Walter B. Denny, Frima Fox Hofrichter, Joseph Jacobs, Ann M. Roberts, David L. Simon	Janson's History of Art: The Western Tradition	Pearson Prentice Hall, Upper Saddle River, New Jersey.
8	2011	Penelope J. E. Davies, Walter B. Denny, Frima Fox Hofrichter, Joseph Jacobs, Ann M. Roberts, David L. Simon	Janson's History of Art: The Western Tradition	Pearson Prentice Hall, Upper Saddle River, New Jersey.

1.2.3.1 Discourse of Authorship Through Editions:

The primary author through the first six editions of Janson's History of Art is Horace Waldemar Janson (1913-1982), colloquially referred to as Peter. He was born in 1913 in St. Petersburg, Russia. His parents were of Swedish and Latvian descent. The family moved to Hamburg, Germany after the Russian Revolution. Janson studied at Munich and then at the University in Hamburg where he was a student of Erwin Panofsky, a prolific art historian known for his contributions to the studies of symbols and iconography in art. In 1935, at the suggestion of his advisor, Janson fled Germany under the sponsorship of Alfred Barr, director of the Museum of Modern Art in New York. Janson studied at Harvard between 1935 and 1942, completing a PhD in art history. His most significant professorial position began in 1949, where he was appointed professor and later chairman of the department of art at New York University. He remained in such a role for 25 years as he grew the department's prestige, solidifying its reputation as one of the most conservative art history programs in the country. A decade later, in 1959, Janson issued a book titled, Key Monuments of the History of Art, in efforts to aid his undergraduates in their study of art as the availability of good personal study images were not easily accessible. Such publication sparked Janson's History of Art released in 1962, a survey of art written with his wife, Dora Jane Janson.

Born Dora Jane Heineberg (1916-2002) in Philadelphia in 1916, she shared a passion for art with Peter. The two met in Cambridge, Massachusetts as she attended Radcliffe College as an undergraduate student while Janson was studying at Harvard. Dora Jane Janson worked with her husband on many publications, but her most notable achievement came in 1971 when she wrote an exhibition catalog for the Nasher Museum of Art at Duke on Art Nouveau jewelry, titled From Slave to Siren: The Victorian Woman and Her Jewelry from Neoclassic to Art Nouveau. Authorship of Janson's History of Art was handed over to one of the couple's four children, Anthony F. Janson, after the sudden passing of Peter Janson in 1982.

Anthony Frederick "Tony" Janson was born March 30th, 1943 in St. Louis, Missouri. The Jansons moved to New York in 1949, and Tony Janson frequently visited the city's museums as a child and teenager. In 1954, the Jansons spent a year in Europe. In an interview, Tony Janson describes his attitude upon the family's return to New York as one of " total rebellion" eventually causing his parents to search for a school that would engage him better academically.[15] Janson details how he rediscovered a love for learning after enrolling at Riverdale

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[12]There are discrepancies through the first and sixth editions of only Harry N. Abrams being listed as the publisher on the book itself and Harry N. Abrams and Prentice-Hall both being listed. Harry N. Abrams was the primary publisher through the first sixth editions as Prentice-Hall was their distributor.

[13]I cataloged the first edition, second printing, published in 1963, but the first edition, first printing was published in 1962. There is no different between printings.

[14]Dora Jane Janson is only listed upon opening the book to the title page. She is not listed anywhere on the exterior of the Janson's History of Art across the first edition, second printing, first edition (revised and enlarged) fourteenth printing, nor the second edition.

[15]Anthony Janson, interview by Sherman Hayes, University of North Carolina Wilmington Archives and Special Collections, (March 15-19, 2007): 11.

Country School on a full scholarship, and it is at this time that he began to study art history. Janson experimented as an artist himself, and cited his early affection for photography as the reason he was the first to add that medium to a survey textbook of art history. [16] Educated at Columbia and Harvard, Janson was asked to continue the work of his father as author of Janson's History of Art . Unable to revise the entire textbook in time, Janson "added women, which was long overdue."[17] and photography to the textbook for the third editio n. After returning from the Vietnam War, Janson earned his PhD in art history from Harvard and went to teach at the College of Charleston before transitioning to a career as chief curator of the Indianapolis Museum of Ar t. In 1984 Janson moved to the Ringling Museum of Art in Sarasota, Florida, and then he was Chief Curator of the North Carolina Museum of Art from 1989 to 199 3. Janson spent the rest of his career at UNC Wilmington and retired in 200 2. The last edition of Janson's History of Art that he worked on was the sixth revised, and he viewed his revisions of Janson's History of Art as more in line with his father's approach than the rest of his own scholarshi p.

The seventh and eighth editions were rewritten by a group of art historians across the United States: Penelope J. E. Davies, Walter B. Denny, Frima Fox Hofrichter, Joseph Jacobs, Ann M. Roberts, and David L. Simon. In Table 2, each author's name, gender, ethnicity and nationality are listed, with question marks next to Frima Fox Hofrichter and Ann M. Roberts' nationality and Joseph Jacob's ethnicity as such information could not be found with full certainty. We observe here a desire to diversify authorship in efforts by the publisher to cater to young readership, and increase sales. Notably, there is gender diversity, with a fifty-fifty split of male to female authorship, though a complete lack of racial diversity, which is a notion reflected additionally in the text itself. Since the Janson name has left the book's authorship, the text has declined significantly from being the most dominant art historical survey.[18]

Table 3: Authors of the Seventh and Eighth Editions of Janson's History of Art.

Author	Gender	Ethnicity	Nationality	Description (As listed by Publisher)
Penelope J. E. Davies	Female	White	American	Associate Professor at the University of Texas, Austin. She is a scholar of Greek and Roman art and architecture as well as a field archaeologist. She is an author of Death and the Emperor: Roman Imperial Funerary Monuments from Augustus to Marcus Aurelius, and winner of the Vasari Award.

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[16] Anthony Janson, interview by Sherman Hayes, University of North Carolina Wilmington Archives and Special Collections, (March 15-19, 2007): 7.

[17] Anthony Janson, interview by Sherman Hayes, University of North Carolina Wilmington Archives and Special Collections, (March 15-19, 2007): 9.

[18] Jeffrey Weidman, "Many are Culled but Few Are Chosen," 94.

Author	Gender	Ethnicity	Nationality	Description (As listed by Publisher)
Walter B. Denny	Male	White	American	Professor of Art History at the University of Massachusetts at Amherst. In addition to exhibition catalogues, his publications include books on Ottoman Turkish carpets, textiles, and ceramics, and articles on miniature painting, architecture and architectural decoration.
Frima Fox Hofrichter	Female	White (?)	Dutch	Professor and former Chair of the History of Art and Design department at Pratt Institute. She is the author of Judith Leyster, A Dutch Artist in Holland's Golden Age, which received CAA's Millard Meiss Publication Fund Award.
Joseph Jacobs	Male	White (?)	American	An independent scholar, critic, and art historian of modern art in New York City. He was the curator of modern art at the John and Mable Ringling Museum of Art in Sarasota, Florida, director of the Oklahoma City Art Museum, and curator of American art at The Newark Museum, Newark, New Jersey.
Ann M. Roberts	Female	White (?)	American	Professor of Art at Lake Forest College, she has published essays, articles and reviews on both Northern and Italian Renaissance topics. Her research focuses on women in the Renaissance, and her most recent publication is entitled Dominican Women and Renaissance Art: The Convent of San Domenico of Pisa.
David L. Simon	Male	White	American	Jetté Professor of Art at Colby College where he received the Basset Teaching Award in 2005. Among his publications is the catalogue of Spanish and southern French Romanesque sculpture in the Metropolitan Museum of Art and The Cloisters.

1.2.3.2 Literature Review:

Many are Culled but Few are Chosen: Janson's History of Art, Its Reception, Emulators, Legacy, and Current Demise

The publication by art historian Jeffrey Weidman, released in January, 2007 in the Journal of Scholarly Publishing begins by reviewing in detail the lineage of English-language art history surveys in America, and the Jansons' text therein; discusses in detail the various reviews of the Jansons' and other survey texts, namely Helen Gardner's *Art Through the Ages*, and Marilyn Stokstad et al.'s *Art History*.[19] He concludes that Janson's History of Art functioned as the dominant art history survey through time. Secondly, Weidman discusses the changes of Janson's History of Art between the sixth edition revised, the last edition written by Peter and Tony Janson, and the seventh edition written by the six various art historians (Table 2).

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[19] Jeffrey Weidman, "Many Are Culled but Few Are Chosen: Janson's History of Art, Its Reception, Emulators, Legacy, and Current Demise." Journal of Scholarly Publishing 38, no. 2 (January 2007): 85-107. https://muse.jhu.edu/article/209994/pdf.

He believes that the seventh edition is a disgrace to Janson's text, and the beauty of Janson's analytically writing has been completely stripped in the seventh edition. He also discusses, yet only through a handful of examples, artists and works which were taken out as well as added between the sixth edition revised and the seventh (for a comprehensive understanding of artists taken out and added through time refer to Fig. ___). Notably, such publication does not discuss data in the aggregate when looking at who is included and excluded, and rather only looks in detail at the changes between the sixth edition revised and the seventh edition.

Revising Art History's Big Book: Who's In and Who Comes Out?

This article published by Randy Kennedy in March of 2006 in the New York Times, also discusses the change between the sixth edition revised and the seventh edition of Janson's *History of Art.*[20] Kennedy looks at only a few artists and works who leave and are added, particularly baffled by the exclusion of James Abbot McNeill Whistler's Arrangement in Black and Gray: The Artist's Mother. He interviews Sarah Touburg, an editor of the seventh edition who claims that upwards of 25% of the book's content had been altered between the sixth edition revised and the seventh edition. Interestingly, Kennedy claims that the new book adds more women and it uses art much more as a way to discuss race, class and gender. Such an observation is not reflected in our data, which can be seen in figures ___, ____, and ____. This publication also discusses the dominance and influence that Janson's History of Art has had over time, as well as its decline as the best-selling art survey in recent years. Kennedy states that a shift in authorship was done in efforts to revitalize Janson's relevance to younger audiences. Though this publication discusses the change between two editions, Kennedy does not do so in the aggregate.

Discussions and Depictions of Women in H. W. Janson's History of Art, Fourth Edition

Art historian Paul E. Bolin discusses gender inequality through the first four editions of *Janson's History of Art.*[21] He states that a primary criticism of Janson's text is its lack of attention given to the importance of work of women artists. The first two editions did not include any women, then there was an influx of female artists when Tony Janson claimed primary authorship for the publication of the third edition in 1986. Bolin argues that even with the edition of female artists in the third and fourth editions, there is still not enough representation and that additionally the fashion in which Tony discusses female artists is apologetic and at times problematic. Bolin uses simple statistics in his discourse, having counted a total of 9 out of the 28 new artists added to the fourth edition as female. Bolin does not discuss racial discrimination, nor does he use complete data in the aggregate when looking gender discrimination.

Significance of Research:

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[20] Randy Kennedy, "Revising Art History's Big Book: Who's In and Who Comes Out?" New York Times, (March 7, 2006), https://www.nytimes.com/2006/03/07/arts/design/revising-art-historys-big-book- whos-in-and-who-comes-out.html.

[21] Paul E. Bolin, "Discussions and Depictions of Women in H. W. Janson's History of Art, Fourth Edition," Journal of Social Theory in Art Education, Vol. 15.(1996), pp. 146-159. https://core.ac.uk/download/pdf/51288476.pdf.

There has not been research done in the aggregate, quantitatively analyzing the change over time in Janson's History of Art nor Gardner's Art Through the Ages. My research is significant as it efficiently shows the gaps of representation in terms of gender, nationality, race and ethnicity that have not been deeply touched on by previous scholars. Additionally, I am able to statistically display through a multiple linear regression which external variables are most impactful when it comes to an artist entering an art historical narrative.

2 Research Questions:

1. What are the demographics (Race, Gender, Ethnicity, Nationality) of artists included in each edition of Janson's History of Art (from 1962-2011) and Gardner's Art Through the Ages (from 1926-2020) looking at two-dimensional works after c. 1750?

   Hypothesis: Janson's History of Art and Gardner's Art Through the Ages will include more female, nonwhite, Hispanic or Latinx artists over time; however, these artists will still be dramatically underrepresented compared to white male artists. Moreover, race and ethnicity will be more of a limiting factor than gender.

   Relevance and reasoning: Janson's History of Art and Gardner's Art Through the Ages being a widely-used art history textbook, serves as a proxy for the traditional art historical narrative in our project. Thus, I interpret inclusion in Janson's History of Art and Gardner's Art Through the Ages as inclusion in the traditional art historical narrative. I hypothesize that the inclusion of marginalized—specifically, female non-white, and Hispanic or Latinx artists—increased across editions of both texts because of the increasing prominence of these artists in art museums, art markets, and art media. However, I predict these improvements in coverage will not result in equal representation with white male artists, who have historically dominated all facets of the art world. I also hypothesize that ethnicity and race will be a greater barrier to representation than gender, as previous research indicates that institutions have generally favored white women artists over Hispanic and Latinx artists and artists of color. Hispanic or Latinx women and women of color will suffer most from the authors' biases, as they are subject to entrenched structures of both racial/ethnic and gender discrimination.

2. Which variables (gender, race, ethnicity, nationality, number of exhibitions at the MoMA or The Whitney) if any, predict the magnitude of an artist's inclusion in art history survey texts (*Janson's History of Art* and *Gardner's Art Through the Ages*)?

