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# Investigating the break between Modernism and Postmodernism in the MoMa Dataset

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# Introduction

The term 'postmodern' has been gradually growing in the vocabulary of the art critics, theorists and artists since the 1950's and up to the 1980's when the art community finally decided to declare a clear break from the narrow confinements of the modern era. Before that time all major art institutions nurtured the 'Grenbergian' view on art dictating to move away from the traditions of the past artistic practices in order to achieve higher art, liberated from illusionism and storytelling. Postmodernists, on the contrary, encouraged the study of the past but by taking a certain ironic distance to it. The appropriation of the iconic artworks became a significant feature of postmodern art (see fig. 1), contesting the principals of originality and authorship. Moreover, in contrast to modernism which deemed to limit the artistic production within the 'White Box' of the art institutions, postmodern art strived to exit the ideological walls of these institutions in order to become actively involved with the polemical debates in contemporary politics, economy, and society. In order to do so, artists explored new practices by experimenting with new and unconventional materials and techniques such as gelatine, waste materials/trash, food, latex (see fig. 2).

In the meantime, the Museum of Modern Art or MoMA, in New York has been the central exhibiting venue for both modern and postmodern art. The museum played a significant role in presenting the emergence of the main concepts of modern and postmodern art as a result of its adaptive policies. As expressed by Alfred Barr, MoMA's first director, the primary mission of MoMA is to provide a space for experimentation where the art of the present - the artworks created by the living artists or who were recently deceased - could be exhibited in contemporary context without concerning itself with timelessness and endurance. Since its beginning the museum's ideology 'of the now' is reflected in the constant track of the current art scene resulting in exhibitions consisting of newest artworks. In this way the museum curates not only their physical forms but ideas that these artworks reflect (Dominguez Rubio & Silva, 2013).

MoMA has a central position in the development of the modern and postmodern art through which we wish to motivate the relevance of MoMA Artworks dataset for our research. The MoMA Artworks dataset will serve as the main source via which we wish to explore to what extent one could measure a clear artistic break from Modernism to Postmodernism. To this end, our research question is: to what extent is there a clear artistic break visible from Modernism to Postmodernism within the MoMa dataset? In order to do so we will take into account three factors: the use of materials and techniques, frequency of nationality, and the appearance of new artists after 1980's. These three factors will serve as a means with which we attempt to measure the purported changes brought forward by postmodernism.

Moreover, we wish to assess relevant academic literature in order to inspect to what extent our findings (generated through analysing the MoMA Artworks dataset) correlate to art history. The latter will be evaluated in the conclusions.



Fig. 1, Cindy Sherman, *Untitled #224 (after Caravaggio's Bacchus)*, 1990. Photograph, 122 x 95,5 cm. Courtesy of the artist and Metro Pictures, MoMA, New York.



Fig 2, Hannah Wilke (posing in front of her artwork), *Ponder-r-rosa 4, White Plains, Yellow Rocks*, 1975, Latex, metal snaps, and push pins, 16 sculptures, each 43.2 x 66 x 14.6 cm, overall 172.7 x 635 x 14.6 cm, MoMA, New York.

## How does art history explain the changes in artistic production from modern to post-modern?

In 1939 and the year that followed, Greenberg published two seminal essays that had a major influence on the course of modern art. The first essay is titled 'Avant-Garde and Kitsch' and the second 'Toward a Newer Laocoon'. The ideas Greenberg expressed in these two essays helped to shape the main theoretical principles of modern art which were introduced in his later study from 1961 named 'Modernist Painting' (Clark, 1982). In this essay Greenberg defined Modernism as a period that started around the 1850's up to his present. The critic explained that 1850 represents a milestone for art and a start of the gradual breaking from realism to abstraction. His most radical idea is that art should exist for the sake of art, referring to the idea that illusionism and storytelling should be eliminated for the purpose of finding a higher value in art. This ideology should manifest itself in reducing artworks to its purest and simplest elements of line, colour, and surface striving towards a final result in achieving total abstraction. The critic believed that the first steps towards modernism were done by Edouard Manet. After that, the movement gradually reshaped throughout the series of -ism movements that followed (Impressionism, Fauvism, Post-Impressionism, Cubism, etc.) (Willette, 2012). Modern artists, Greenberg claimed, strived to free themselves from using old traditional methods, techniques and materials by replacing them with new artistic practices where process and experimentation became as important as the final product. The critic praised Abstract Expressionism as the movement where all his ideas were being met and the painter Jackson Pollock as the movement's main protagonist. Pollock was known for his experimental practices and reinventing the nature of painting by introducing new techniques and materials into his practice such as using gigantic canvases on which he dripped commercial paint directly onto the unstretched canvas without any prior application of a primer and with an ordinary house painter's brush. For Abstract Expressionists the experimentation represented a form of self-expression and personal freedom (Moma Learning, n.d.).

In a similar light, another acclaimed American art critic, Harold Rosenberg, perceived the modernist art as a giant laboratory where the artists had the chance to experiment with numerous attempts of trial and error. Moreover, the process of creation was more important than the final product. Similar for Greenberg, Abstract Expressionism was the definition of such practice for Rosenberg. However, the two critics divided in their opinion on the origin of Abstract Expressionism with Rosenberg challenging Greenberg's claim that the movement sprung from European art in a process of constant renewal (Rosenberg, 1952).

By the 1960's Modernism, as defined by Greenberg, became the leading tradition in American and European art institutions. However, towards the end of the 60's, many artists started to move beyond Greenberg's extreme and rigid ideas about art striving to exceed modernistic grand narrative in order to explore contemporary topics in politics, social ideology and culture. An American art critic Rosalind Krauss, who was among first who observed the new generation of artists that strived to move away from modernism, referred to Greenberg's view on art being limiting to the artistic creativity process and obscuring much of the individual artist's idiosyncrasies and irrationalities (Krauss, 1986).

According to Krauss, it was through the engagement with the ideologies of the surrounding world that shaped the post-modernist artistic movements, not by rigid rules but by willful eclecticism (Wolf, 2021). The characteristics often associated with post-modernist

artistic production are: the use of new media and technology such as video and photography; using body as an artistic medium and a form of expression (performance, bodyart); use of new techniques by application of mixed media (bricolage, and collage); blurring boundaries between high and low art; simplification of forms; appropriation of already existing images by positioning them in a new context; recycling historical styles and applying them to the contemporary context (Dewitte et al., 2015).

## To what extent did the relative frequency of materials change from modernism to postmodernism?

According to the research carried out, the frequency of materials changed progressively from the period known as modernism to postmodernism. It should be clarified that the present work evidences the existence of a solid and growing body of critical and historiographic works that, in the first place, define and delimit the existence of modernism and postmodernism; both movements being two artistic orientations with particular interests, bifurcations, characteristics and searches (Oliva, 2017). Secondly, it allows us to verify that there is indeed a change in the relationship and integration of the materials used in artistic creation for each movement, which inevitably generates new interactions and roles in the artistic field (Dominguez and Silva, 2013).

