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Visual Contagions, the Art Historian, and the Digital Strategies to Work on Them

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Visual Contagions, the Art Historian, and the Digital Strategies to Work on Them

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Abstract

How do images and styles spread out over time and place? This article presents how art historians can use digital methods to study "visual contagions"– the visual part of globalization: how images circulate, as material artefacts (paintings, sculptures, engravings, etc.…) or in reproductions (in illustrated periodicals, in photography, or on the internet…), through which channels (cultural, geographical, political…) and according to which visual logics. It sketches the new possibilities offered by deep learning and artificial intelligence algorithms applied to images, to better understand the epidemiology of visual diffusions. This Paper is also an opportunity to assess 10 years of digital approach to artistic globalization with the Artl@s Project (https://www.artlas.huma-num.fr).

Résumé

Comment les images et les styles se diffusent-ils ? Cet article montre comment les historiens de l'art peuvent utiliser le numérique pour étudier les « contagions visuelles » – la part visuelle de la mondialisation : comment les images circulent, sous forme matérielle (peintures, sculptures, gravures, …) ou en reproductions (périodiques, photo, images sur Internet…), selon quels canaux (culturels, géographiques, politiques…) et quelles logiques visuelles. On y aborde l'intérêt d'appliquer l'apprentissage profond et l'intelligence artificielle aux images pour étudier le côté épidémique du phénomène. Cet article est aussi l'occasion d'un bilan, après dix années d'étude numérique de la mondialisation artistique, déployées par Artl@s (https://www.artlas.huma-num.fr).

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Some images have been contagious, reproduced over and over again, sometimes globally, only to be forgotten. Other images have marked their time: We think of the *Mona Lisa*, Picasso's *Guernica*, photographs of Che Guevara, Marilyn Monroe, and their multiple reinterpretations over time and space. We know that some images have contributed to cultural globalization, but we are not able to explain how this globalization process happened. Identifying globally influential images, their channels of circulation, their influence over other images, and the ideas that accompanied them, is essential for understanding the extent to which images fueled the historical upheavals and cultural modernization process, from ancient forms of visual contagion (citation, copy, pastiche, reuse…) to the contemporary acceleration of image circulation through the Internet. It will help us discover which prescriptive images might have been at the heart of the international convergences of taste, and of cultural, gendered, social and political representations.

In this paper, I define "influential" images as those that have been reproduced extensively, whatever the medium: those that have been copied, imitated, or have inspired other images. "Influential" can also be defined more broadly as a social and political power that leads some actors to new worldviews, and to new types of behavior. In the expression "visual contagions," "contagion" is used to broaden the neutralizing scope of the term "circulation," and to deal with the overwhelming effect that images can have. The word "circulation" implies the movement of the source object to a target culture or subgroup. Rather, diffusion refers to a reproduction/copy (even most often a continuum of reproductions) of a source object that spreads in space and time. Moreover, the circulation of images it not neutral: a visual contagion can often be taken negatively, because it is incontrollable. Some visual circulations seem to behave like diseases, viruses, or epidemics. They touch broad regions, huge populations, and broadcast from continent to continent. We can think of fashions trends, of religious and devotional representations, as well as

of political propagandist images, "fake news," or visual "memes." "Contagion" is precisely what we do not understand from images. Why do they have such impact? Taking advantage of the recent development of visual big data, why not apply to this data the same questions that are being asked to study epidemics? In this article, I propose therefore to develop an epidemiology of images.

Many approaches are possible. So far, historians have worked on circulating still images one by one. Now, the multiplication of images over time makes it impossible to study them this way. For just the period of the material and the printed regime of image circulation (in artwork, engravings and illustrated periodicals), from the 1880s to the apparition of Internet in the 1990s (and the dramatic change that this triggered in image circulation processes), analyzing the impact of artistic and non-artistic images in the global diffusion of styles, iconographies, ideas, practices and representations, is a real challenge for research. Understanding the diffusion of digital images is even more difficult. Digital approaches help a great deal, provided that a clear methodology is defined, and provided that they are applied on representative and commensurable corpora before employing more traditional, archival, historical, and hermeneutical approaches. Starting from the hypothesizes that the circulation of still images, artistic and non-artistic, in original and reproduction, reflects the development of cultural globalization in the 20th century, the digital and historical study of visual contagions will help better understand convergences and divergences in cultural globalization**.** It will help us to understand the geography of this globalization, its main nuclei, its pockets of resistance, but also its directions and how it operates. In addition, it will likely help us better understand the social, cultural, economic, — and why not cognitive factors of image circulation.