   Hypothesis: I hypothesis demographic

   Relevance and reasoning:

3 Methodology: NEEDS TO BE ADDED

3.1 Data Dictionary:

Outcome:

`space_ratio_per_page_total` = The area of both the text and the figure of a particular artist in a given edition of *Janson's History of Art* divided by the area of a single page of the respective edition.

Potential Predictors:

`artist_gender` = The gender of the artist.

`artist_race` = The race of the artist.

`artist_ethnicity` = The ethnicity of the artist.

`artist_nationality_other` = The nationality of the artist. Roughly 80% of of the total count of artists through all editions of Janson account for French, Spanish, British, American and German. Therefore, the categorical strings of this variable are French, Spanish, British, American, German and Other.

`whitney_count_to_date` = The count of exhibitions held by The Whitney of a particular artist at a particular moment of time, as highlighted by `year`.

`moma_count_to_date` = The count of exhibitions held by the Museum of Modern Art (MoMA) of a particular artist at a particular moment of time, as highlighted by `year`.

`year` = The year of publication for a given edition of Janson or Gardner.

Other variables:

`edition_number` = The Edition Number of the textbook of their Janson or Gardner.

`book` = Which book, either Janson or Gardner the particular artist at that particular time was included.

`artist_unique_id` = A unique identifying number assigned to artists across books and editions denoted in alphabetical order.

3.2 Exploratory Data Analysis: *Gardner's Art Through the Ages* and *Janson's History of Art* Through Editions

Count Through Editions:

Overall Count of Artists in Gardner's Art Through the Ages
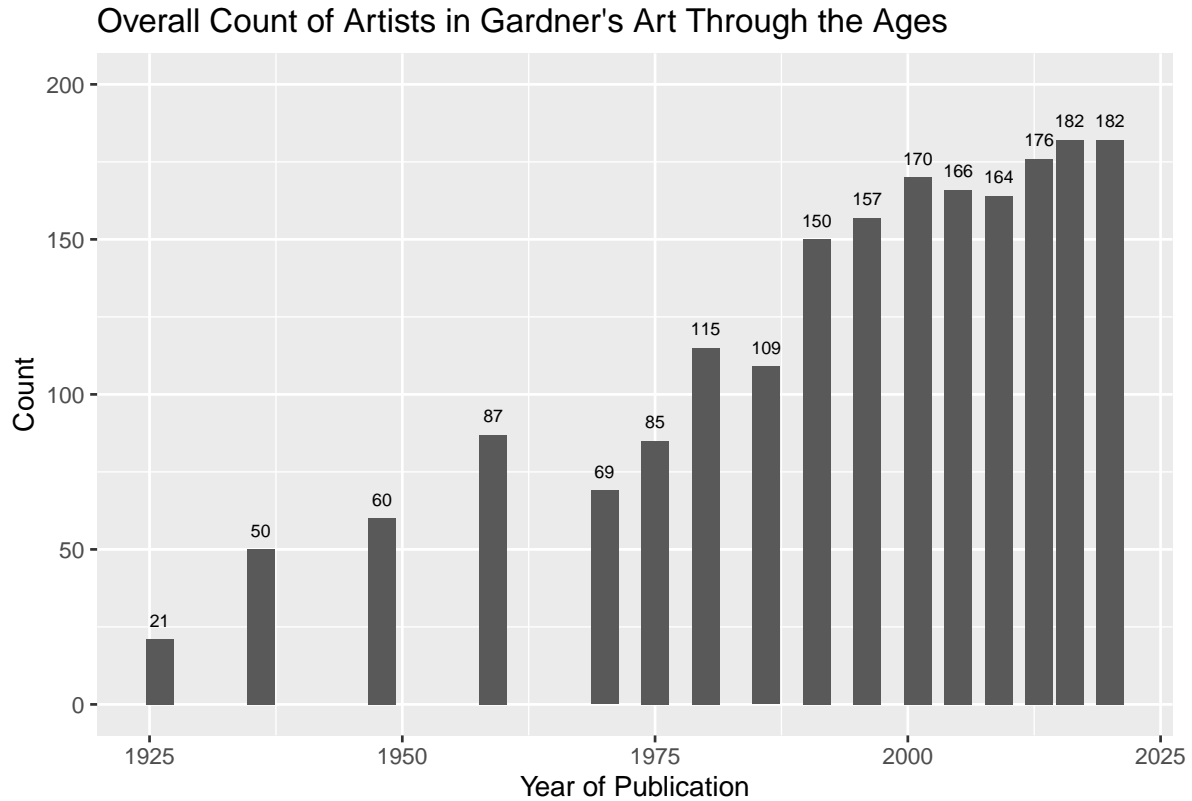

```
# A tibble: 164 x 15
# Groups:   artist_name [164]
  artist_name          edition_number  year artist_national~ artist_national~
  <chr>                         <dbl> <dbl> <chr>            <chr>
1 Aaron Douglas                    13  2009 American         American
2 Adolphe William Bougu~           13  2009 French          French
3 Albert Bierstadt                 13  2009 German-American  Other
4 Alfred Stieglitz                 13  2009 American        American
5 Ana Mendieta                     13  2009 Cuban-American   Other
6 André Derain                     13  2009 French          French
7 Andy Warhol                      13  2009 American        American
8 Angelica Kauffmann               13  2009 Swiss           Other
9 Anne Louis Girodet Tr~           13  2009 French          French
```

```
10 Anselm Kiefer                    13  2009 German         German
# ... with 154 more rows, and 10 more variables: artist_gender <chr>,
#   artist_race <chr>, artist_ethnicity <chr>, book <chr>,
#   space_ratio_per_page_total <dbl>, artist_unique_id <int>, moma_count <dbl>,
#   moma_count_to_date <dbl>, whitney_count <dbl>, whitney_count_to_date <dbl>
```

The shape of the overall count of works by artists in *Gardner's Art Through the Ages* is heavily left-skewed, multimodal, and asymmetrical. Such highlights how through time, more works are, on average, continually added to *Gardner's Art Through the Ages* that are two-dimensional and made after c. 1750. The first edition, published in 1926 by Helen Gardner, only has a a total of 21 works. Edition 15, published in 2016 as well as edition 16, published in 2020, have 182 works respectively, which is the maximum amount of works through all editions. There are some respective lulls and peaks through time, as in the fourth edition published in 1959, there are 87 works, while in the fifth published in 1970, there is a significant regression to 69 works. Such trend is evident as well in the seventh edition published in 1980, which has 115 works, while the eighth published in 1986 regresses to 109 works. There is yet another peak at edition eleven published in 2001, with 170 works. There is then a lull over the course of two editions, ending with edition thirteen published in 2009 having 164 works.

Overall Count of Works by Artists in Janson's History of Art
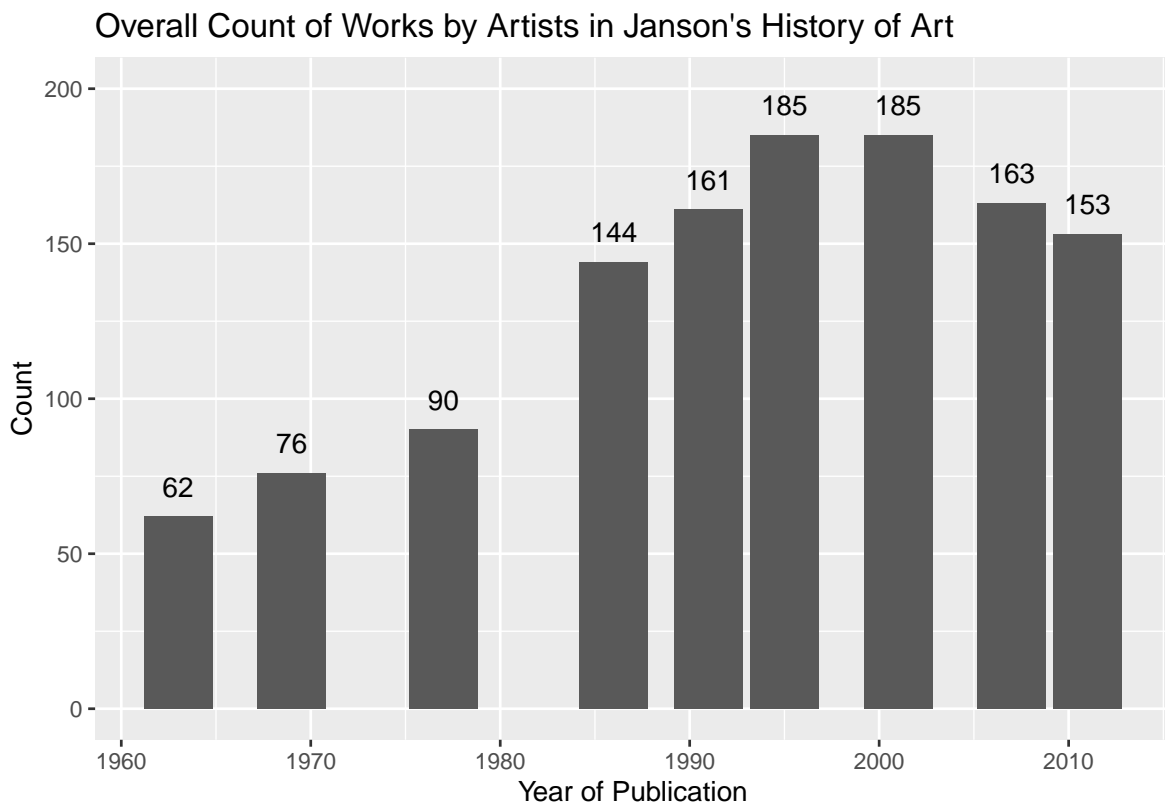
```
# A tibble: 153 x 15
# Groups:   artist_name [153]
   artist_name              edition_number  year artist_national~ artist_national~
   <chr>                             <dbl> <dbl> <chr>            <chr>
 1 Adolphe William Bougu~                8  2011 French           French
 2 Albert Pinkham Ryder                  8  2011 American         American
 3 Alexander Rodchenko                   8  2011 Russian          Other
 4 Alfred Stieglitz                      8  2011 American         American
 5 Ando Hiroshige                        8  2011 Japanese         Other
 6 André Derain                          8  2011 French           French
 7 Andy Warhol                           8  2011 American         American
 8 Angelica Kauffmann                    8  2011 Swiss            Other
 9 Anne Louis Girodet Tr~                8  2011 French           French
10 Anselm Kiefer                         8  2011 German           German
# ... with 143 more rows, and 10 more variables: artist_gender <chr>,
#   artist_race <chr>, artist_ethnicity <chr>, book <chr>,
#   space_ratio_per_page_total <dbl>, artist_unique_id <int>, moma_count <dbl>,
#   moma_count_to_date <dbl>, whitney_count <dbl>, whitney_count_to_date <dbl>
```

The shape of the overall count of works by artists in *Janson's History of Art* is left-skewed, unimodal and asymmetrical. Such highlights how through time, more works are added to *Janson's History of Art* that are two-dimensional and made after c. 1750. There is then a drop-off of works included in the seventh (published in 2007 with 163 works) and eighth (published in 2011 with 153 works) editions, when new authorship took over. Within edition five (published 1995) and edition six (published in 2001), both written by Anthony Janson, there are the same number of works, the maximum amount included in the text throughout time, 185, as compared to the count of works in the first edition, first printing 62, and first edition, second printing, 76.