Following Dominguez and Silva, as opposed to modernism and the more traditional use by its exponents of more conventional and canonical materials for the achievement of their works, postmodernist artists have made an atypical and dissimilar use of their raw material. As this article suggests, with the entry of the avant-garde and the emergence of modernism during the first half of the 20th century, they were already destabilizing the canonical and dominant idea of art as an absolute object, exploring new artistic forms and, above all, integrating new materials in their works. With the entry of postmodernism, this search intensified, transgressing the conception of classical and modern art based on the static object and incorporating in its place works of conceptual art, performances or installations. This idea of noble and traditional art is finally broken with the incorporation into the artistic dynamic of an increasingly complex set of non-traditional materials ranging from organic elements such as waste or food to the use of industrial plastics, acrylic paints or mass-produced technologies and materials. The consolidation of new artistic practices and the integration of atypical materials has resulted in the transformation of the artistic field, its dynamics, institutions, study, reception, etc. (2013).

Likewise, Buskirk details in his comprehensive study, *The Contingent Object of Contemporary Art*, the same trajectory of movement of the notion of art materialized in the use of innovative and new materials. As the author states, during the late 1960s, early 1970s and beyond, many exponents of postmodernism, such as the renowned Jasper Johns and Robert Rauschenberg, rewrote the history of art, using in their works materials alien to the artistic tradition; materials more closely linked to the cultural and advertising production of the time and, above all, products linked to mass production and manufacturing. For Buskirk, the common use of these everyday materials not only reveals the interplay between artistic production and mass production, but also accounts for the social history of each object and speaks of the transitions undergone by artistic practices (2003). Going back to Dominguez and Silva, who call these formal transformations of the artistic device over time: "temporal trajectories of artworks", these processes are fundamental because they remind us of the provisional character of the artwork and the impact that such material changes have on artistic practice. As the authors state, it is not possible to assume that the physical

characteristics of artworks can provide a transparent view of the artistic field; no rigorous review of the material transformations of artistic processes can account for the tensions, redefinitions and relationships within postmodern art (2013).

## To what extent did the relative frequency of nationalities change from modernism to postmodernism?

Because of the Second World War many modernist artists have left Europe and migrated to America where a new centre of art has been created in New York (Jenkins, 2015). In the 1940's the new art capital became the birthplace of the first Abstract Expressionists with American artists such as Jackson Pollock, Mark Rothko, Willem de Kooning in the foreground. Starting in the 1960's with Minimalism (Michael Fried) the new generation of artists finally decided to break free in 1980's from narrow modernist confinements, and declared a new era of art called Postmodernism (Fried, 1998). These artists promoted inclusive art (unlike modernism which was predominantly exclusive to white men of Euro-American descent) open to anybody no matter the nationality, gender, race, descent, political and religious affiliation etc (Rzayeva Oktay, 2016). On the basis of the theoretical framework that defined postmodernist theory of inclusiveness and the support of the results derived from analysing the MoMA dataset we propose that there was an increase in relative frequency of nationalities from modernism to postmodernism.

## To what extent did a new generation of artists emerge from modernism to postmodernism?

According to the historian Guasch, it is possible to historicize and identify the main exponents of postmodernist art, as well as to point out a distance with the predecessor movements, through the exhibitions held during the decade of the 1970s and 1980s. In these spaces one can see the flourishing of new artists, but also the transition of artists from the modernist current to postmodernism. At the same time, with the emergence of these exhibitions, the aesthetic, semiotic and plastic concerns that accompany the works of art of this period can be framed (2000).

In relation to recognized artists who were part of the modernist movement and who moved towards postmodernism, we can list figures such as Philip Guston, Willem De Kooning, Roberto Matta, Jean Hélion, Balhaus and the last stage of Picasso. Likewise, some exhibitions held during this period became referential and useful to identify the artists belonging to these currents, among the most illustrious are: the *Zeitgeist* exhibition, held in Berlin; *Transavanguardia: Italia/América*, held in Italy; *Cota Cero, Sobre el Nivel del Mar*, Spanish exhibition; *Pictures endgame, Reference and Simulation in Recent Painting and Sculpture, A Forest of Signs, Art in the Crisis of Representation, Image World*, all of them held in the United States (Guasch, 2000).

Following the study advanced by Olivia, we can list a varied group of artists who swelled the ranks of postmodernism, exponents who usually came from the United States or Europe and who seemed to share a temporal and creative framework, artists such as: Sherrie Levine, Louise Lawler, Vikky Alexander, Barbara Kruger, Mike Bidlo, Ross Blekner, Robert Gober, Allan McCollum, Richard Prince, Peter Halley, Jeff Koons, Haim Steinbach, Jan Vercruysse, Wolfgang Laib, Reinhardt Mucha, Joseph Beuys, Donald Judd and Sol LeWitt (Guasch, 2000).

On the other hand, Jencks reflects on the impossibility of defining with certainty the exact beginning of one or the other generation, since many artists of the second half of the 20th century worked somewhere between modernism and postmodernism; however, for the theorist and historian it is possible to determine certain concerns and frames of reference to delimit postmodern artists. For Jencks, postmodern artists were oriented by a "social style of the arts", an approach that desacralized the work of art, the museum and authorship, and brought artistic creation closer to the public. Likewise, for Jencks, the artists who could be framed within this movement felt a great interest in mass production and the close relationship between technology and society (1992).



# Dataset

## What is included/excluded from the Moma dataset?

In this dataset, there are 138.155 records of artworks. Each of them is described with 29 attributes, which contains information about both artworks and its creators. For the part of artists, categories of metadata include name, gender, nationality, date of birth and death (if applicable). For artworks, there is information about its title, collection ID, dimension, medium, year of creation and date of curation, category, link for photograph, as well as a brief description of each work.

While the dataset offers comprehensive descriptions for all works in the rich repository of MoMA, it does not assign a detailed classification of style for each work, which leaves space for our analysis. Moreover, there is no direct access of photographs included because of license issues (MoMA, 2021).

## What other research is being done on the Moma dataset, how does our research differ from this?

In 2018, Topaz et.al conducted a research project to analyze the diversity of artists whose artworks are curated by museums in the States. In the same vein with our attempt of concretizing trends, Topaz et.al (2018) quantify the term of 'diversity' into several scales of measurement including gender and race of artists, the geographical distribution of museums, etc. In this project, we attempt to find clues for the shift from modernism to postmodernism by comparing the medium used, nationality of artists, and the extent to which there is a new generation of artists post-1980. By contrast, Topaz et.al (2018) uses the R programming language to scrape data from public online catalogues, in order to construct a customized dataset for later analysis. This step is simplified to us as MoMA offers free access to their large collections in Github. Thanks to the comprehensive information provided in the csv file, which includes detailed descriptions about both artists and artworks, we create the project dataset by extracting useful columns and sorting entries by the dividing point of modern and postmodern periods.