This article provides an overview of the research available on the subject, and describes the work currently underway to study visual contagions. It is also an opportunity to assess 10 years of digital

approach to artistic globalization with the Artl@s Project (https://www.artlas.huma-num.fr).

The Challenges of Visual Circulations, from Wölfflin and Warburg to Global Historical Studies

Art historians never clearly defined what they understood as "diffusions" and "influences," or even as "styles," and how they can work on such phenomena—even if the circulation of styles has always been an issue for them. We can suppose that their difficulty to do so was linked to the monographic fate of the discipline: art historians were long driven by case-studies, often considered as an ethic, while the study of broad diffusions required more than a dozen cases to work on, which implied an energy that individuals could not have. Yet, some art historians were interested quite soon in using technology to better study images diffusion.

Defining and Tracing Visual Diffusions. From "Paper Museums" to Photography

As the Louvre exhibition "Paper Museums" demonstrated, 17th and 18th century antique dealers often constituted imposing figurative collections of antiques where they collected images of ancient works in engravings or drawings.[1] These "paper museums" had a real effect from the 18th century on the development of a penchant for the ancient, and on the development and propagation of the neoclassical style. Within the antiquarian culture, these major projects helped to visually reconstruct the stylistic evolution of given artistic objects. Moreover, antiquarian erudition, whose visual aspects were crucial, was an essential root of the birth of Art History, despite the subsequent

denials of art historians who were careful to distinguish themselves from it.[2] As Pascal Griener has shown, in the 18th century, Art History, like the history of science, began to give new importance to the technical devices that made it possible to represent, display, and compare art objects.[3] In their "Laboratories," art historians began to develop new experiments, serializing and comparing images to draw hypotheses about the history of styles in particular.

Reproductive photography became an essential instrument in the appreciation of art in the 19th century. The cheap, illustrated Art History textbook was born at that time. It gave access to portable and visual knowledge, ready to be invested in the museum.[4] The rise of photography had an even stronger impact on art historians. Using photography and the possibility to compare images and display the possible circulation of patterns or themes visually, art historians continued to reconstruct strictly optical evolutions. Following Alois Riegls's *Stilfragen: Grundlegungen zu einer Geschichte der Ornamentik* (*Problems of style: foundations for a history of ornament*, 1893) and Heinrich Wölfflin's *Kunstgeschichtliche Grundbegriffe* (*Fundamental Principles of Art History,* 1899),[5] they studied stylistic diffusions from case to case, from image to image and from artefact to artefact. The gradual expansion of the study led them to envisage the possibility that shapes could be thought of as autonomous, if historical and social logics could be relativized.

Aby Warburg and the Pledge of Iconology

Without necessarily increasing the corpus studied, the "iconology" proposed by Aby Warburg brought to light the importance of photographic

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[1] Elisabeth Décultot, *Musées de papier. L'antiquité en livres 1600-1800,* exhibition catalogue (Paris: Gourcuff Gradenigo, 2010).

[2] Gabriele Bickendorf, *Die Historisierung der italienischen Kunstbetrachtung im 17. und 18. Jahrhundert* (Berlin: Gebruder Mann Verlag, 1998).

[3] Pascal Griener, *La république de l'oeil. L'Expérience de l'art au siècle des Lumières* (Paris: Odile Jacob/ Collège de France, 2010).

[4] Pascal Griener, *Pour une histoire du regard. L'expérience du musée au XIXe siècle* (Paris: Hazan, 2017).