Gender Through Editions:

Gender of Artists in Janson's History of Art

Gender of Artists in Gardner's Art Through the Ages

Race Through Editions:

Race of Artists in Janson's History of Art

Race of Artists in Gardner's Art Through the Ages
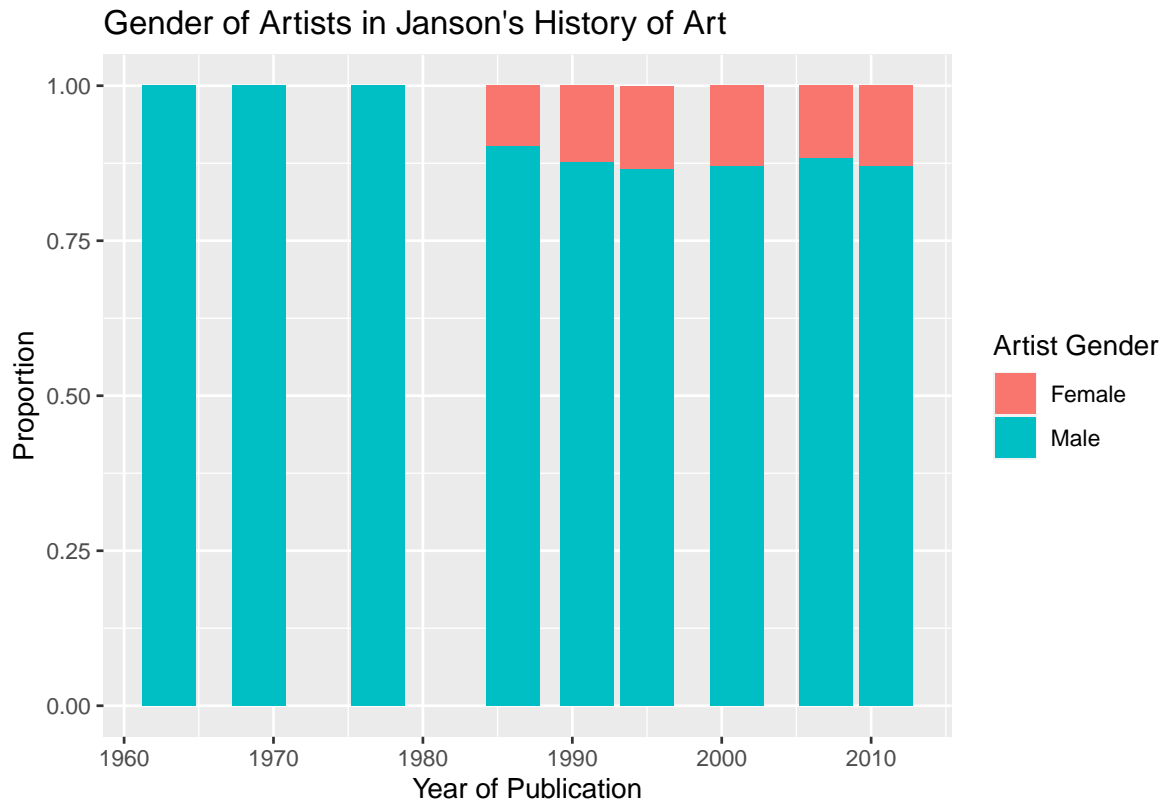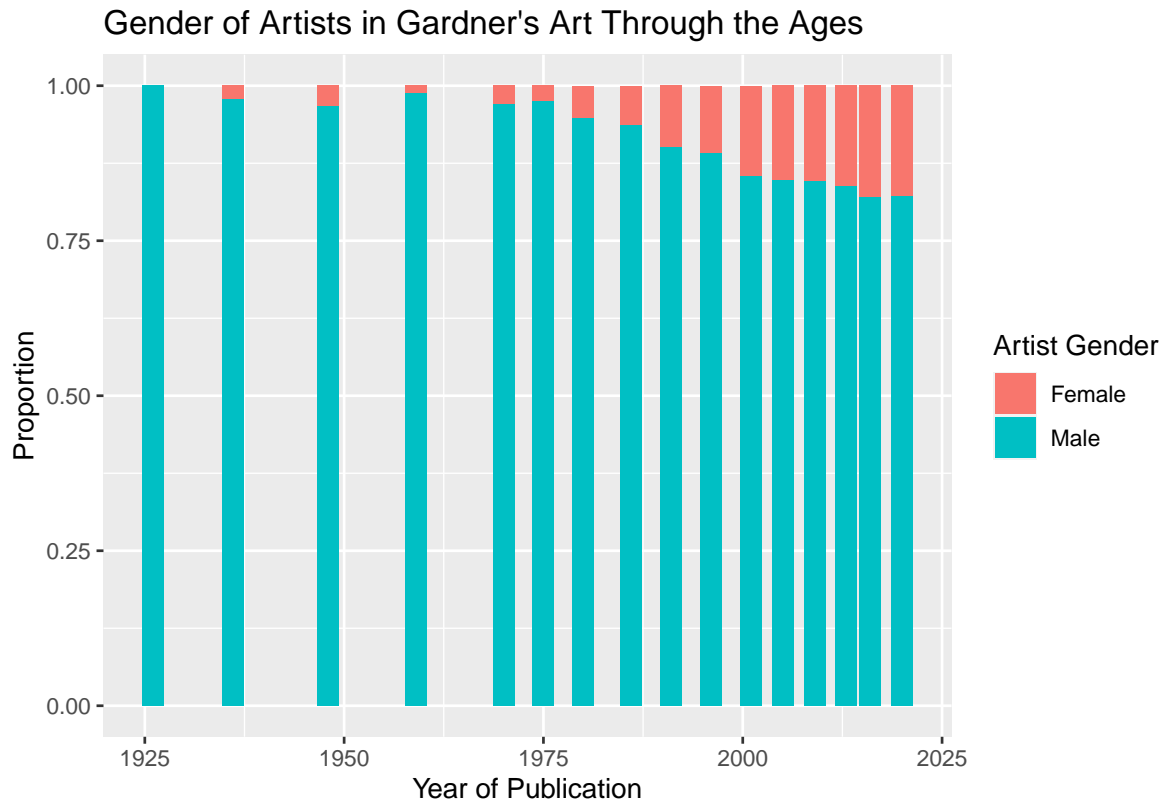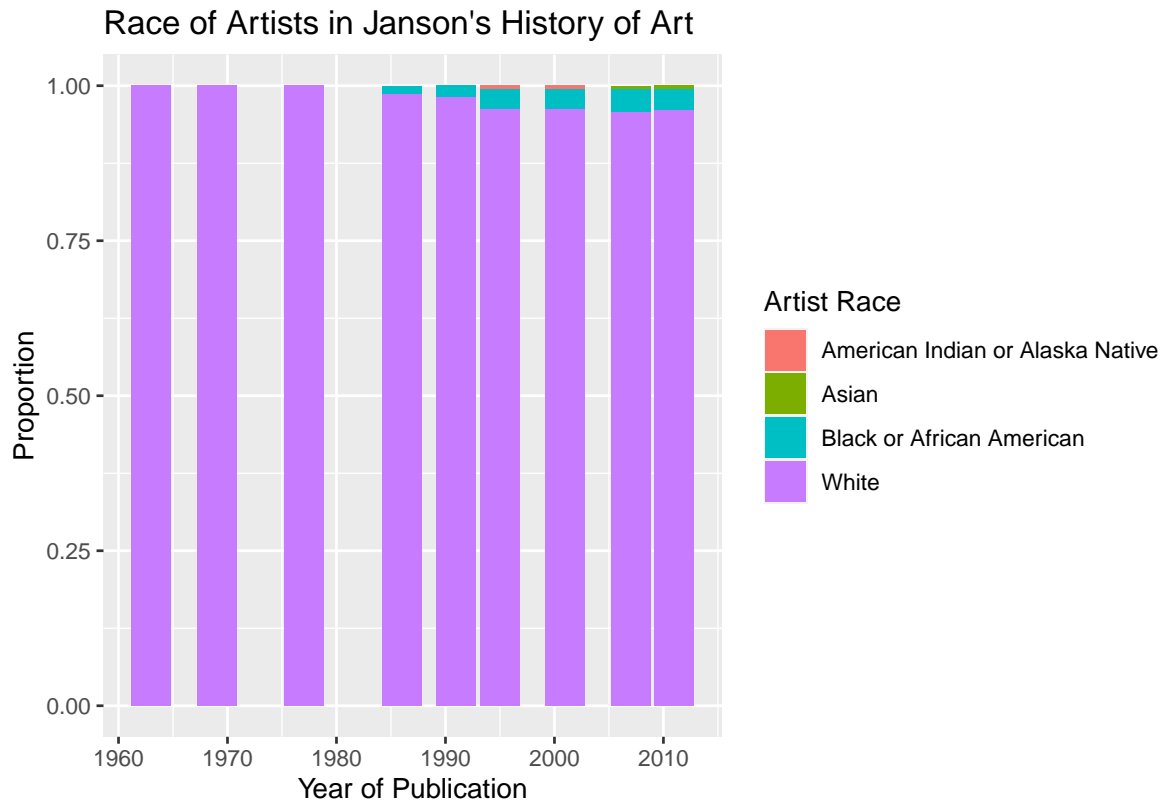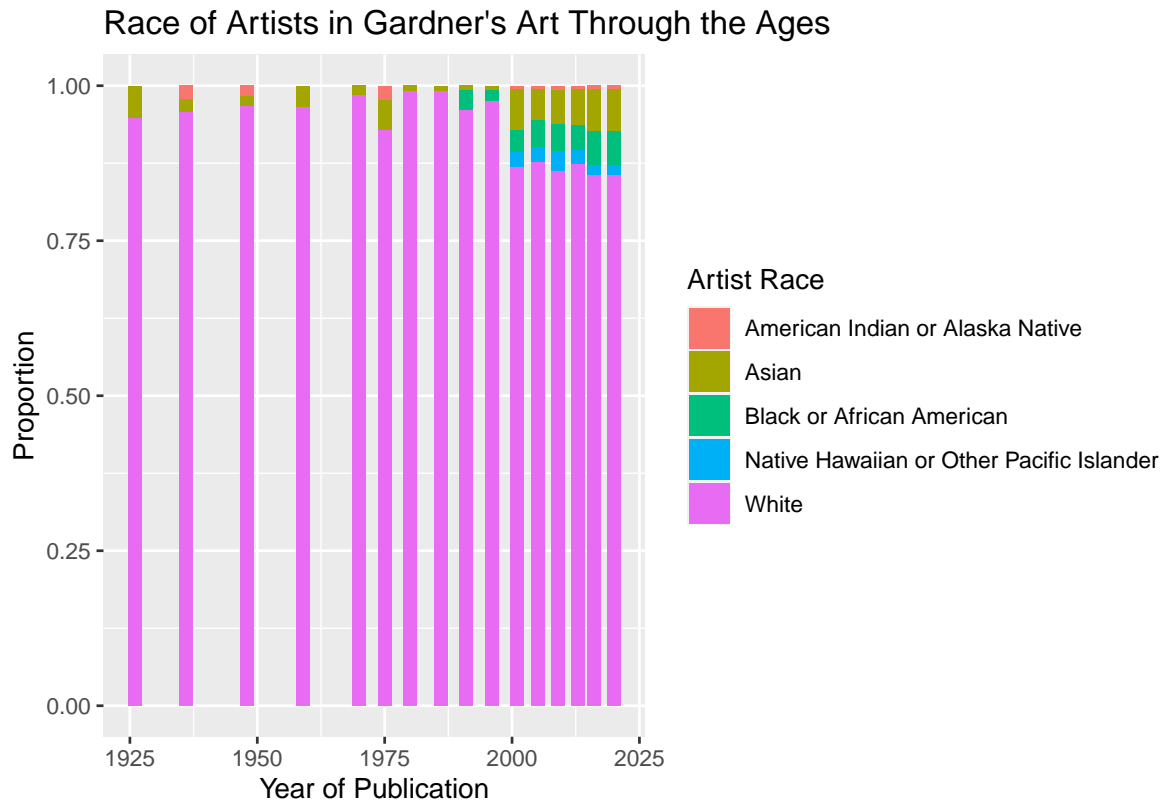
Ethnicity Through Editions:

Ethnicity of Artists in Janson's History of Art

Ethnicity of Artists in Gardner's Art Through the Ages
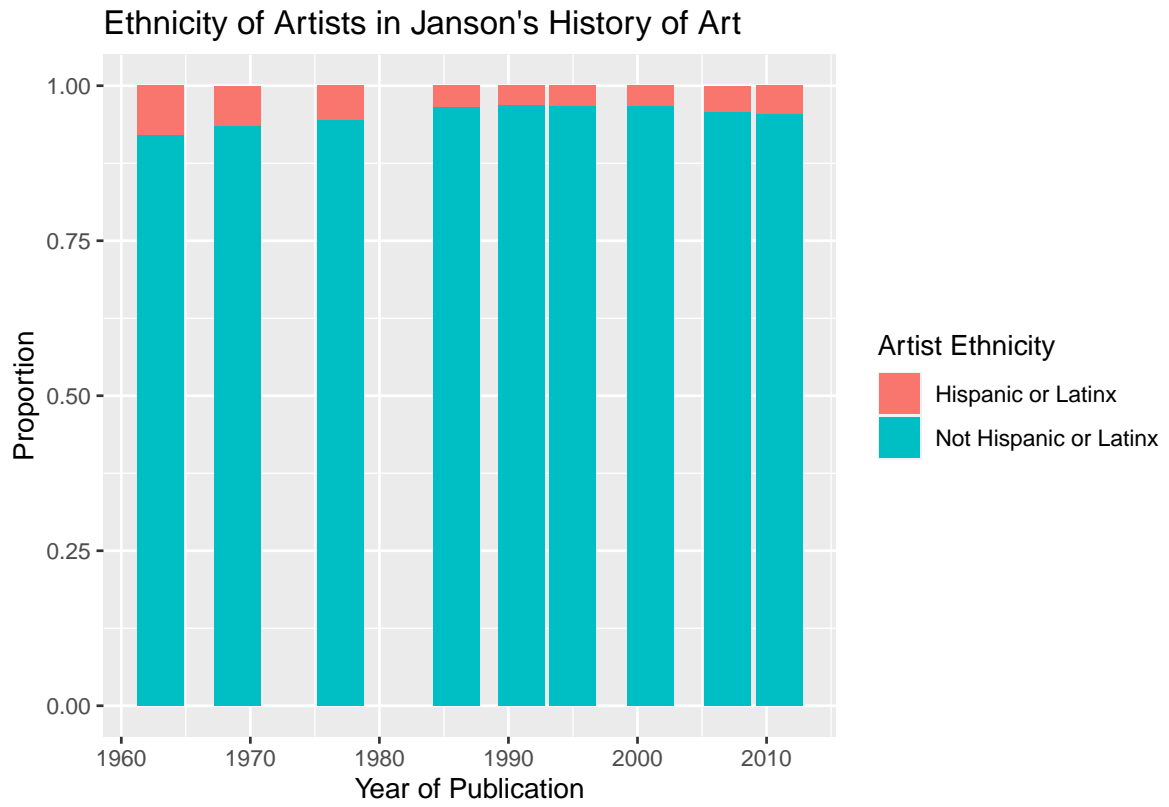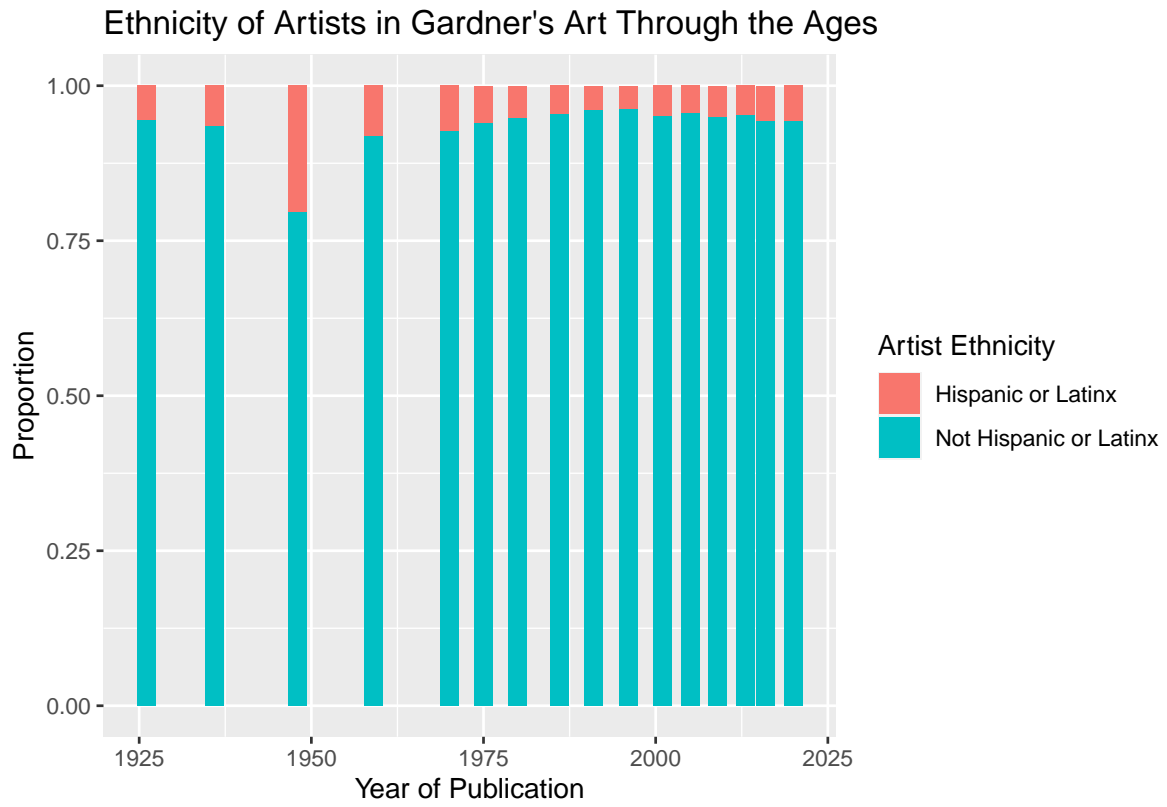
Nationality Through Editions:

Nationality of Artists in Janson's History of Art

Nationality of Artists in Gardner's Art Through the Ages
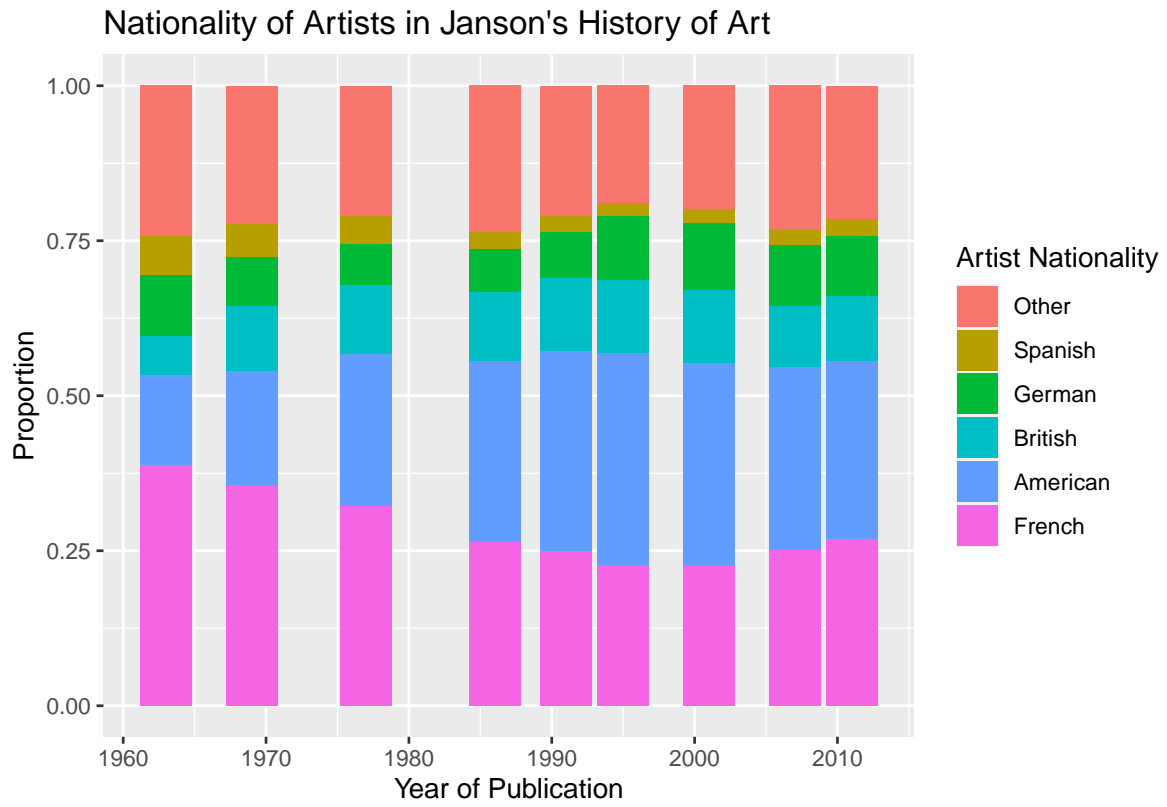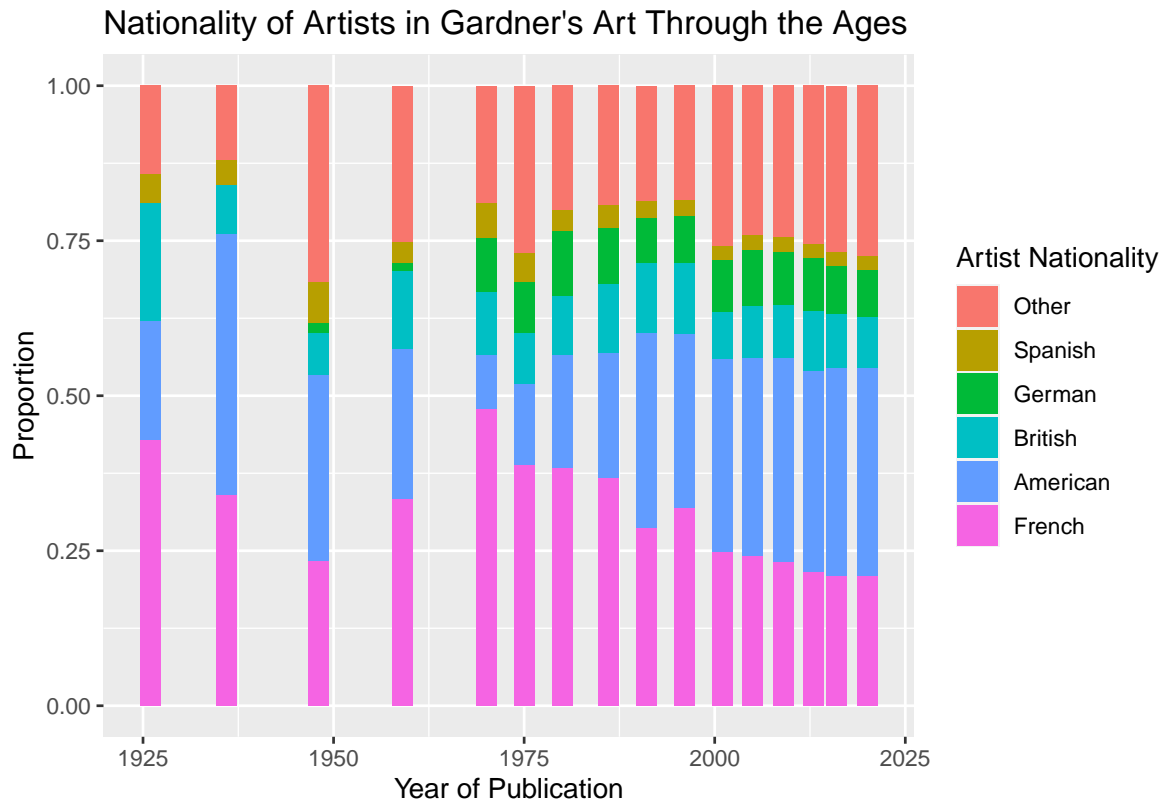
3.3 Exploratory Data Analysis: *Janson's History of Art*, `space_ratio_per_page_total`

Distribution of `space_ratio_per_page_total`
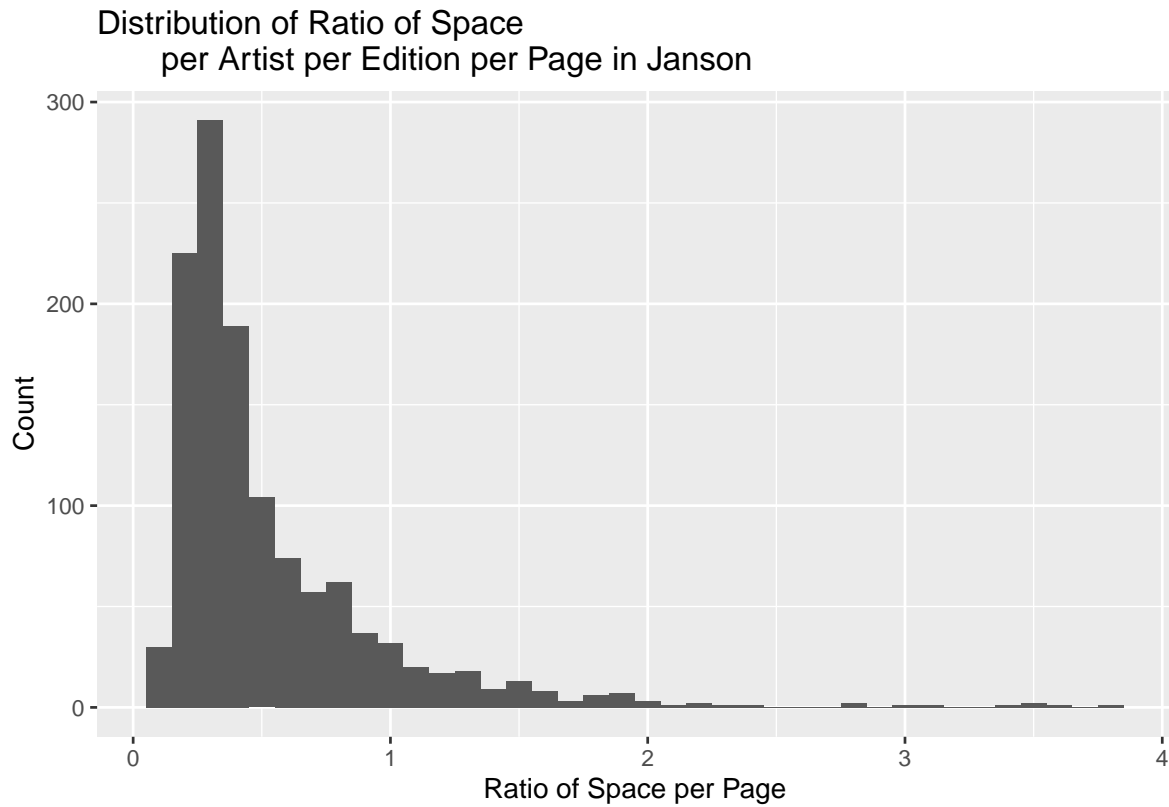
Distribution of Ratio of Space
per Artist per Edition per Page in Janson

The visualization above is right skewed, unimodal and assymetrical. Therefore, we would want to look at the median to understand its center and IQR to understand its spread. The median is