In other research, the MoMa dataset is applied as the object of analysis. For instance, the MoMA dataset is used as an example case that supports the designing of a recommender system for museum visitors (Ilarri et.al, 2017), in which the dataset acts as a sample for debugging and testing the functionality of the system.

Moreover, the trend of digitalization gives light to the application of data science into the field of art history. This is evident in the case in which the MoMA dataset is rendered as a subset for building shared databases (Wildenhaus, 2019). To illustrate, it is collected as part of a plan to establish an 'open data' platform where all data is available simultaneously. For this a larger database containing numerous museum repositories was constructed.

Besides, a lot of research on MoMA focusses on fields like computer vision (such as detection of visual elements (Castellano & Vessio, 2020) and distant viewing (Mantoan, 2021)). Our project differs from this since our dataset excludes photographs and is limited to textual analysis of metadata.

## To what extent are claims based on the Moma dataset generalizable?

The Museum of Modern Arts was established with the appearance of modern arts, hence its repository starts with the appearance of modernism and covers this whole period, as well as the shift from modernism to postmodernism. In terms of coverage the dataset is therefore representative for the time period that we intend to investigate. Moreover, MoMa has numerous works that are regarded as significant to modern art history, making it one of the most well-known datasets available on this time period. One limitation is that the dataset is entirely derived from the artwork collection of the New York museum of modern art. This means that claims derived from the MoMa dataset might not be generalizable towards the collections of other museums. We acknowledge this limitation by including it within our central research question: to what extent is there a clear artistic break visible from Modernism to Postmodernism within the MoMa dataset?

The year 1980 is frequently named throughout the literature as a breaking point between modernism and postmodernism. For the purposes of this research, we accept this delineation, however, we acknowledge that by taking a single year as point of delineation, it is possible that we obscure the nature of change between modernism and postmodernism. The break between modernism and postmodernism might not be constituted by a single radical break, but rather by incremental changes within an underlying continuity. Part of this research is therefore to investigate the suitability of taking the year 1980 as point of delineation. We intend to investigate whether we can find any evidence of changes in terms of the diversity of materials and techniques, the diffusion of nationalities and the emergence of a new generation of artists between before 1980 and on and after 1980. Future research might focus on taking other years as points of delineation, or may focus on tracking changes dynamically over-time.

## Methodology

### Description of Methodology

We decided to analyze the dataset on the basis of three subquestions:

1. SubQ 1: To what extent did the relative frequency of materials change from modernism to postmodernism?
2. SubQ 2: To what extent did the relative frequency of nationalities change from modernism to postmodernism?
3. SubQ 3: To what extent did a new generation of artists emerge from modernism to postmodernism?

In total, there are 138.155 records present within the dataset. In order to answer the subquestions, we decided to split the total record of artworks on the year 1980, with the first subset consisting of all artworks created before 1980, and the second subset consisting of all artworks created on or after 1980. The year of creation of each artwork was derived from the 'date' column. In case an artwork was created over a number of years, the year of creation is taken to be the year at which creation began.

In order to answer the subquestions, we derived a total of 505.610 cited materials (excluding stopwords). From this, 357.465 materials were cited on artworks from before 1980, and 148.145 materials were cited on artworks from on or after 1980. Furthermore, we derived a total of 127.723 nationalities cited. From this, 91.415 nationalities were cited on artworks from before 1980, and 36.578 nationalities were cited on artworks from on or after 1980. In terms of artists, 7678 different artists were cited before 1980, and 5650 different artists were cited on or after 1980. Since the sample sizes of the two subsets are not symmetrical, we included, besides counts, also the percentages of materials, nationalities and artists as a percentage of the total.

We compare the two subsets with each other on the basis of count differences and percentage differences. Count difference refers to the total difference in the number of counts between before 1980 and on or after 1980. Percentage difference refers to the increase or decrease between the percentages of before 1980 and on or after 1980. The comparisons only include the materials, nationalities and artists that were included in both the first as well as the second subset. Since there is significant continuity between the two subsets, this means that the majority of all materials, nationalities and artists are included in the comparison. However, some that were only present before 1980 and not on or after 1980, or vice versa, are excluded from this comparison. We will note the most significant of these below in the analysis, but for a complete list of all excluded records we refer to the notebooks, which contain a list of all excluded records.

## Overview of CSV files:

- [Subquestion1Before1980.csv] = CSV file of words, word counts and percentages of materials from before 1980.
- [Subquestion1Onafter1980.csv] = CSV file of words, word counts and percentages of materials from on or after 1980.
- [Subquestion1Comparison.csv] = CSV file of words, word counts before 1980, percentage before 1980, word counts on or after 1980, percentage on or after 1980, word count difference and percentage difference of all materials present in both subset 1 as well as subset 2.

- [Subquestion2Before1980.csv] = CSV file of nationalities, counts and percentages of nationalities from before 1980.
- [Subquestion2Onafter1980.csv] = CSV file of nationalities, counts and percentages of nationalities from on or after 1980.
- [Subquestion2Comparison.csv] = CSV file of nationalities, counts before 1980, percentage before 1980, counts on or after 1980, percentage on or after 1980, word count difference and percentage difference of all nationalities present in both subset 1 as well as subset 2.
- [Subquestion3 artist count.csv] = CSV file of artist counts and the percentage of how often they occur before and after 1980. It was used to answer the third subquestion.

## Overview of Python Notebooks

- [MomaDatasetVersion1.ipynb] = Jupyter Notebook with exploratory data analysis, date cleaning and adding of medium 'Wordcount' column
- [MomaDatasetVersion2.ipynb] = Jupyter Notebook with data cleaning and adding of 'Date\_start\_year' column
- [MomaDatasetSubquestion1.ipynb] = Jupyter Notebook with data analysis for the first subquestion and creation of the two subsets
- [MomaDatasetSubquestion2.ipynb] = Jupyter Notebook with data analysis for the second subquestion and creation of the two subsets
- [ComparativeAnalysisSubquestion1.ipynb] = Jupyter Notebook with comparative analysis between the first and second subset of the first subquestion
- [ComparativeAnalysisSubquestion2.ipynb] = Jupyter Notebook with comparative analysis between the first and second subset of the second subquestion

## Analysis of results

To what extent did the relative frequency of materials change from modernism to postmodernism?