[5] Alois Riegl, *Stilfragen: Grundlegungen zu einer Geschichte der Ornamentik* (Berlin: George Siemens, 1893); Heinrich Wölfflin, *Kunstgeschichtliche Grundbegriffe: Das*

Problem der Stilentwicklung in der neueren Kunst (Munich: F. Bruckmann A.-G., 1899). Alois Riegel, *Historische Grammatik der bildenden Künste,* posthume edition by K. M. Swoboda and O. Pächt, 1966 (Sesto San Giovanni: Mimesis Verlag, 2017, introduction Andrea Pinotti). On photography and art history, see Wolfgang M. Freitag, "Early Uses of Photography In the History Of Art," in: Art Journal 39 (1979-1980), 20-119; and for a synthesis: Ingeborg Reichle, "Photographie und Lichtbild: Die 'unsichtbaren' Bildmedien der Kunstgeschichte", in: Anja Zimmermann (ed.), Sichtbarkeit und Medium. Austausch, Verknüpfung und Differenz naturwissenschaftlicher und ästhetischer Bildstrategien (Hambug: Hamburg University Press, 2005), 169-181.

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reproductions in the study of Art History[6]—an importance that had tended to be overshadowed, as if art historians had been able to work only on real objects themselves.[7] Warburg displayed large panels around a room set up as a circle for the comparison of photographic pictures.[8] Each panel itself was dedicated to the visual presentation of several photographic images containing similar motives and references that could be compared. Warburg followed the hypothesis that shapes lived, and that they could be transferred from one medium to another, and from one time to another. He came to the idea of the *Pathosformel:* the pathos formula embedded in an image. Warburg hypothesized that *Pathosformeln* circulate and tell us something about society, about its anxiousness, and about its collective desires and expectations.[9]

Warburg's iconology led to a theory of symbolic forms that was developed in philosophy, with Ernst Cassirer's *Philosophie der symbolischen Formen*.[10] In Art History, however, iconology did not really benefit from further historical and visual study, beyond Erwin Panofsky's attempts of formalization.[11] Indeed, Panofsky reoriented iconology towards the interpretation of the symbolic meaning of images. He was interested in the evolution of styles and the circulation of ways of painting this or that object or character; but he was not concerned with what historical and cultural trauma a given shape conveyed; nor with the factors that make one image or pattern circulate better than another. Iconology was about to be fiercely criticized in the 1950s, which did not help art historians to better read Warburg and to question Panofsky's domination in the definition of iconology. Otto Pächt's reticence about iconology (that he developed in his teaching, conference talks, and in his book *Methodisches zur kunsthistorischen Praxis* published in 1977*)* was probably not limited to the tendency of iconology to over-interpret any

pictorial representation. Iconology took the artwork out of its individual value. This was wrong, from Pächt's perspective. Iconology turned to the multiple. But art history's monographic fate was still at play. Pächt's criticism of iconology was also germane. Iconology as such depended on the size of the corpus gathered by the art historian, and on reproductions that, at the time, gave a limited view of the work of art (black and white images, poor definition, lack of relief or detail, etc.). This reality could only weaken the historian's conclusions, and justify scholarly criticism attached to a detailed approach for each work.

Many questions that Warburg raised have remained open. Does the meaning of certain motives that circulate more than others intensify as they change (as Warburg suggested), or does this meaning become commonplace and disappear? We still do not know. What do the images that remain and build up over time say about a society? We can only suppose it. Iconology laid the foundations for a study of the factors that govern the genesis and transmission of iconographic forms and themes, but art historians gradually abandoned these ambitions in favor of a text-centered approach of the reception of images. The project of a general iconology was too Promethean.