Distribution of Ratio of Space per Artist per Edition per Page in Janson
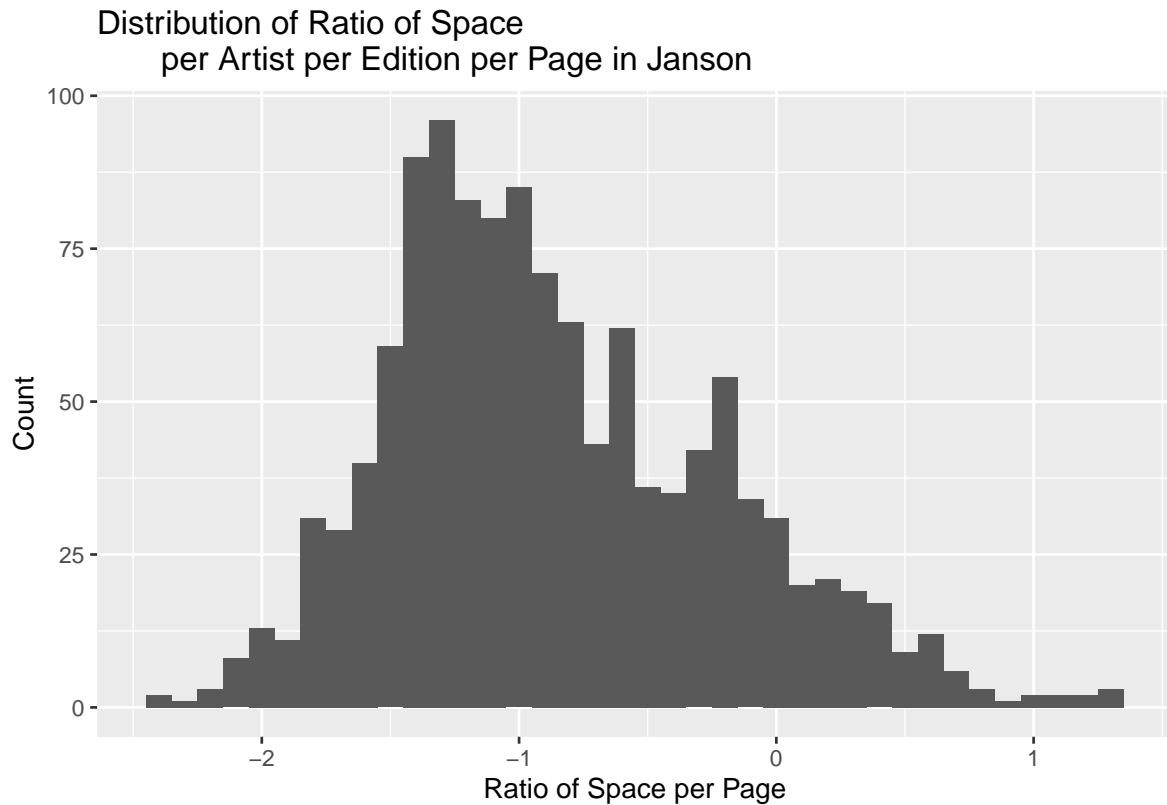

```
# A tibble: 10 x 4
# Groups:   artist_name [2]
   artist_name    edition_number  year space_ratio_per_page_total
   <chr>                   <dbl> <dbl>                      <dbl>
 1 Pablo Picasso               6  2001                       3.80
 2 Pablo Picasso               4  1991                       3.60
 3 Pablo Picasso               7  2007                       3.50
 4 Pablo Picasso               5  1995                       3.45
 5 Pablo Picasso               8  2011                       3.43
 6 Pablo Picasso               2  1977                       3.06
 7 Pablo Picasso               3  1986                       3.00
 8 Pablo Picasso               1  1963                       2.80
 9 Pablo Picasso             1.1  1969                       2.79
10 Claude Monet                8  2011                       2.43
```

The visualization above is right skewed, unimodal and assymetrical. Therefore, we would want to look at the median to understand its center and IQR to understand its spread.

space_ratio_per_page_total vs. artist_gender

Ratio of Space per Page per Artist per Edition in Janson by Gender
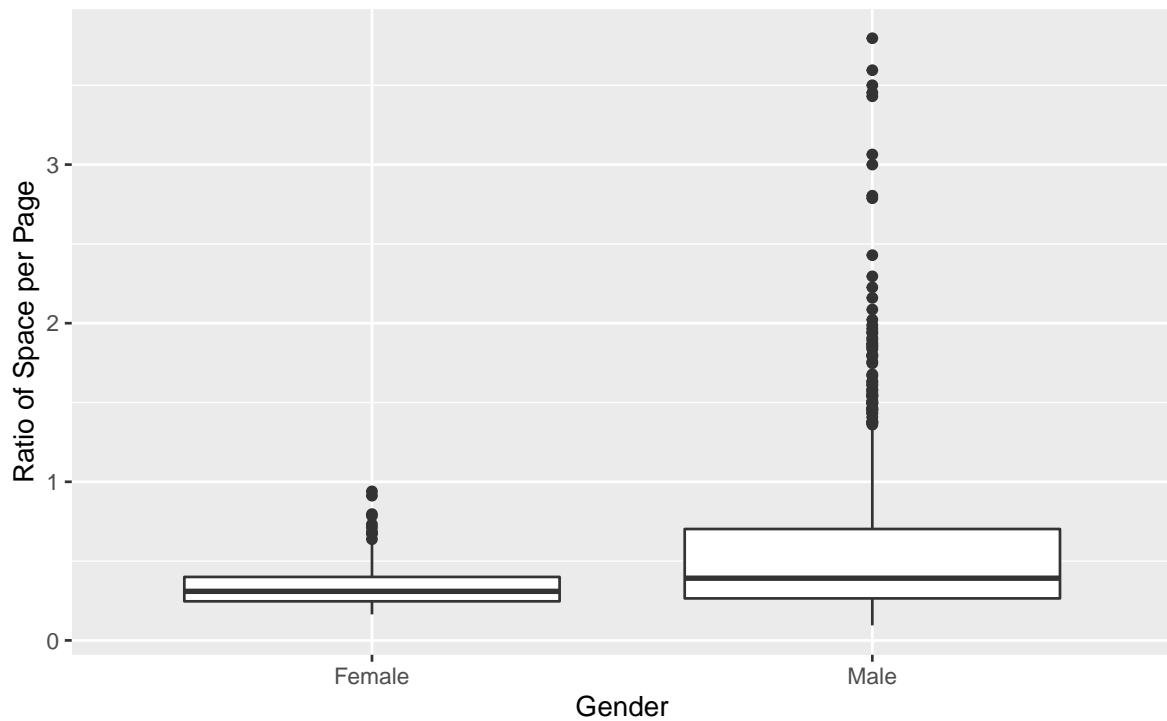

```
# A tibble: 10 x 5
# Groups:   artist_name [7]
   artist_name       artist_gender edition_number  year space_ratio_per_page_t~
   <chr>             <chr>                  <dbl> <dbl>                   <dbl>
 1 Hannah Höch       Female                     8  2011                   0.940
 2 Hannah Höch       Female                     7  2007                   0.913
 3 Angelica Kauffmann Female                    8  2011                   0.797
 4 Liubov Popova     Female                     8  2011                   0.785
 5 Angelica Kauffmann Female                    7  2007                   0.733
 6 Mary Cassatt      Female                     7  2007                   0.712
 7 Susan Rothenberg  Female                     5  1995                   0.685
 8 Elizabeth Murray  Female                     5  1995                   0.679
 9 Mary Cassatt      Female                     8  2011                   0.671
10 Rosa Bonheur      Female                     8  2011                   0.638
```

```
[1] 0.3093875
```

```
[1] 0.3921904
```

Interestingly enough, the median `space_ratio_per_page_total` for female artists is 0.309, not far below the median `space_ratio_per_page_total` for male artists, 0.392 in *Janson's History of Art.* This indicates that even though the number of female artists per edition included is far fewer, 122, the median amount of space given to women is similar to that as the median amount of space given to male artists per edition, 1097. The only female artist that comes close to being larger than 1 for SpaceRatioPerPage is Hannah Hoch, as seen by the table above.

`space_ratio_per_page_total` vs. `artist_race`

Regarding race, there is only artist for American Indian or Alaska Native, which is Kay Walkingstick in the 5th and 6th Editions and one artist for Asian, Ando Hiroshige in the 7th and 8th Editions. Additionally, there is only one Black or African American artist who has a `space_ratio_per_page_total` that is over .75, William T. Williams in the 3rd Edition. There are myriad white artists per work per edition, 1187, and their space trumps that of the space allotted to nonwhite artists.

`space_ratio_per_page_total` vs. `artist_ethnicity`

Ratio of Space per Page per Artist per Edition in Janson by Ethnicity
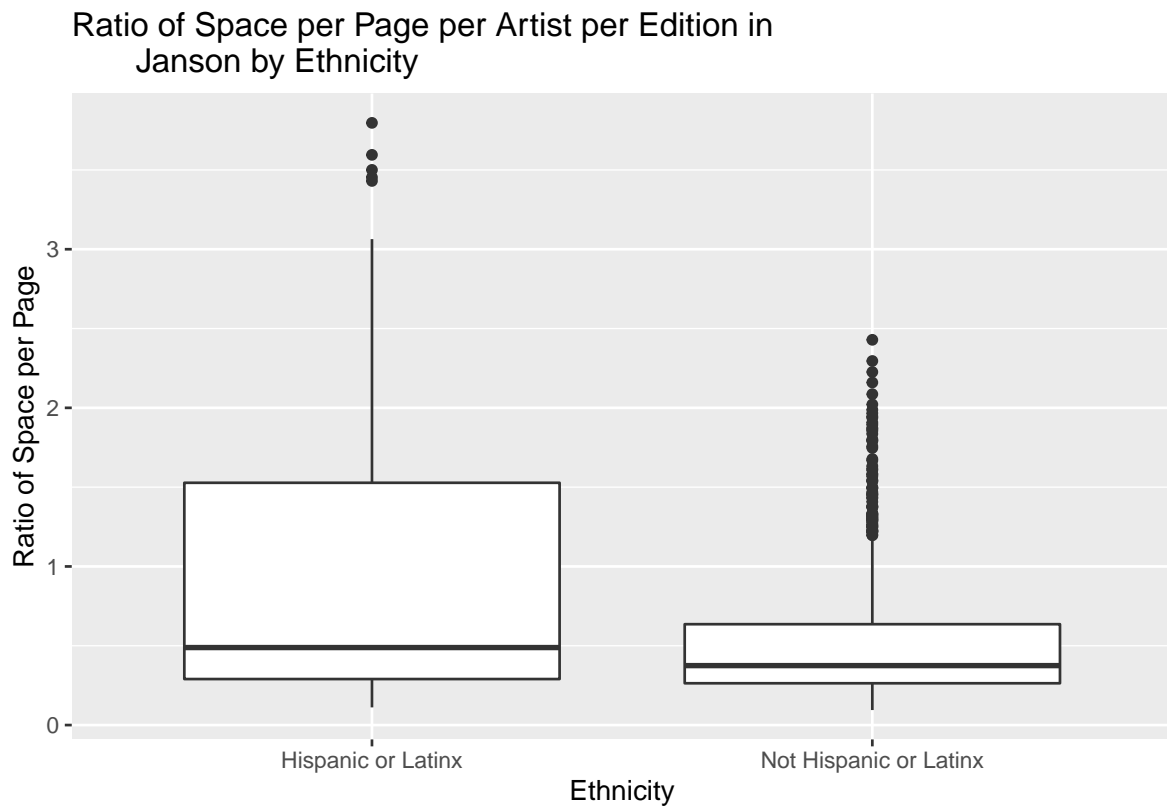
[1] 0.488591

```
[1] 0.374853
```

Interestingly, the median `space_ratio_per_page_total` for artists who are Hispanic or Latinx, 0.489 is higher than those who are Not Hispanic or Latinx, 0.375. There are 51 observations of artists per edition who are Hispanic and Latinx and there are 1168 observations of artists per edition who are not Hispanic or Latinx. Picasso plays a large role in such, as he is Hispanic or Latinx and is accounting for the outlyingly larger observations for `space_ratio_per_page_total`.