	word	wordcount_before	percentage_before	wordcount_onafter	percentage_onafter	wordcount_differenc	percentage_differen
0	print	26521	0.07419187893	7936	0.05356913834	-18585	-27.7964932
1	silver	23150	0.06476158505	6083	0.04106112255	-17067	-36.59648306
2	lithograph	19429	0.05435217434	5159	0.03482399001	-14270	-35.92898457
3	gelatin	17189	0.04808582658	4863	0.03282594755	-12326	-31.73467135
4	paper	13559	0.03793098625	4669	0.03151641972	-8890	-16.91115144
5	printed	11898	0.03328437749	4161	0.02808734686	-7737	-15.61402384
6	one	11355	0.03176534766	4043	0.02729082993	-7312	-14.0861601
7	etching	9643	0.02697606759	3835	0.02588680009	-5808	-4.037903186
8	book	8189	0.0229085365	3579	0.02415876337	-4610	5.457471601
9	pencil	8167	0.02284699201	3331	0.0224847278	-4836	-1.585610099
10		7777	0.02175597611	3243	0.02189071518	-4534	0.6193198019
11	illustrated	7359	0.02058663086	2910	0.01964291741	-4449	-4.584108266
12	albumen	5874	0.016432378	2468	0.01665935401	-3406	1.381273096
13	ink	5679	0.01588687004	2463	0.01662560329	-3216	4.649960935
14	color	5532	0.01547564097	1980	0.01336528401	-3552	-13.63663685
15	black	5387	0.01507000685	1951	0.01316952985	-3436	-12.61098963
16	aquatint	5132	0.0143566503	1893	0.01277802153	-3239	-10.99580149
17	portfolio	5118	0.01431748563	1854	0.01251476594	-3264	-12.59103544
18	engraving	4832	0.0135174073	1788	0.01206925647	-3044	-10.71322921
19	woodcut	4561	0.01275929112	1617	0.01091498194	-2944	-14.45463669
20	drypoint	4040	0.01130180577	1611	0.01087448108	-2429	-3.781030192
21	offset	3592	0.01004853622	1499	0.01011846502	-2093	0.695910285
22	screenprint	3200	0.008951925363	1491	0.01006446387	-1709	12.42792429
23	letterpress	3161	0.008842823773	1190	0.008032670694	-1971	-9.161701053
24	wood	3099	0.008669380219	1183	0.00798541969	-1916	-7.889382073
25	including	2997	0.008384037598	1177	0.00794491883	-1820	-5.237557244

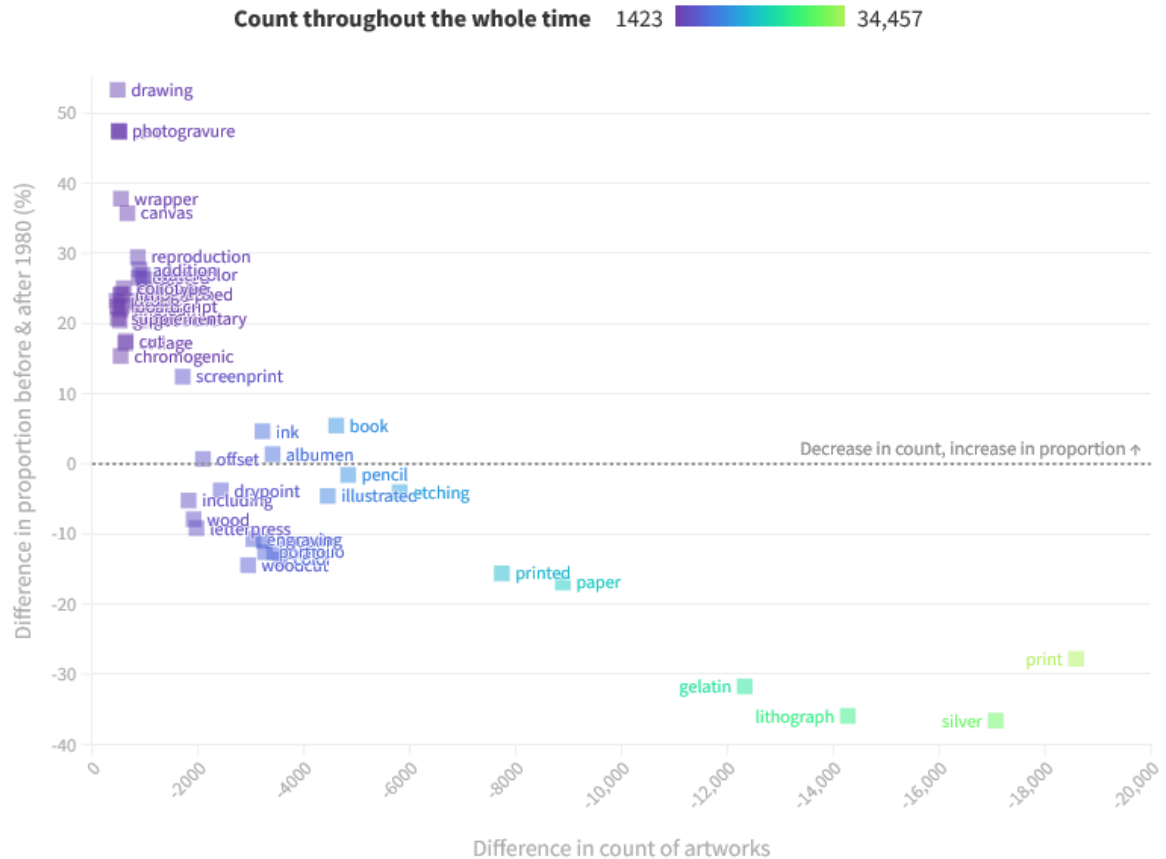
Fig. 3, Top 25 most frequently mentioned 'materials' in the dataset, and the changes from before 1980 to on and after 1980. Full dataset is also available as Subquestion1Comparison.csv

The data analysis points to significant continuity between materials used before 1980 compared to on and after 1980. The top 25 materials (example of the dataset used seen in fig. 3), ordered by word count, does not change from before 1980 to after 1980. At the same time however, the relative frequency of all top 25 materials decreases, with the exceptions of 'albumen', 'ink' and 'offset'. A noticeable observation is that the relative frequency of the top 5 materials decreases significantly, by 27.8, 36.6, 35.9, 31.7 and 16.9 percent respectively. This strongly points towards less concentration amongst materials used (see also chart 1).

A number of materials were only used on or after 1980, but not before 1980. The most significant of these are 'archival', 'multichannel', 'dye transfer' and 'modelling' artworks. Some other interesting exceptions, which correspond to the emergence of new media computer and video art are 'computer generated', 'silicone' and 'digitally' artworks. Some other interesting materials that were used on or after 1980, but not before are 'mayonnaise', 'intestines', 'curry', 'seatbelts', 'rabbitskin' and 'honey'. Some interesting types of materials

that were only used before 1980 are heliogravure, hectrographed, celluloid and paperfaced artworks.

## Popularity change of mediums throughout the whole time



Data: Top 50 of the mostly used materials& techniques. sorting by count

Chart 1. Representation of the top 50 most used materials from before and after 1980, sorted by count. On the Y-axis, percentage increase of percentage decrease from before 1980 to after 1980 is visualized. On the X-axis, the decrease in total count is visualized. The colors that are assigned reflect the sum of counts from both before as well as after 1980.