Reception Studies and Iconography. Their Limits

Reconstructing the impact of images in their reception could still be a solution to trace specific visual influences. Since Hans Robert Jauss pioneered Reception Studies as a sub-category of Literary Studies,[12] many art historians have been stimulated by the possibility to do the same with images. Reception Studies applied to images gave a great deal of excellent critical research, such as Wolfgang Kemp's analysis and history of the

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[6] Aby Warburg, *Der Bilderatlas: Mnemosyne. Gesammelte Schriften II*.1. Ed. Martin Warnke with Claudia Brink (Berlin: Akademie Verlag, 2008).
[7] For example, the Art History methodology of Otto Pächt overlooked the technical elements in Art History. *Methodisches zur kunsthistorischen Praxis* (1st Edition München 1977; Frankfurt am Main : Prestel Verlag, 1996).
[8] See https://zkm.de/de/event/2016/09/aby-warburg-mnemosyne-bilderatlas (consulted 19 December 2019).

[9] See Georges Didi-Huberman, *L'image survivante : histoire de l'art et temps des fantômes selon Aby Warburg* (Paris: Les Éditions de Minuit, 2002).
[10] Ernst Cassirer, *Philosophie der symbolischen Formen*, 3 vols. (1st ed. Berlin: Bruno Cassirer, 1923–1929. Last ed. by Claus Rosenkranz: *Ernst Cassirer / Gesammelte Werke*, vol. 11–13 (Hamburg: Meiner, 2001-2003).
[11] Erwin Panofsky, *Studies in Iconology* (Oxford: Oxford University Press, 1939).
[12] Hans Robert Jauss, *Literaturgeschichte als Provokation* (Frankfurt am Main: Suhrkamp Verlag, 1970).

"implicit viewer" in the artworks, an equivalent to the "implicit reader" of Wolfgang Iser.[13] A viewer that Kemp claimed became an "Explicit viewer" after 1967, against Michael Fried's idea of contemporary arts theatricality.[14] However, when Reception Studies became fashionable in the 1990s, it was according to a very limited conception of reception, i.e. the critical reception of artworks, for the most part.[15] Many young art historians were oriented towards the study of "the reception of this artist in that or this country." The collective result is a great number of PhDs and articles that have never led to any general conclusion, except that nationalism and politics have always been central in the reception of art at the time of the printed press. Such conclusions are partly driven by an source effect: so many sources taken from the press, and so few from archives (be it archival images such as photography and artwork, or usual archival documents such as correspondence or other personal documentation).[16] Art historians skeptical of this approach could be interested in Cultural Transfer Theory's criticism of Reception Studies.[17] But it was to focus more on the diversity of reception, on the changes in the meaning of works (and, therefore, in their reception) from one context to another, on the effects on artworks and their interpretation of their own circulation, and on the strategies adopted by those involved in the circulation of artworks to ensure better reception.[18] Images, as images, remained studied one by one, even when the perspective was as broad and quantitative as possible.[19] When it was a question of studying the effects of the images outside themselves, i.e. on other sources that would respond to their action (press, correspondence,

other images), images have been the Achilles' heel of art historical reception and transfer studies, despite the fact that the impact of an image is all the stronger because it circulates on various *visual* mediums, more than in textual allusions.

Not that scholars had abandoned the project of iconology –which they transferred to, and reduced, to iconography, the description of diverse representations of a given subject, theme, or style. Iconography traced the circulation of themes and sometimes styles using analogical approaches. A theme (for example, trees, clouds, or cats) is studied in its diverse visual avatars, with neither any clear idea of the visual corpus used for the study, nor any certitude on the representativeness of the artefacts gathered and of the medium studied for the research. What can be called classical, analogic iconography produced brilliant pages such as Panofsky's writings on the diffusion of the gestural motif, on the broadcasting of landscapes in the background of paintings from Irish medieval books to Italian international style and Netherlandish painting.[20] However, the conclusions drawn from iconographic studies about general historical trends are only as strong as the scholar's scholarship, erudition, and corpus of works. The quality of a research will not necessarily be indexed to the size of its corpus; however, the conclusions driven from studies using computational methods based on complete or representative corpora, and their textual descriptions, say more on the diffusion of images, motives, and ideas,[21] than the usual study of clouds in a few European landscape paintings that reveal conclusions on "the invention of nature" in "European painting". Limited knowledge and horizon often means that the study of images or

[13] Wolfgang Kemp (ed.), *Der Betrachter ist im Bild.* Kunstwissenschaft und Rezeptionsästhetik (Berlin: DuMont 1985; New Edition Berlin: Gebr. Mann Verlag, 1992). Especially: "Kunstwissenschaft und Rezeptionsästhetik," 7-27.