`space_ratio_per_page_total` vs. `artist_nationality_other`
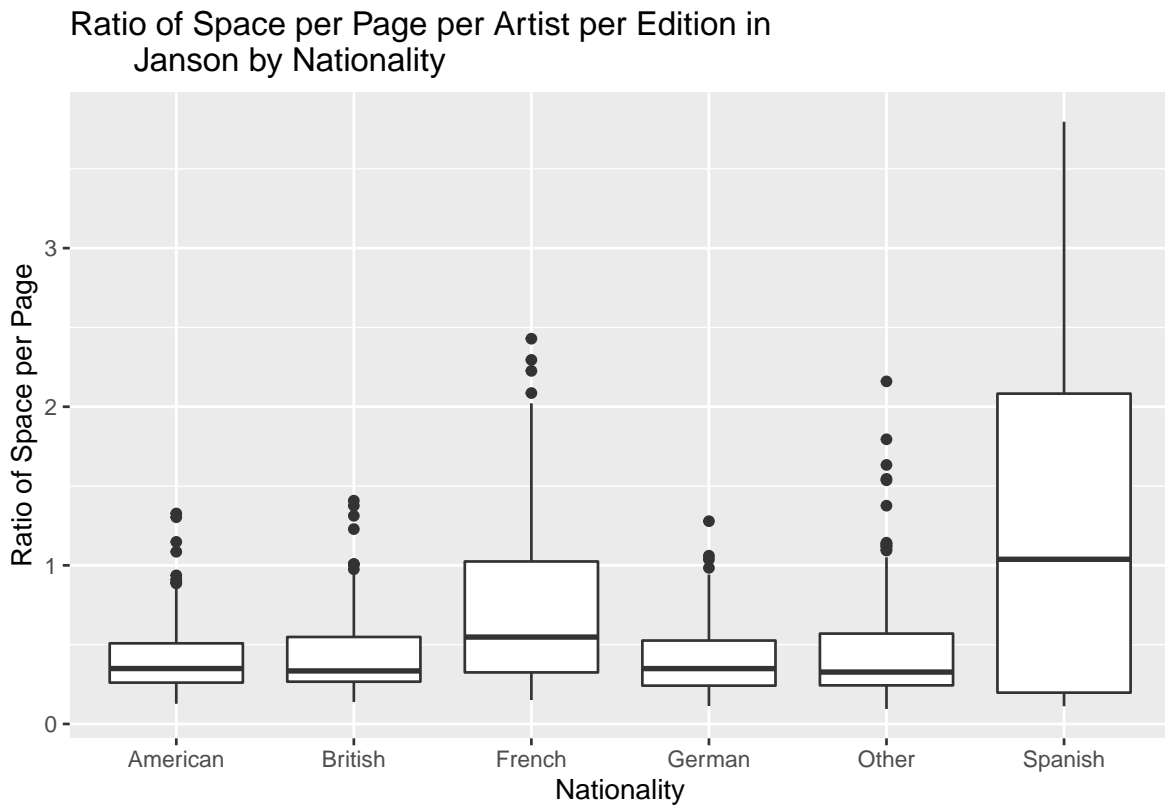
3.4 Exploratory Data Analysis: *Gardner's Art Through the Ages,* `SpaceRatioPerPage`

Distribution of `SpaceRatioPerPage`

Distribution of Ratio of Space
per Artist per Edition per Page in Gardner
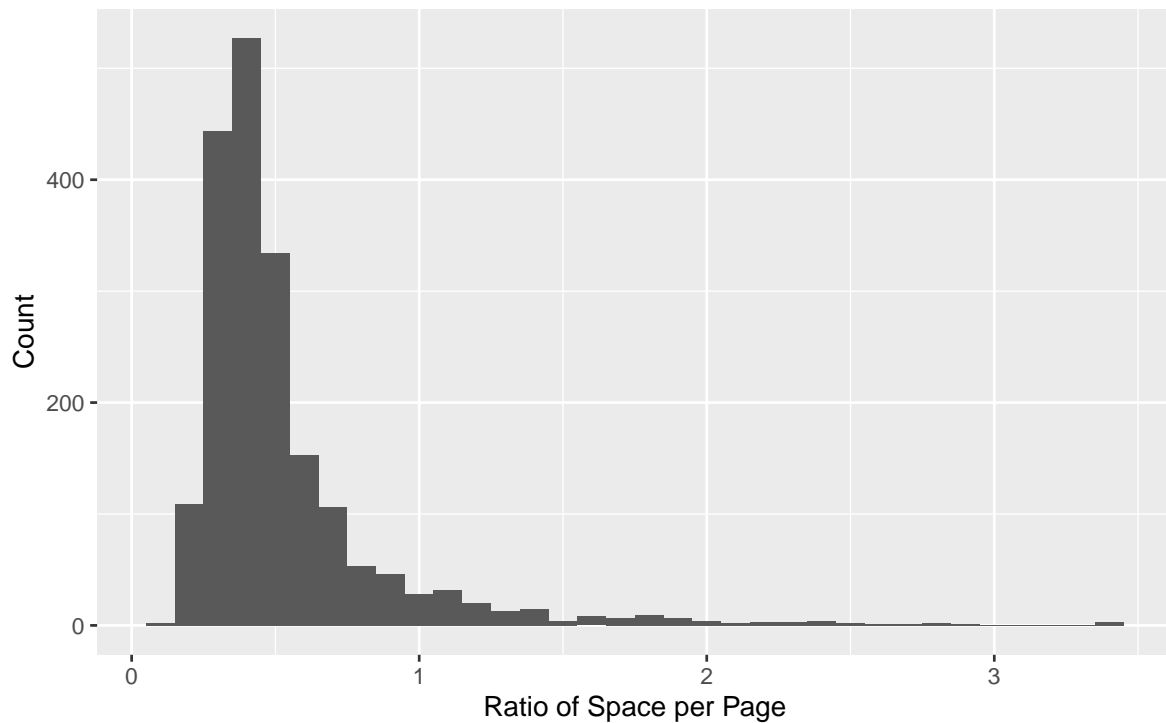

```
artist_name         edition_number      year       artist_nationality
Length:1943         Min.   : 1.0    Min.   :1926    Length:1943
Class :character    1st Qu.: 7.0    1st Qu.:1980    Class :character
Mode  :character    Median :11.0    Median :2001    Mode  :character
                    Mean   :10.4    Mean   :1995
                    3rd Qu.:14.0    3rd Qu.:2013
                    Max.   :16.0    Max.   :2020
artist_nationality_other artist_gender      artist_race
Length:1943              Length:1943        Length:1943
Class :character         Class :character   Class :character
Mode  :character         Mode  :character   Mode  :character




artist_ethnicity        book          space_ratio_per_page_total
Length:1943         Length:1943        Min.   :0.1423
Class :character    Class :character   1st Qu.:0.3371
Mode  :character    Mode  :character   Median :0.4204
                                       Mean   :0.5292
```

```
                                   3rd Qu.:0.5760
                                   Max.   :3.4220
 artist_unique_id    moma_count       moma_count_to_date whitney_count
 Min.   :  2.0    Min.   :0.00000   Min.   : 0.000    Min.   :0.00000
 1st Qu.:111.0    1st Qu.:0.00000   1st Qu.: 0.000    1st Qu.:0.00000
 Median :194.0    Median :0.00000   Median : 1.000    Median :0.00000
 Mean   :203.6    Mean   :0.04735   Mean   : 3.937    Mean   :0.03603
 3rd Qu.:305.0    3rd Qu.:0.00000   3rd Qu.: 4.000    3rd Qu.:0.00000
 Max.   :414.0    Max.   :1.00000   Max.   :64.000    Max.   :1.00000
 whitney_count_to_date
 Min.   : 0.000
 1st Qu.: 0.000
 Median : 0.000
 Mean   : 2.131
 3rd Qu.: 0.000
 Max.   :40.000


# A tibble: 24 x 4
# Groups:   artist_name [6]
   artist_name         edition_number  year space_ratio_per_page_total
   <chr>                        <dbl> <dbl>                      <dbl>
 1 Eugène Delacroix                10  1996                       3.42
 2 Pablo Picasso                   10  1996                       3.37
 3 Eugène Delacroix                 5  1970                       3.37
 4 Jacques-Louis David             10  1996                       2.93
 5 Pablo Picasso                   11  2001                       2.77
 6 Eugène Delacroix                 8  1986                       2.76
 7 Pablo Picasso                    4  1959                       2.74
 8 Eugène Delacroix                 6  1975                       2.60
 9 Francisco Goya                   5  1970                       2.52
10 Pablo Picasso                    6  1975                       2.51
# ... with 14 more rows
```

The visualization above is right skewed, unimodal and assymetrical. Therefore, we would want to look at the median to understand its center and IQR to understand its spread. There are potential outliers that are over 2.0, meaning the amount of space, area of text and area of figure in text combined is more than just the area of a single page within the respective book of *Gardner's Art Through the Ages.* It is obvious to observe that Spanish painter, Pablo Picasso dominates space through Gardner's, similarly as he did in *Janson's History of Art,* but he has more company this time around. French painters such as Delacroix and Jacques-Louis David also occupy substantial space, particularly in the 10th edition.

space_ratio_per_page_total vs. artist_gender

Ratio of Space per Page per Artist per Edition in Gardner by Gender
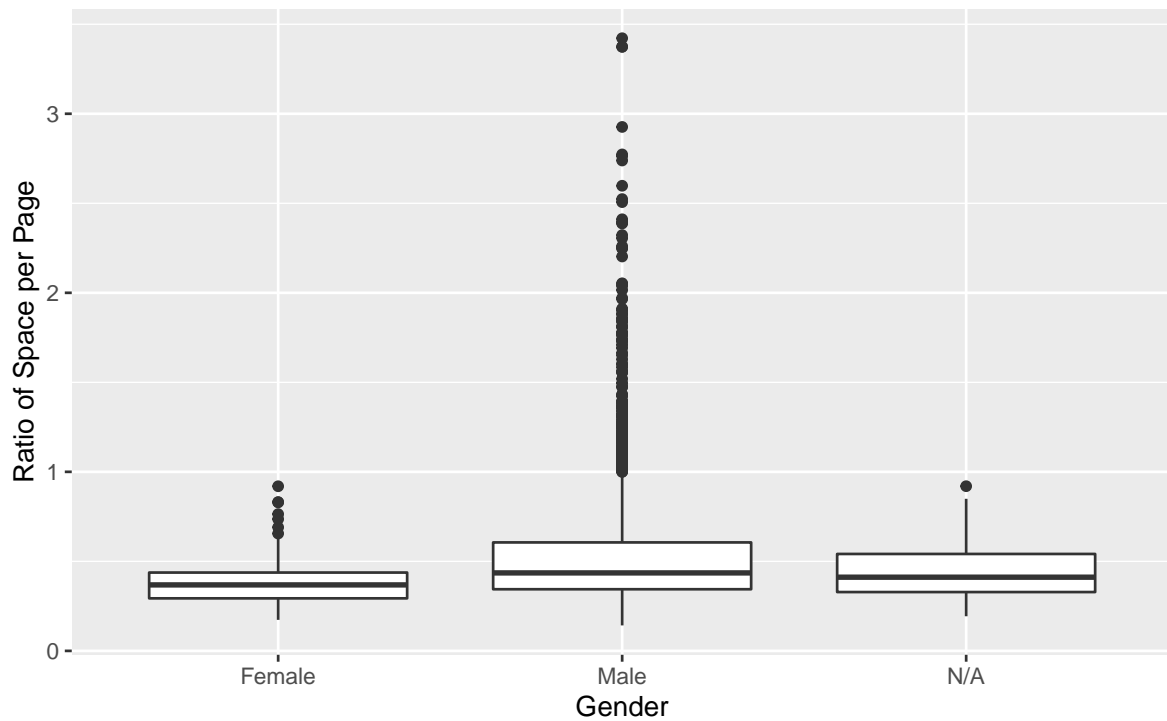

```
# A tibble: 9 x 5
# Groups:   artist_name [8]
  artist_name                   artist_gender edition_number  year space_ratio_per~
  <chr>                         <chr>                  <dbl> <dbl>            <dbl>
1 Hannah Höch                   Female                    11  2001            0.920
2 Élisabeth Louise Vigée-Le~    Female                    11  2001            0.831
3 Cindy Sherman                 Female                    11  2001            0.830
4 Angelica Kauffmann            Female                    16  2020            0.764
5 Dorothea Rockburne            Female                    10  1996            0.736
6 Gunta Stölzl                  Female                    11  2001            0.690
7 Frida Kahlo                   Female                    15  2016            0.656
8 Georgia O'Keeffe              Female                    10  1996            0.652
9 Hannah Höch                   Female                    14  2013            0.644
```

```
[1] 0.368567
```

```
[1] 0.4355323
```

```
NULL
```

The median `space_ratio_per_page_total` for female artists is 0.309 is below the median for artists whose gender is unknown, , as well as the median for male artists 0.436 in *Gardner's Art Through the Ages.* The number of artists whose gender is unknown has the fewest observations, 64, the number of female artists is slightly greater, 214, and the amount of male artists through editions is, 1665. The only female artist that comes close to being larger than 1 for `space_ratio_per_page_total` is again Hannah Hoch, as seen by the table above. Male artists have a dramatic amount of outlying artists through editions over a `space_ratio_per_page_total` of 1, 154.

`space_ratio_per_page_total` vs. `artist_race`

What sticks out like a sore thumb in the visualization above is the significant number of outlying white artists. The only artists that have a `space_ratio_per_page_total` of 1 or more are white. Though all the medians of race range between .25 and .6, the highest median is that of American Indian or Alaska Native artists, median(gardner_NAA$space_ratio_per_page_total) .

`space_ratio_per_page_total` vs. `artist_ethnicity`

Across all three categories, Hispanic or Latinx, Not Hispanic or Latinx and N/A, the medians remain relatively similar. The tail for Hispanic or Latinx are comparable to the tail for Not Hispanic or Latinx, just simply the number of observations are far fewer.