## To what extent did the relative frequency of nationalities change from modernism to postmodernism?

	nationality	count_before	percentage_before	count_onafter	percentage_onafter	count_difference	percentage_differer
0	american	30994	0.4111755263	26937	0.5119739993	-4057	24.51470638
1	french	16167	0.2144761804	3626	0.06891701828	-12541	-67.8672857
2	german	6113	0.08109685721	2747	0.05221043829	-3366	-35.61965275
3	british	3351	0.04445535229	1967	0.03738548675	-1384	-15.90329436
4	russian	2941	0.03901617161	1379	0.02620975406	-1562	-32.82335766
5	spanish	2265	0.03004815665	1348	0.02562055727	-917	-14.73501165
6	italian	1746	0.02316294989	1327	0.02522142396	-419	8.886925335
7		1614	0.02141179904	1307	0.02484129699	-307	16.01686035
8	japanese	1364	0.01809522546	1198	0.02276960505	-166	25.83211576
9	mexican	973	0.01290810438	1126	0.02140114798	153	65.79621108
10	swiss	919	0.01219172449	766	0.01455886266	-153	19.41594216
11	dutch	729	0.009671128564	746	0.0141787357	17	46.6089051
12	argentine	710	0.009419068971	693	0.01317139925	-17	39.83759209
13	austrian	676	0.008968014964	619	0.01176492949	-57	31.18766564
14	nationality unknown	496	0.006580081986	612	0.01163188505	116	76.77416596
15	czech	491	0.006513750514	466	0.008856958224	-25	35.97324928
16	belgian	442	0.005863702092	407	0.007735583685	-35	31.92320421
17	brazilian	383	0.005080990727	371	0.007051355153	-12	38.77913839
18	venezuelan	314	0.004165616418	318	0.006044018702	4	45.09302094
19	polish	260	0.003449236525	298	0.00566389174	38	64.20711364
20	danish	233	0.003091046578	275	0.005226745733	42	69.0930758
21	hungarian	193	0.002560394805	239	0.004542517201	46	77.41471714
22	chilean	191	0.002533862216	236	0.004485498156	45	77.02218091
23	canadian	179	0.002374666684	206	0.003915307713	27	64.87820116
24	finnish	164	0.002175672269	195	0.003706237883	31	70.34908867
25	swedish	159	0.002109340798	177	0.003364123617	18	59.48696487

Fig. 4, Top 25 most frequently mentioned 'nationalities' in the dataset, and the changes from before 1980 to on and after 1980. Full dataset is available as Subquestion2Comparison.csv

What we find evidence of within the dataset (example of the dataset seen in fig. 4) is that there is an increased percentage of artworks from nationality 'american' after 1980 compared to before 1980. The nationality 'american' increased by 24.5 percent, from 41.1 percent of the total to 51.1 percent of the total. This points towards more concentration of the artworks in terms of nationality. However, besides the fact that the 'american' nationality became responsible for the majority of artworks after 1980, most other factors correspond with a picture of increased diffusion after 1980. Firstly, there was a lower percentage of artworks from major European nationalities ('french', 'german', 'british', 'russian'). Most significantly, 'French' decreased from 21.4 percent of the total to just 6.9 percent of the total, a decrease of 67.9 percent. Also 'German', 'British' and 'Russian' decreased by 35.6 percent, 15.9 percent and 32.8 percent respectively. Secondly, we observed that there was a higher total number of nationalities reported after 1980 compared to before 1980, from 96 before 1980 to 101 after 1980 (note, this included also entities such as 'nationality unknown' or empty). Some of this also corresponds to changing international borders after 1980 or changing political climates. Some nationalities that were mentioned after 1980 but not before 1980, for example, include 'palestinian' and 'welsh'. Most significant is 'Ivorian', which was mentioned 482 times after 1980 but none before. Thirdly, all nationalities outside of the top

10 most frequently named nationalities, increased their presence after 1980 compared to before 1980. The most significant 'upcoming' nationalities are: 'japanese', 'mexican', 'Swiss' and 'Dutch'. We visualised our findings in Chart 2 and Chart 3 representing the top 25 most frequent nationalities present in the MoMA dataset before and after 1980's.

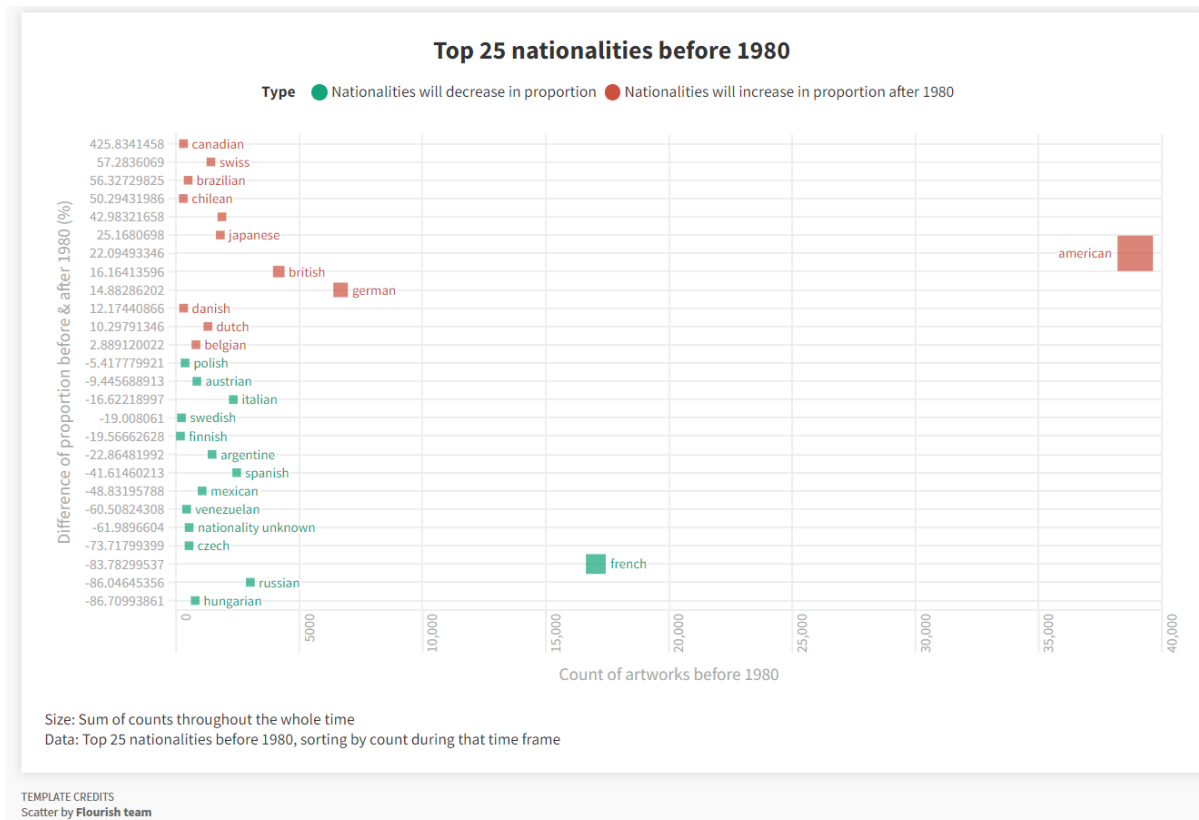


Chart 2. Representing top 25 most frequent nationalities present in the MoMA dataset before 1980's. The chart expresses multiple things: it tells which nationalities one can find in the MoMA before 1980's, the number of times they appear in the MoMA dataset (the X axis) and the difference of the proportion in percentage before and after 1980's based on the general proportion the nationality is occupying within the dataset.