[14] Wolfgang Kemp, "Zeitgenössische Kunst und ihre Betrachter. Positionen und Positionszuschreibungen," in: Kemp (ed.), *Zeitgenössische Kunst und ihre Betrachter* (Cologne: Oktagon, 1996), 13-43; and id., *Der explizite Betrachter. Zur Rezeption zeitgenössischer Kunst* (Konstanz: Konstanz University Press, 2015). Very good critical survey in Ilka Becker: Rezension von: Wolfgang Kemp: Der explizite Betrachter. Zur Rezeption zeitgenössischer Kunst, Konstanz: Konstanz University Press 2015, *KUNSTFORM* 17 (2016), 6, https://www.arthistoricum.net/kunstform/rezension/ausgabe/2016/6/. Consulted 19 December 2019.

[15] Béatrice Joyeux-Prunel, "Art History and the Global. Deconstructing the Latest Canonical Narrative," *Journal of Global History* (Cambridge University Press) Volume 14, Special Issue 3 (Historicizing the global: an interdisciplinary perspective), November 2019, pp. 413-435, 2019. DOI: https://doi.org/10.1017/S1740022819000196.

[16] See my assessment of Reception Studies in Art History in: Béatrice Joyeux-Prunel, "Circulation and Resemanticization: An Aporetic Palimpsest," *Artl@s Bulletin* 6, no. 2 (Summer 2017), 4-17. URL: http://docs.lib.purdue.edu/artlas/vol6/iss2/13.

[17] See Michel Espagne, "La notion de transfert culturel," *Revue Sciences/Lettres* 1 (2013), online since 1 May 2012, consulted 19 December 2019. URL: http://journals.openedition.org/rsl/219; DOI: 10.4000/rsl.219.

[18] Joyeux-Prunel, "Circulation and Resemanticization."

[19] See my own research, for instance *Nul n'est prophète en son pays? L'internationalisation de la peinture des avant-gardes parisiennes, 1855-1914* (Paris: Musée d'Orsay-Nicolas Chaudun, 2009).

[20] Erwin Panofsky, *Early Netherlandish Painting, Its Origins and Character*. Cambridge: Harvard University Press, 1953. Reprinted New York: Harper and Row, 1971.

[21] Jérôme Baschet, "Inventivité et sérialité des images médiévales. Pour une approche iconographique élargie," *Annales HSS*, 51, 1996, 1, 93-133. https://doi.org/10.3406/ahess.1996.410835.

motives in circulation will be limited to those of which we were already aware, detecting origins and outcomes that could be biased by the corpora at our disposal.

In any case, art history seemed to renounce the deployment of particular theoretical elements to interpret the circulation of images. Those challenged by the agency of images gradually turned to the anthropology and sociology of objects. Surprisingly, however, art historians have made little use yet of the anthropology of artefacts proposed by Alfred Gell, or of the agency of objects initiated by Bruno Latour;[22] nor has the anthropology of images proposed in the early 2000s by Hans Belting gained much attention.[23] The anthropology of images renounced global scales anyway, perhaps because it was too new and had first to refine its method on case studies.

Images and their Role in Global History

Given the little interest of art historians for large, multiple visual broadcasts, one could assume that art historians have surrendered the study of visual globalization to historians. But could historians do a better job on the circulation of images, and how would they take the epidemic part of visual diffusion into account?