`space_ratio_per_page_total` vs. `artist_nationality_other`

statistical inference:

4 Model Exploration

5 Data Preparation for Modeling:

6 Model Exploration:

Linear mixed model fit by maximum likelihood . t-tests use Satterthwaite's
  method [lmerModLmerTest]
Formula: log(space_ratio_per_page_total) ~ artist_race + artist_ethnicity +
    artist_gender + artist_nationality_other + moma_count_to_date +
    whitney_count_to_date + artist_gender * moma_count_to_date +
    artist_nationality_other * moma_count_to_date + (1 | artist_name)
   Data: gardnerjanson_museums

     AIC   BIC   logLik deviance df.resid
  3907.9   4046.9 -1931.0   3861.9   3081

Scaled residuals:
    Min   1Q Median   3Q   Max
-3.6310 -0.5872 -0.0783 0.6271 3.0678

Random effects:
 Groups   Name   Variance Std.Dev.
 artist_name (Intercept) 0.1264   0.3556
 Residual   0.1649   0.4060
Number of obs: 3104, groups: artist_name, 395

Fixed effects:
                                                        Estimate Std. Error
(Intercept)   -1.007e+00 3.495e-01
artist_raceAsian   -9.882e-02 3.451e-01
artist_raceBlack or African American   4.443e-02 3.393e-01
artist_raceN/A   -5.558e-02 4.671e-01
artist_raceNative Hawaiian or Other Pacific Islander   2.022e-01 4.007e-01
artist_raceWhite   2.414e-02 3.270e-01
artist_ethnicityNot Hispanic or Latinx   -1.494e-02 1.316e-01
artist_genderMale   7.891e-02 6.944e-02
artist_nationality_otherBritish   5.249e-03 8.311e-02
artist_nationality_otherFrench   2.637e-01 6.725e-02
artist_nationality_otherGerman   -6.458e-02 8.828e-02
artist_nationality_otherOther   -5.073e-02 6.631e-02

artist_nationality_otherSpanish	6.339e-01	2.409e-01
moma_count_to_date	-1.073e-03	1.235e-02
whitney_count_to_date	1.761e-03	3.768e-03
artist_genderMale:moma_count_to_date	-1.350e-02	1.429e-02
artist_nationality_otherBritish:moma_count_to_date	1.371e-02	1.726e-02
artist_nationality_otherFrench:moma_count_to_date	3.291e-02	9.191e-03
artist_nationality_otherGerman:moma_count_to_date	2.825e-02	9.959e-03
artist_nationality_otherOther:moma_count_to_date	1.929e-02	9.271e-03
artist_nationality_otherSpanish:moma_count_to_date	3.959e-02	1.055e-02

	df	t value
(Intercept)	6.413e+02	-2.882
artist_raceAsian	6.528e+02	-0.286
artist_raceBlack or African American	6.485e+02	0.131
artist_raceN/A	6.773e+02	-0.119
artist_raceNative Hawaiian or Other Pacific Islander	6.310e+02	0.505
artist_raceWhite	6.680e+02	0.074
artist_ethnicityNot Hispanic or Latinx	4.991e+02	-0.114
artist_genderMale	4.449e+02	1.136
artist_nationality_otherBritish	4.575e+02	0.063
artist_nationality_otherFrench	4.635e+02	3.921
artist_nationality_otherGerman	4.846e+02	-0.732
artist_nationality_otherOther	5.244e+02	-0.765
artist_nationality_otherSpanish	4.018e+02	2.631
moma_count_to_date	5.679e+02	-0.087
whitney_count_to_date	9.689e+02	0.467
artist_genderMale:moma_count_to_date	6.475e+02	-0.944
artist_nationality_otherBritish:moma_count_to_date	7.781e+02	0.795
artist_nationality_otherFrench:moma_count_to_date	1.000e+03	3.580
artist_nationality_otherGerman:moma_count_to_date	1.009e+03	2.837
artist_nationality_otherOther:moma_count_to_date	8.612e+02	2.081
artist_nationality_otherSpanish:moma_count_to_date	1.592e+03	3.753

	Pr(>|t|)	
(Intercept)	0.004080	**
artist_raceAsian	0.774700	
artist_raceBlack or African American	0.895857	
artist_raceN/A	0.905309	
artist_raceNative Hawaiian or Other Pacific Islander	0.613965	
artist_raceWhite	0.941172	
artist_ethnicityNot Hispanic or Latinx	0.909657	
artist_genderMale	0.256386	
artist_nationality_otherBritish	0.949669	
artist_nationality_otherFrench	0.000101	***
artist_nationality_otherGerman	0.464776	

```
artist_nationality_otherOther                          0.444524
artist_nationality_otherSpanish                        0.008838 **
moma_count_to_date                                     0.930835
whitney_count_to_date                                  0.640421
artist_genderMale:moma_count_to_date                   0.345469
artist_nationality_otherBritish:moma_count_to_date     0.427104
artist_nationality_otherFrench:moma_count_to_date      0.000360 ***
artist_nationality_otherGerman:moma_count_to_date      0.004644 **
artist_nationality_otherOther:moma_count_to_date       0.037702 *
artist_nationality_otherSpanish:moma_count_to_date     0.000181 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

the multiple of the number of degrees of freedom used for the penalty. Only k = 2 gives the genuine AIC: k = log(n) is sometimes referred to as BIC or SBC.

```
Linear mixed model fit by maximum likelihood . t-tests use Satterthwaite's
  method [lmerModLmerTest]
Formula: log(space_ratio_per_page_total) ~ artist_race + artist_ethnicity +
    artist_gender + artist_nationality_other + moma_count_to_date +
    whitney_count_to_date + artist_gender * moma_count_to_date +
    artist_nationality_other * moma_count_to_date + (1 | artist_name)
   Data: gardnerjanson_museums

     AIC      BIC   logLik deviance df.resid
  3907.9   4046.9  -1931.0   3861.9     3081

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.6310 -0.5872 -0.0783  0.6271  3.0678

Random effects:
 Groups        Name         Variance Std.Dev.
 artist_name (Intercept) 0.1264   0.3556
 Residual                 0.1649   0.4060
Number of obs: 3104, groups:  artist_name, 395

Fixed effects:
                                          Estimate Std. Error
(Intercept)                              -1.007e+00  3.495e-01
artist_raceAsian                         -9.882e-02  3.451e-01
artist_raceBlack or African American      4.443e-02  3.393e-01
```

```
artist_raceN/A                                               -5.558e-02  4.671e-01
artist_raceNative Hawaiian or Other Pacific Islander  2.022e-01  4.007e-01
artist_raceWhite                                              2.414e-02  3.270e-01
artist_ethnicityNot Hispanic or Latinx                       -1.494e-02  1.316e-01
artist_genderMale                                             7.891e-02  6.944e-02
artist_nationality_otherBritish                               5.249e-03  8.311e-02
artist_nationality_otherFrench                                2.637e-01  6.725e-02
artist_nationality_otherGerman                               -6.458e-02  8.828e-02
artist_nationality_otherOther                                -5.073e-02  6.631e-02
artist_nationality_otherSpanish                               6.339e-01  2.409e-01
moma_count_to_date                                           -1.073e-03  1.235e-02
whitney_count_to_date                                         1.761e-03  3.768e-03
artist_genderMale:moma_count_to_date                         -1.350e-02  1.429e-02
artist_nationality_otherBritish:moma_count_to_date            1.371e-02  1.726e-02
artist_nationality_otherFrench:moma_count_to_date             3.291e-02  9.191e-03
artist_nationality_otherGerman:moma_count_to_date             2.825e-02  9.959e-03
artist_nationality_otherOther:moma_count_to_date              1.929e-02  9.271e-03
artist_nationality_otherSpanish:moma_count_to_date            3.959e-02  1.055e-02
                                                                   df t value
(Intercept)                                                  6.413e+02  -2.882
artist_raceAsian                                             6.528e+02  -0.286
artist_raceBlack or African American                         6.485e+02   0.131
artist_raceN/A                                               6.773e+02  -0.119
artist_raceNative Hawaiian or Other Pacific Islander  6.310e+02   0.505
artist_raceWhite                                             6.680e+02   0.074
artist_ethnicityNot Hispanic or Latinx                       4.991e+02  -0.114
artist_genderMale                                            4.449e+02   1.136
artist_nationality_otherBritish                              4.575e+02   0.063
artist_nationality_otherFrench                               4.635e+02   3.921
artist_nationality_otherGerman                               4.846e+02  -0.732
artist_nationality_otherOther                                5.244e+02  -0.765
artist_nationality_otherSpanish                              4.018e+02   2.631
moma_count_to_date                                           5.679e+02  -0.087
whitney_count_to_date                                        9.689e+02   0.467
artist_genderMale:moma_count_to_date                         6.475e+02  -0.944
artist_nationality_otherBritish:moma_count_to_date           7.781e+02   0.795
artist_nationality_otherFrench:moma_count_to_date            1.000e+03   3.580
artist_nationality_otherGerman:moma_count_to_date            1.009e+03   2.837
artist_nationality_otherOther:moma_count_to_date             8.612e+02   2.081
artist_nationality_otherSpanish:moma_count_to_date           1.592e+03   3.753
                                                             Pr(>|t|)
(Intercept)                                                  0.004080 **
artist_raceAsian                                             0.774700
```

```
artist_raceBlack or African American                          0.895857
artist_raceN/A                                                0.905309
artist_raceNative Hawaiian or Other Pacific Islander 0.613965
artist_raceWhite                                              0.941172
artist_ethnicityNot Hispanic or Latinx                        0.909657
artist_genderMale                                             0.256386
artist_nationality_otherBritish                               0.949669
artist_nationality_otherFrench                                0.000101 ***
artist_nationality_otherGerman                                0.464776
artist_nationality_otherOther                                 0.444524
artist_nationality_otherSpanish                               0.008838 **
moma_count_to_date                                            0.930835
whitney_count_to_date                                         0.640421
artist_genderMale:moma_count_to_date                          0.345469
artist_nationality_otherBritish:moma_count_to_date   0.427104
artist_nationality_otherFrench:moma_count_to_date    0.000360 ***
artist_nationality_otherGerman:moma_count_to_date    0.004644 **
artist_nationality_otherOther:moma_count_to_date     0.037702 *
artist_nationality_otherSpanish:moma_count_to_date   0.000181 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
                                          GVIF Df GVIF^(1/(2*Df))
artist_race                            1.375255  5        1.032377
artist_ethnicity                       1.609272  1        1.268571
artist_gender                          1.310043  1        1.144571
artist_nationality_other               4.055801  5        1.150291
moma_count_to_date                    31.944102  1        5.651911
whitney_count_to_date                  1.232127  1        1.110012
artist_gender:moma_count_to_date      41.927417  1        6.475138
artist_nationality_other:moma_count_to_date 23.593720  5        1.371765
```

GET PVALUES FOR COEFFICIENTS - STATISTICALLY SIGNIFICANT - GO THROUGH INTERPRETATIONS WITH LOG TRANSFORMATION AND MIXED EFFECTS MODEL - CONFIRM MODEL DIAGNOSTICS - AIC / BIC FOR MIXED EFFECTS -

```
Linear mixed model fit by maximum likelihood . t-tests use Satterthwaite's
  method [lmerModLmerTest]
Formula: log(space_ratio_per_page_total) ~ artist_race + artist_ethnicity +
    artist_gender + artist_nationality_other + moma_count_to_date +
    whitney_count_to_date + artist_gender * moma_count_to_date +
```

```
    artist_nationality_other * moma_count_to_date + (1 | artist_name)
  Data: gardnerjanson_museums


    AIC      BIC   logLik deviance df.resid
 3907.9   4046.9  -1931.0   3861.9     3081


Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.6310 -0.5872 -0.0783  0.6271  3.0678


Random effects:
 Groups       Name          Variance Std.Dev.
 artist_name (Intercept) 0.1264   0.3556
 Residual                   0.1649   0.4060
Number of obs: 3104, groups:  artist_name, 395


Fixed effects:
                                                            Estimate Std. Error
(Intercept)                                                -1.007e+00  3.495e-01
artist_raceAsian                                           -9.882e-02  3.451e-01
artist_raceBlack or African American                        4.443e-02  3.393e-01
artist_raceN/A                                             -5.558e-02  4.671e-01
artist_raceNative Hawaiian or Other Pacific Islander  2.022e-01  4.007e-01
artist_raceWhite                                            2.414e-02  3.270e-01
artist_ethnicityNot Hispanic or Latinx                     -1.494e-02  1.316e-01
artist_genderMale                                           7.891e-02  6.944e-02
artist_nationality_otherBritish                             5.249e-03  8.311e-02
artist_nationality_otherFrench                              2.637e-01  6.725e-02
artist_nationality_otherGerman                             -6.458e-02  8.828e-02
artist_nationality_otherOther                              -5.073e-02  6.631e-02
artist_nationality_otherSpanish                             6.339e-01  2.409e-01
moma_count_to_date                                         -1.073e-03  1.235e-02
whitney_count_to_date                                       1.761e-03  3.768e-03
artist_genderMale:moma_count_to_date                       -1.350e-02  1.429e-02
artist_nationality_otherBritish:moma_count_to_date          1.371e-02  1.726e-02
artist_nationality_otherFrench:moma_count_to_date           3.291e-02  9.191e-03
artist_nationality_otherGerman:moma_count_to_date           2.825e-02  9.959e-03
artist_nationality_otherOther:moma_count_to_date            1.929e-02  9.271e-03
artist_nationality_otherSpanish:moma_count_to_date          3.959e-02  1.055e-02
                                                                  df t value
(Intercept)                                                6.413e+02  -2.882
artist_raceAsian                                           6.528e+02  -0.286
artist_raceBlack or African American                       6.485e+02   0.131
```