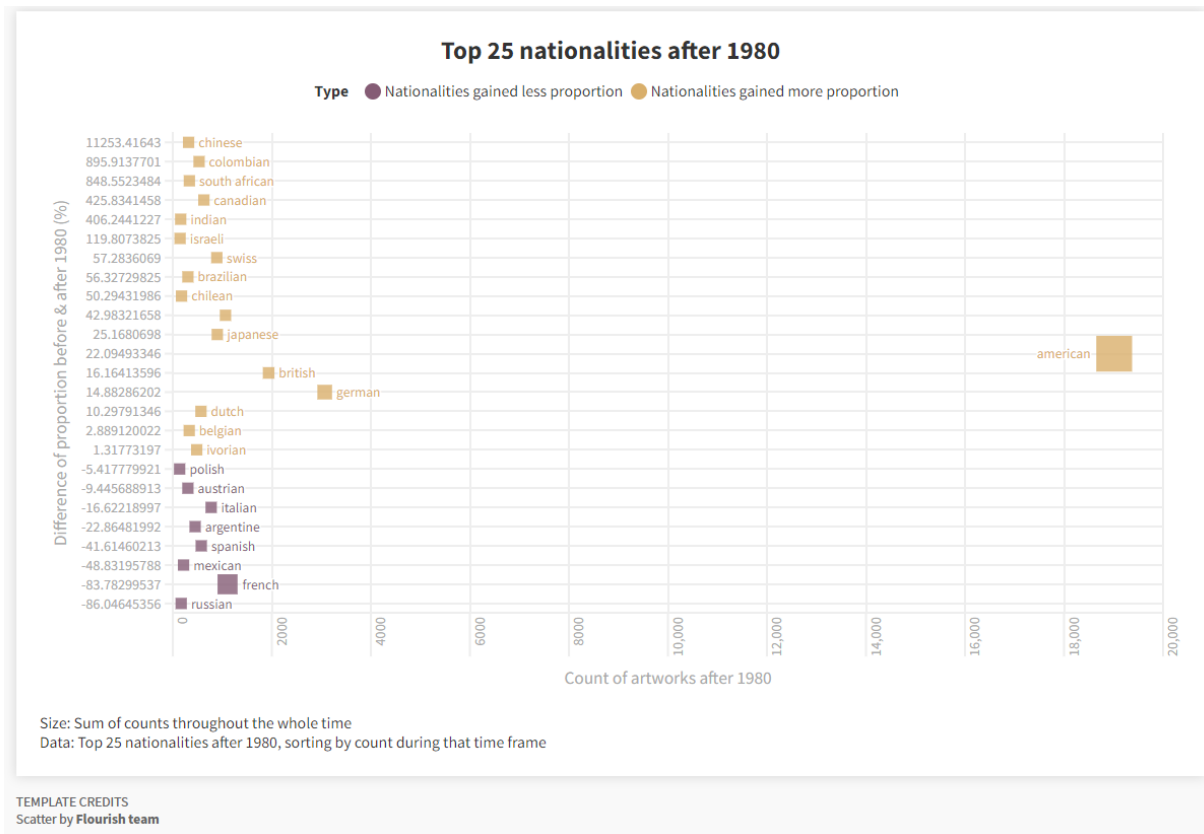


Chart 3. representing the top 25 nationalities present in the MoMA dataset after 1980. As Chart 2, Chart 3 tells us the number of times a certain nationality appears in the MoMA dataset and if their appearance in the dataset increased or decreased (in percentage) after 1980's. It also indicates that new nationalities appear in the (top 25 of the) dataset (such as Chinese, Israeli, Ivorian, etc.,).

## To what extent was there a new generation of artists?

	A	B	C	D	E	F	G	H
1	Artist	Count_bef	Percentage_be	Count_aft	Percentage_aft	Count_diff	Percentage_difference	
2	Eugène At	4951	5,038416527	56	0,149289542	-4895	-0,97036975	
3	Ludwig Mi	2636	2,682542106	6	0,015995308	-2630	-0,994037257	
4	Unknown	2452	2,495293339	250	0,666471168	-2202	-0,732908689	
5	Jean Dubu	1411	1,435913092	24	0,063981232	-1387	-0,955442128	
6	Pablo Pica	1249	1,271052765	60	0,15995308	-1189	-0,87415701	
7	Marc Chag	1160	1,180481351	1	0,002665885	-1159	-0,997741697	
8	Henri Mati	1056	1,074645092	7	0,018661193	-1049	-0,982635018	
9	Frank Lloy	860	0,87518445	9	0,023992962	-851	-0,972585251	
10	Lee Friedla	766	0,779524754	554	1,476900109	-212	0,894616048	
11	August Sar	700	0,712359436	50	0,133294234	-650	-0,812883458	
12	Unknown	585	0,595328957	6	0,015995308	-579	-0,973131984	
13	George Ma	539	0,548516766	276	0,73578417	-263	0,341406891	
14	Dorothea	477	0,485422073	2	0,005331769	-475	-0,989016221	
15	Joan Miró	473	0,481351448	12	0,031990616	-461	-0,933540003	
16	Jan Dibbet	425	0,432503943	2	0,005331769	-423	-0,987672323	
17	Pierre Alec	391	0,397903628	37	0,098637733	-354	-0,752106475	
18	Album-mis	381	0,387727065	6	0,015995308	-375	-0,95874596	
19	Garry Win	355	0,361268	3	0,007997654	-352	-0,977862268	
20	Jules Pasci	345	0,351091436	1	0,002665885	-344	-0,992406864	
21	Louise Bou	345	0,351091436	2991	7,973661059	2646	21,71106681	
22	Henri Cart	305	0,310385183	1	0,002665885	-304	-0,991411043	
23	Josef Albe	289	0,294102682	2	0,005331769	-287	-0,981871063	
24	Alexander	287	0,292067369	3	0,007997654	-284	-0,972617092	
25	Alighiero E	277	0,281890805	6	0,015995308	-271	-0,943257078	

Fig 5. Representation of a dataset of 50 top artists before 1980's and after 1980's.