Working on the circulation of images, on a large scale and for long periods of time, has always been a true challenge for global history, as Sanjay Subrahmanyam pointed out.[24] Since the 1990s, several historians claimed their growing awareness of the accelerating global flow of "people,

machinery, money, images, and ideas."[25] Like culture, artefacts and images have always been in circulation. Working on them helped historians recognize the limits of the concepts of nation-state and national culture.[26] However, within global history, the study of *images* in the context of globalization remained limited. Some scholars approached the topic of social imaginary, but their work still relied on a textual, abstract dimension.[27] While specialists in the study of nationalism studied images extensively, especially since Perry Anderson's seminal book *Imagined Communities* (1991),[28] research on how a global imaginary is symbolically and socially produced through images has been marginalized in the work of specialists in globalization.[29] Some have pointed out the importance of investigating the interplay between visual culture and globalization.[30] But they mostly aimed to "frame the intercultural" or "the global imaginary," in the way that Anderson framed the national imaginary; what's more, they worked exclusively on this topic for the last 20 years. They neither studied how local imaginaries may have evolved towards or away from the global, nor did they the question of visual diffusions.

By analyzing single images and patterns in circulation, some studies have highlighted the mixed nature of cultural crossroads, and the recovery capacity of colonized populations who resemanticized images and objects from colonial societies before the 19th century.[31] Global literary studies, which have added computation to their approach, could also offer a strong example. A growing number of studies have used what Franco

[22] Alfred Gell, *Art and agency: an anthropological theory* (Oxford: Clarendon Press, 1998); Bruno Latour, *Changer de société. Refaire de la sociologie* (Paris: La Découverte, 2006).
[23] Hans Belting, *Bild-Anthropologie. Entwürfe für eine Bildwissenschaft* (Munich: Wilhelm Fink Verlag, 2001).
[24] Sanjay Subrahmanyam, "Par-delà l'incommensurabilité: pour une histoire connectée des empires aux temps modernes," *Revue d'histoire moderne et contemporaine*, 54-4 bis (2007): 34-53.
[25] Arjun Appadurai (1990), "Disjuncture and Difference in the Global Cultural Economy," Theory Culture Society 1990, 7: 295-310, 11. See also Anthony Giddens, Ulrich Beck and Scott Lash, *Reflexive Modernization. Politics, Traditions and Aesthetics in the Modern Social Order*. (Stanford: Stanford University Press, 1994).
[26] For instance, Anne-Marie Thiesse, *La Création des identités nationales. Europe, 18°-20° siècle* (Paris: Editions du Seuil, 1999).
[27] See for instance: Michael D. Bordo, Alan M. Taylor, & Jeffrey G. Williamson (ed.), *Globalization in Historical Perspective* (Chicago: Chicago University Press, 2003); Erik Swyngedouw, *Glocalisations* (Philadelphia: Temple University Press, 2004); Arjun Appadurai (ed.), *Globalization* (Durham, NC: Duke University Press, 2002); Arjun Appadurai, *The Future as Cultural Fact: Essays on the Global Condition* (London: Verso, 2013).

[28] Benedict R. O'G Anderson, *Imagined Communities. Reflections on the Origins and Spread of Nationalism* (revised edition, London: Verso, 1991).
[29] W.J.T Mitchell, "World pictures: Globalization and visual culture," *Neohelicon,* Dec. 2007, Vol. 34, Issue 2: 49–59. https://doi.org/10.1007/s11059-007-2005-7.
[30] Vincent O'Brien, "Framing globalization: Visual perspectives," *Visual Studies* Volume 24, 2009 - Issue 1: Page 89 | Published online: 05 Nov 2010. https://doi.org/10.1080/14725860902733064; Tommaso Durante, "Visual Culture and Globalization: The Visual Archive Project of the Global Imaginary." *Global-E – Twenty First Century's Global Dynamics*, June 1, 2014|Volume8 |Issue4, https://www.21global.ucsb.edu/global-e/june-2014/visual-culture-and-globalization-visual-archive-project-global-imaginary. Consulted 17 January 2019.
[31] Serge Gruzinski, *Les quatre parties du monde. Histoire d'une mondialisation* (Paris: La Martinière, 2004); Romain Bertrand, *L'histoire à parts égales: récits d'une rencontre Orient-Occident (XVIe-XVIIe siècles)*, Paris: Seuil; Thomas DaCosta Kaufmann and Michael North, Michael (ed.); *Mediating Netherlandish Art and Material Culture in Asia* (Amsterdam: Amsterdam University Press, and Chicago: The University of Chicago Press, 2014). See also Mary D. Sheriff (ed.), *Cultural Contact and the Making of European Art since the Age of Exploration* (Chapel Hill: University of North Carolina Press, 2010).