```
artist_raceN/A                                                 6.773e+02  -0.119
artist_raceNative Hawaiian or Other Pacific Islander           6.310e+02   0.505
artist_raceWhite                                               6.680e+02   0.074
artist_ethnicityNot Hispanic or Latinx                         4.991e+02  -0.114
artist_genderMale                                              4.449e+02   1.136
artist_nationality_otherBritish                                4.575e+02   0.063
artist_nationality_otherFrench                                 4.635e+02   3.921
artist_nationality_otherGerman                                 4.846e+02  -0.732
artist_nationality_otherOther                                  5.244e+02  -0.765
artist_nationality_otherSpanish                                4.018e+02   2.631
moma_count_to_date                                             5.679e+02  -0.087
whitney_count_to_date                                          9.689e+02   0.467
artist_genderMale:moma_count_to_date                           6.475e+02  -0.944
artist_nationality_otherBritish:moma_count_to_date             7.781e+02   0.795
artist_nationality_otherFrench:moma_count_to_date              1.000e+03   3.580
artist_nationality_otherGerman:moma_count_to_date              1.009e+03   2.837
artist_nationality_otherOther:moma_count_to_date               8.612e+02   2.081
artist_nationality_otherSpanish:moma_count_to_date             1.592e+03   3.753
                                                               Pr(>|t|)
(Intercept)                                                    0.004080 **
artist_raceAsian                                               0.774700
artist_raceBlack or African American                           0.895857
artist_raceN/A                                                 0.905309
artist_raceNative Hawaiian or Other Pacific Islander           0.613965
artist_raceWhite                                               0.941172
artist_ethnicityNot Hispanic or Latinx                         0.909657
artist_genderMale                                              0.256386
artist_nationality_otherBritish                                0.949669
artist_nationality_otherFrench                                 0.000101 ***
artist_nationality_otherGerman                                 0.464776
artist_nationality_otherOther                                  0.444524
artist_nationality_otherSpanish                                0.008838 **
moma_count_to_date                                             0.930835
whitney_count_to_date                                          0.640421
artist_genderMale:moma_count_to_date                           0.345469
artist_nationality_otherBritish:moma_count_to_date             0.427104
artist_nationality_otherFrench:moma_count_to_date              0.000360 ***
artist_nationality_otherGerman:moma_count_to_date              0.004644 **
artist_nationality_otherOther:moma_count_to_date               0.037702 *
artist_nationality_otherSpanish:moma_count_to_date             0.000181 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
          R2m        R2c
[1,] 0.1733762 0.5321474
```

Marginal R2 provides the variance explained only by fixed effects and conditional R2 provides the variance explained by the entire model, i.e., both fixed effects and random effects.

Model Diagnostics : Check for linearity, independence, residuals, normal distribution of the residuals - no pattern in residuals, constant variance
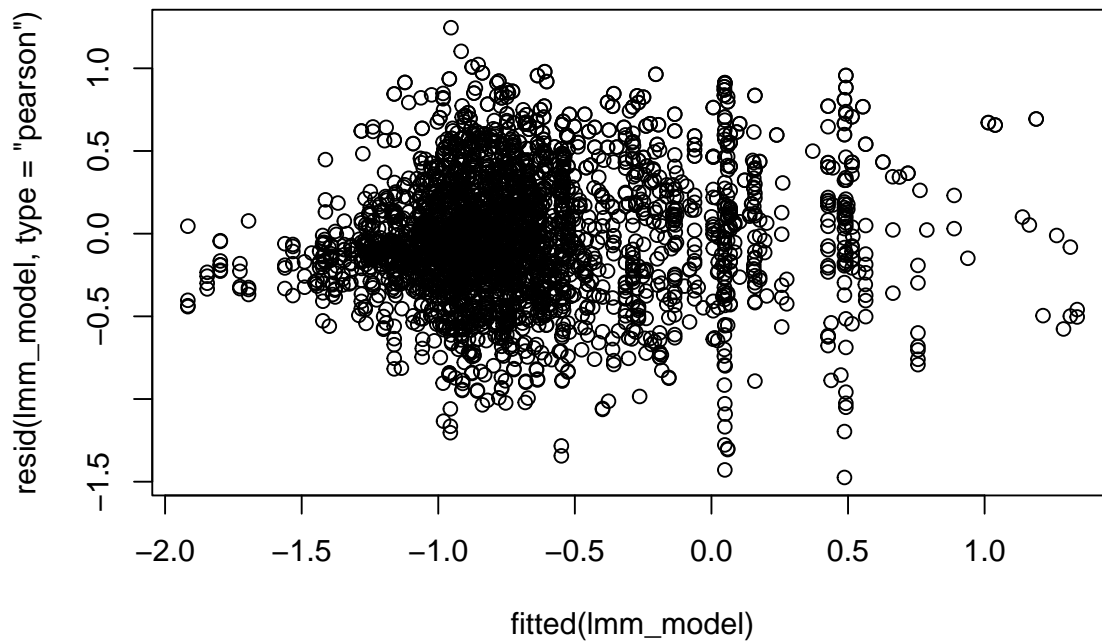
RESOURCE: https://www.ssc.wisc.edu/sscc/pubs/MM/MM_DiagInfer.html

Plotting : log transform some variables : Fitted v. Residuals

7 Appendix:

7.1 Assumptions:

### 7.1.1 Residuals and Constant Variance:

before log transforming our outcome variable, the constant variance assumption was violated. Therefore, in order to pass the constant variance assumption, I performed a log transformation.

7.1.2 Normality:
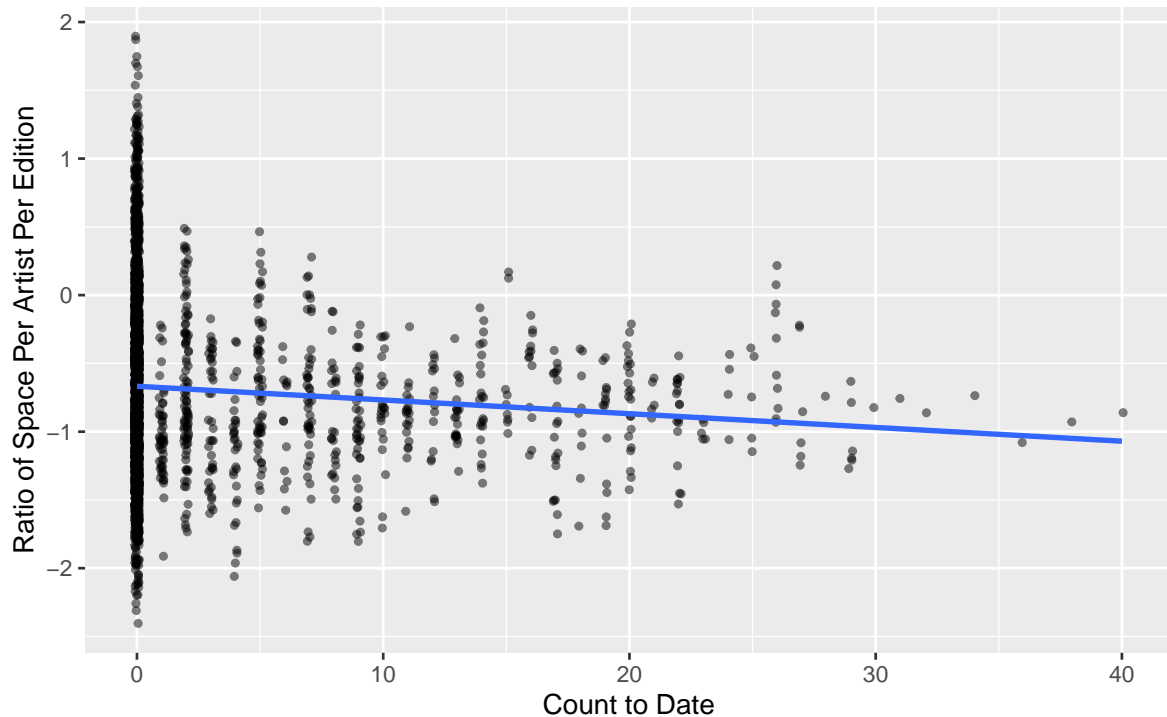
Normal Q–Q Plot
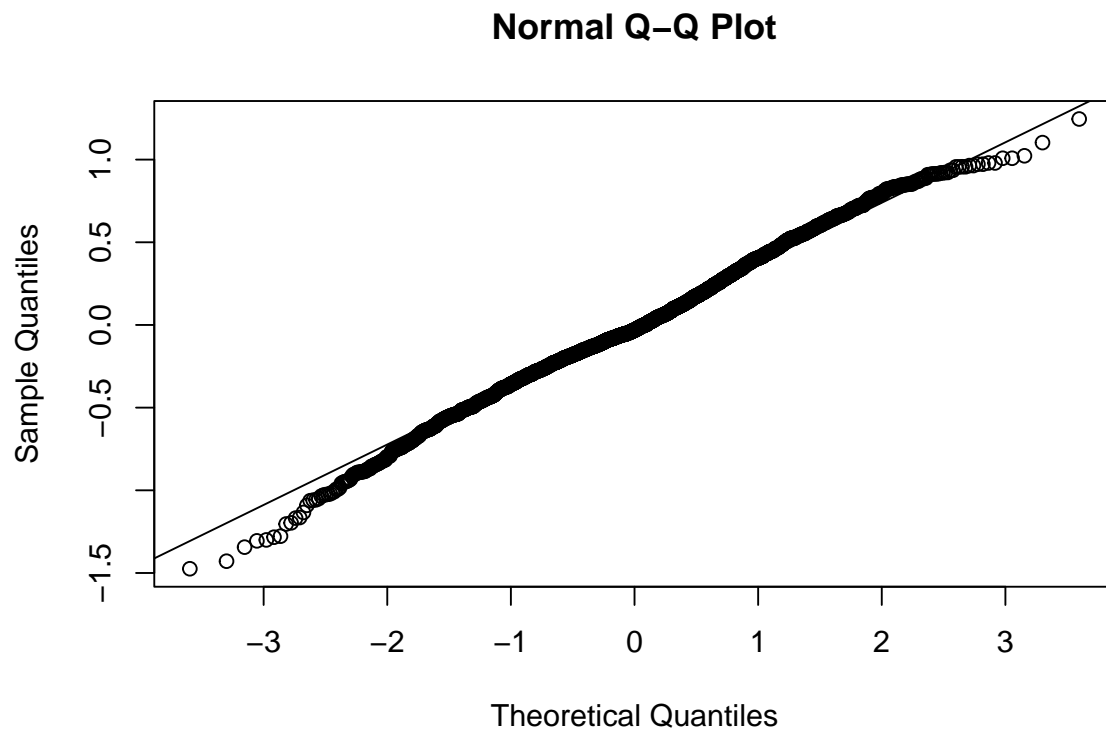
7.1.3 Linearity:

Log of
   Ratio of Space Per Artist Per Edition by
Number of Exhibitions per Artist per Editions in the MoMA
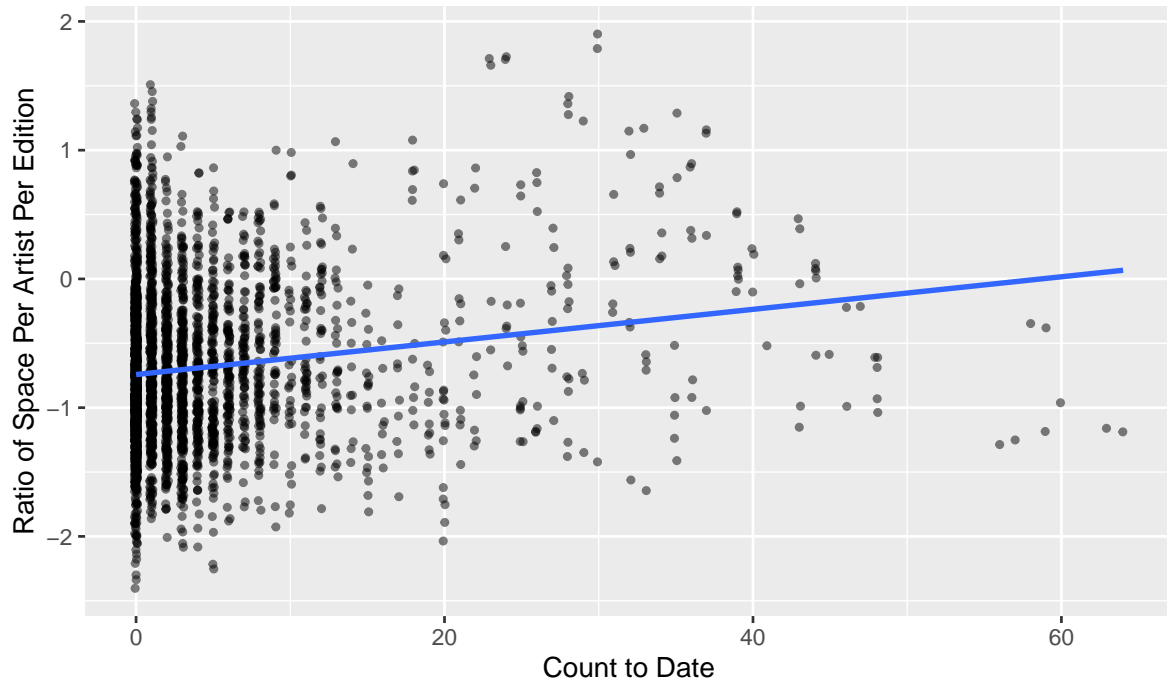
Log of Ratio of Space Per Artist Per Edition by
Number of Exhibitions per Artist per Editions in the Whitney

Normality of random effect: Get the estimate of random effect (in your case random intercepts), and check them as check the residual. But it is not efficient because you just have 7 random intercepts.

7.1.4 Independence:

Another assumption is the independence between subjects. No test, based on your judgement. Subject specific random intercept means the correlation between the response variable from the same subject are the same.

all obervations of different artists are independent -

log transforming predictors - interpretations change - variables weren't changed - same idea, bit different

INDEPENDENCE: DOUBLE CHECK - EMPIRICALLY ARGUE OR ?

verbally argue the independence between artists - since we are using a mixed effects model, and our random effect is per artist, we eliminate the dependence of our observations had we not used a mixed effects model. Between artists, we expect the observations to be independent.