From the dataset we could deduce that in general a big percentage of artists who were mentioned most frequently in the MoMA dataset before 1980's have a large decrease of their frequency after 1980's. It can be noticed that many artists that appear in the dataset before 1980 do not appear at all or appear in a much smaller percentage after 1980's. Furthermore, it can be observed that many renowned artists that appeared in the group of the most frequently mentioned artists before 1980's, such as Pablo Picasso and Marc Chagall, are mentioned much less or not at all after 1980's.

Moreover, we observed that there was also a small group of artists who remain mentioned in equal proportions both before and after 1980's or appear even more frequently after the delimited year. Most noticeable is a group of artists — Jasper Johns, Jim Dine, Robert Rauchenberg, George Maciunas, Louise Bourgeois, and Lee Friedlander — who are the most frequently mentioned artists both before and after 1980's (see fig. 1). Furthermore, our results have shown that a great proportion of artists appeared for the first time in the dataset after the delimiter year 1980's (see chart 5).

From our analysis we could conclude that, despite the continuous presence of a small group of artists, there was a relatively clean cut between the 'older' (artists before 1980's) and the younger (artists after 1980's) generation of the artists represented in the

MoMA dataset (see chart 4). This result also coincides with the MoMA's ideology of 'the art of now', always striving to present the most contemporary artworks in the art scene.

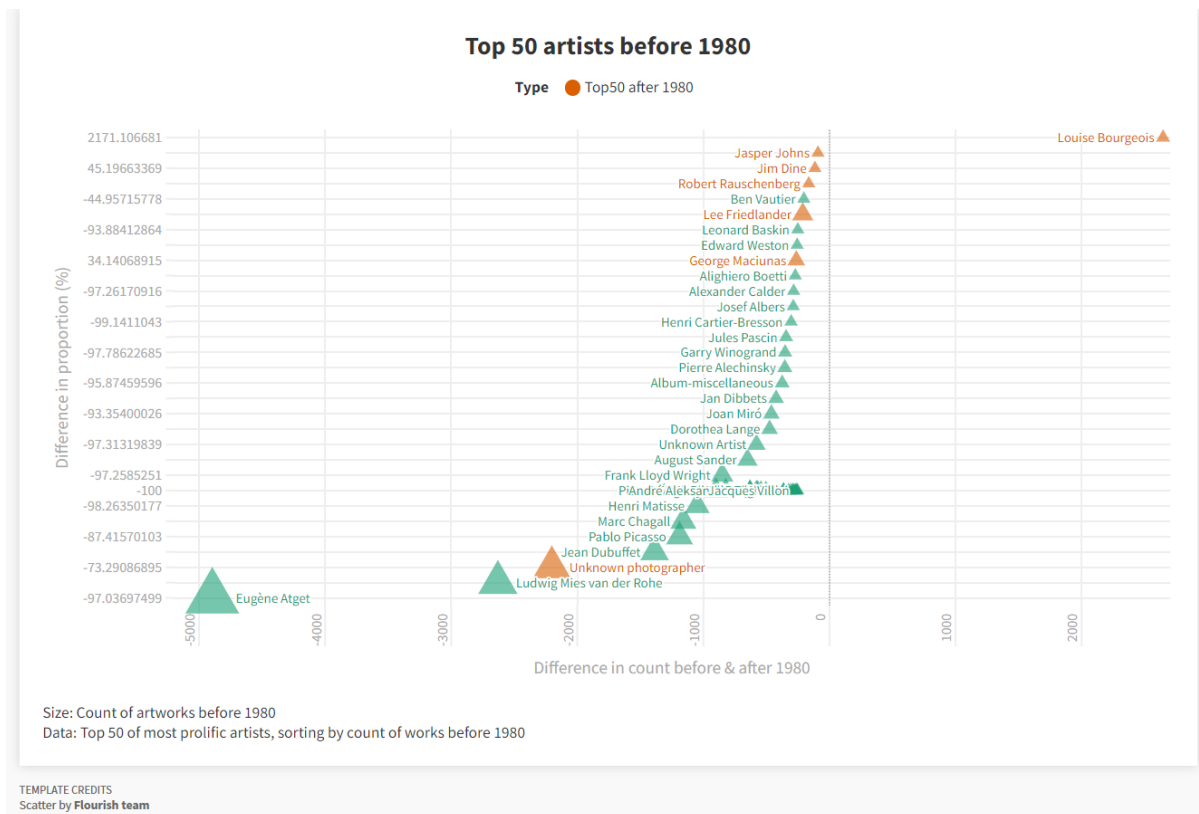


Chart 4. Representation of the 50 most frequently mentioned artists in the MoMA dataset. The orange colour represents the artists who would still be active (among top 50) after 1980, and the green colour represents the artists who were only active before 1980.