Moretti called "distant reading"[32] to better understand the logics of literary globalization and its mediators.[33] They show how cultural practices overcome traditional national, linguistic and geographic frontiers, and highlight unexpected, polycentric channels of literary circulations. Doing the same type of studies for images—and comparing the results with these literary conclusions—could be interesting topic to explore, which was the main issue of the Artl@s Project when it was launched in 2009.

10 years Working on Artistic Global Circulation with Exhibition Catalogues: The Artl@s Project

To study epidemics is first and foremost to look at where they circulate, on a global scale. We need massive data, worldwide, over the long term, and therefore we need to be able to locate and map it. The international research group Artl@s[34] was built from this perspective: to collectively gather digital sources and tools that would help art historians globalize and spatialize their research. The goal was to visualize the circulation of exhibitions, artists, and artworks from the 18th century into the 2000s, using exhibition catalogues, a massive source that spread globally since the 1700s, and to an even greater extent since the 1880s.

Exhibition Catalogues and Global Art History

Working with exhibition catalogues was a good starting point, since they contain the textual descriptions of images circulating from shows. We have explained in this journal why these catalogues are useful for the global study of images in circulation.[35] Since their first appearance around

1673, they have gradually expanded globally until today where they crisscross the world art market. Giving information as to the existence of an exhibition, its address, its dates, its title, listing the artists who participated in a given show and often the works that were displayed, exhibition catalogues give access to a rich source of data, whether artistic, social, commercial, geographical or even political. Working with the titles that are listed in these publications, we can study recurring patterns of words or themes. Using artists' addresses on a large scale, places of birth, or the addresses of dealers and collectors, we can induce information about the geography of art production, trade, and consumption. Using the gender of artists, we can contribute to the study of women and men in the art world. The names of masters, art dealers and collectors, the names of models or subjects of portraits, etc., can be useful for a social study of artistic networks and carriers… The overall catalogues' information taken in large quantities, thus help us work on the social history of art (tell me where you live and I may tell you what you paint and to whom you sell it); on the history of tastes (when and where do we paint the seaside?); on aesthetics (at what point, for instance, do we no longer see titles for artwork?); and on global circulations and visual diffusions.

BasArt: A Digital Source to Trace Art in Globalization

With its global, collaborative database of exhibition catalogues (19th-21st century) known as BasArt (https://artlas.huma-num.fr/map/#/), the Artl@s research group has applied digital spatial methodology to trace the circulation of exhibitions, artists, and artworks, before going to more traditional archival sources and methods. BasArt is a collective digital archive of exhibition catalogues

[32] Franco Moretti, *Atlas of the European Novel, 1800-1900* (London: Verso, 1998); Franco Moretti, "Conjectures of World Literature." *New Left Review*, I (2000): 55-67.
[33] See for instance: David Damrosch, *What Is World Literature?* (Princeton: Princeton University Press, 2003); Blaise Wilfert-Portal, "Traduction littéraire : approche bibliométrique," in: *Histoire des traductions en langue française. XIXe siècle,* Yves Chevrel, Lieven d'Hulst and Christine Lombez, eds. (Paris: Verdier, 2012): 255-344, or Diana Roig-Sanz and Reine Meylaerts (ed.), *Literary Translation and Cultural Mediators in 'Peripheral' Cultures: Customs Officers or Smugglers?* (Cham: Springer International Publishing, 2018).