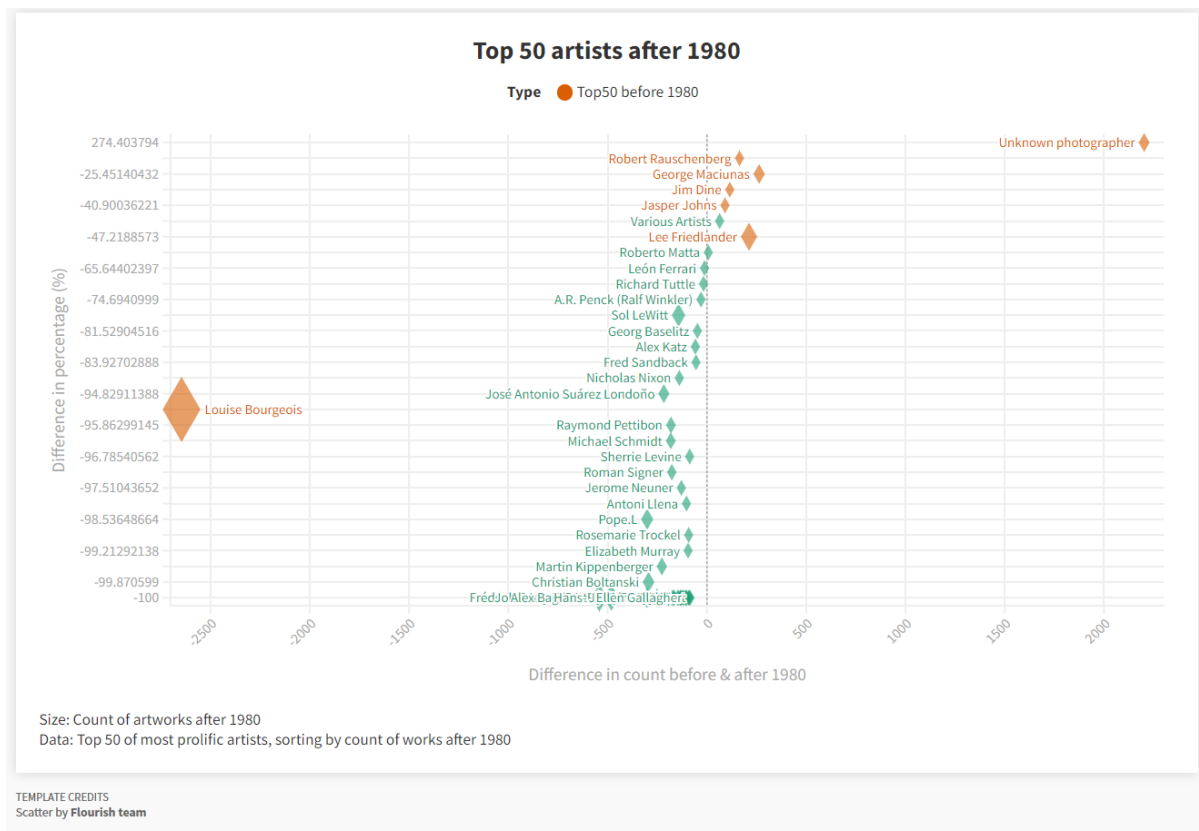


Chart 5. Representation of top 50 artists who appear most frequently in the MoMA dataset after the delimiter year 1980. Orange colour represents artists who were active all throughout the whole period (both before and after 1980) and green colour represents new artists who appeared after 1980 as top 50.

## Conclusion

The data analyses provide interesting results that resonate with the literature cited above. As the evidence shows, there appears to be a sustained continuity in the use of materials before and after the 1980s. This information could be read through the lens provided by Jencks, who states that it is difficult to draw a chronological line defining when modernism begins and ends and where the postmodernist movement begins, so the formal changes such as the use of materials explored here cannot be seen as an abrupt change but rather as a progressive, non-linear, synchronic transition (1992).

However, the data shown here allow us to make several significant observations. As already mentioned, the frequency concentration of the most commonly used materials decreased, while from 1980 onwards we observe the appearance of materials never used before. However, it should be clarified that prior to the appearance of these novel materials, in the preceding years, elements emerged that could be called "hinge" materials, components that fit well in the context of modernity and that explain the passage to the most dominant materials in postmodernity. Both conclusions could be interpreted in the light of some theorists previously consulted (Dominguez and Silva, 2013; Buskirk, 2003), who claim that from the 1980s onwards, artists adopted a new collection of materials, dissident elements in relation to the traditional and canonical set of materials previously used. This new collection of materials is closely related to industrial production, mass consumption, mass media and technological development. This break with tradition in terms of materiality also foreshadows an important direction for the Postmodernist movement, namely the emergence of media art and computer art that requires computer media and devices for reproduction and interaction (Dominguez and Silva, 2013).

The results generated from the dataset correspond well with the fact that after the Second World War the art market gradually shifted from Europe to America (Jenkins, 2015). We assume that as the geographical artistic centres shifted from one continent to another, so did the relative frequency of the artists' nationalities found in the MoMA dataset. This historical factor clearly explains the growing amount of artworks made by Americans and decrease of the artworks made by European artists in the MoMA dataset. We argue that the MoMA dataset expresses the increase in the varieties of nationalities as a result of the inclusiveness ideology practiced in Postmodernism promoting multicultural interactions (Rzayeva Oktay, 2016). Postmodernists refused modernistic praise of artworks created predominantly by white men of European descent (Arnason, 2013). Because of this protest, which was also reflected in MoMA's policy, there were more artworks in the MoMA created by artists coming from different countries around the world after 1980's.

Regarding a new generation of artists, although the data suggest that a continuity can be traced between artists belonging to a generation prior to 1980 and the years after, the frequency of artists present before 1980 decreases progressively after this year. This result could be understood on the basis of Jencks, who refers to the impossibility of thinking of artistic movements as finished and absolute phenomena in time. This position is materialized in the fact that the five most prolific artists before and after 1980 are the same, which suggests that their careers could have begun in Modernism and that it is not easy to distinguish when a phenomenon begins and ends (1992). But at the same time, and as Guasch confirms, these data allow us to glimpse the formation of a corporeal generation of

postmodern artists who undoubtedly share a temporal, creative and sociological framework (2000).

In that sense, the MoMA, as well as the exhibitions, shows and spaces that emerged in 1980 and the following years, are spaces of confirmation of the so-called Postmodernist movement. This movement represented a series of changes in materials, role, space, geography, and so forth; transformations that redefined the place and role of art.

Returning back to our research question then, through the analysis developed and presented in this work, it can be concluded that it is possible to perceive a soft break from Modernism to Postmodernism within the MoMa dataset. However, on the basis of a series of interesting and significant observations, we suggest that this transition did not occur as a rupture, but rather developed as a progressive transition. This thesis is based on the findings provided by our study, where it is evident that although the frequency of the variables chosen (materials, nationalities, generations) did not change radically after 1980, small variations do appear that demonstrate the emergence of new materials, geographical places of enunciation and the conformation of new generations. Future research could focus on investigating these small variations over-time, and focus on testing our hypothesis against a broader set of sub questions and/or a larger set of datasets.

# Members' Contributions

## Gina:

- Actively participate in group meetings
- Actively participate in the process of defining and refining the research question
- Participate in the preparation of the presentation and in the presentation itself
- Take an active role in the creation of the theory paper, especially in the construction of the theoretical background and the consideration of the conclusions of the final document

## Weiyu

- Actively participate in group meetings
- Dataset section in theoretical part:
  - Overview of the dataset
  - Literature review of similar researches and researches related to the dataset
  - generalizability of the conclusions
- Analysis of the results of 3 sub questions
- Visualizations for sub question 1,2 and 3 based on the analysis
- Data Management Plan
- Participate in the preparation of the presentation and in the presentation itself

## Olivier:

- Actively participate in group meetings
- Analysis of subquestion 3
- Exploratory data analysis of the MoMa dataset
- Managing OSF
- Methodology
- Grammar/spelling check of the final draft

## Alexander:

- Actively participate in group meetings
- Cleaning of the dataset
- Analysis of subquestion 1 and 2
- Analysis of the results of sub question 1 and 2
- Reflecting on and working on some of the methodological issues
- Methodology
- Participating in the preparation of presentation and presentation itself

## Nika:

- Actively participating in the group meetings
- Finding MoMA dataset
- Participating in the preparation of presentation and presentation itself
- Taking an active role in creating the theoretical document:
  - finding and assessing relevant academic literature
  - writing the introduction to our topic

- chapter 'How does art history explain the changes in artistic production from modern to post-modern?'
- chapter 'To what extent did the relative frequency of nationalities change from modernism to postmodernism?'
- analysing the dataset
- writing the results of the analysis under 'To what extent was there a new generation of artists?'
- co-creating the 'Conclusions'.
- Co-creating DBMS for this project



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