[34] https://artlas.huma-num.fr/en/. Artl@s has worked since 2009 thanks to the support of the École normale supérieure in Paris, France, the French National Agency for research (CNRS), the Labex Transfers, the graduate school Translitterae, the university Paris Sciences Lettres (PSL), Purdue University, and since September 2019 the European Commission and the University of Geneva.
[35] Béatrice Joyeux-Prunel and Olivier Marcel, "Exhibition Catalogues in the Globalization of Art. A Source for Social and Spatial Art History." *Artl@s Bulletin* 4, no. 2 (2016): Article 8. https://docs.lib.purdue.edu/artlas/vol4/iss2/8/

made of an open-source geographic information system, whose structure has been designed and tested over 6 years to deal with all forms of exhibition catalogues, knowing how much this literary form has evolved over centuries. Whatever the language, the date or the place, the database geolocalizes all the addresses listed in the catalogues. Its visualization and mapping interfaces facilitate data analysis and visualization. BasArt and its visualizations are open data—under a CC-BY license—and are thus freely available for everyone to use and republish as they wish, without restrictions, provided they acknowledge the Artl@s Project and its contributors.

These sources and tools place quantitative and cartographic analyses within the reach of the scholars who do not have the institutional support to launch their own digital projects, who do not have the knowledge to do so, or simply who do not desire to engage in computational techniques but might be interested in getting some data and visuals for their research. BasArt also gives access to catalogues that are only accessible in remote archives, and are therefore not part of the main narrative of modern art. The project makes room for the peripheries of Art History in order, simply, to globalize our work and narratives.

Decentering and Globalizing the History of Art

Based on these methodologies, the Artl@s teams have worked on the global trajectories of artists, on the worldwide circulation of works, on stylistic trends and their international transmission, and on the transnational construction of reputations.[36] Digital methods applied to massive data allow us to see very quickly dissemination phenomena. We are then able to compare the hypotheses suggested by the remote approach ("distant reading") with more traditional methods such as archival surveys,

historical contextualization, monographs, work analyses and theoretical interpretation.

These multi-scalar approaches contribute to the effective crisis of some widespread ideas about art globalization.

First, they contradict the commonplace idea that there would have been global centers and peripheries in the history of art (Paris before 1945, New York after). The "global centers" art historians have long written about were the result of many historiographical blind spots. Several of us have shown, for the particular case of the history of modern art, how the peripheries were essential in the establishment of new artistic movements, both for their birth (often initiated by artists from the peripheries), and for their commercial dissemination. Picasso's painting, for example, was first exhibited in Germany and Central Europe, before being shown in Paris.[37] Even though foreign amateurs mainly bought Picasso's older works, the fame of his peripheral exhibitions and reception contributed to the rise in popularity of his more recent creations (especially Cubism). Similarly, as Catherine Dossin demonstrated, Pop Art would probably not have been as successful in the USA if it had not first been exhibited in Paris in 1963 and, above all, if it had not been an immediate success in Germany.[38]

Secondly, global computational approaches to exhibition catalogues go against the widespread idea that nothing would have happened in art in global peripheries, and that these peripheries would have necessarily been imitating the centers. For example, the Paris Artl@s group held 1400 exhibitions in the "Arab countries" between 1900 and 1990 —and the work seems to be almost satisfactory only for Morocco, Algeria, Tunisia, and Egypt (Map 1). The following map shows the project's results for the just the 1980s. Catherine Dossin's team at Purdue university launched another project, on another art historical periphery

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[36] Browsing The Artl@s Bulletin will give an idea of the various publications possible on such subjects: see https://docs.lib.purdue.edu/artlas/.
[37] Béatrice Joyeux-Prunel,"¿Exponer al cubista sin cubismo ? De cómo Kahnweiler llegó a convencer a Alemania — e incluso al mundo entero— del aura de Picasso

mediante su pedagogía expositiva (1908-1914)," in: *Registros Alemanes*, exhibition catalogue (Malagá: Museo Picasso, 2015), 258-273.
[38] Catherine Dossin, "To Drip or to Pop? The European Triumph of American Art." *Artl@s Bulletin* 3, no. 1 (2014): Article 8. https://docs.lib.purdue.edu/artlas/vol3/iss1/8/.
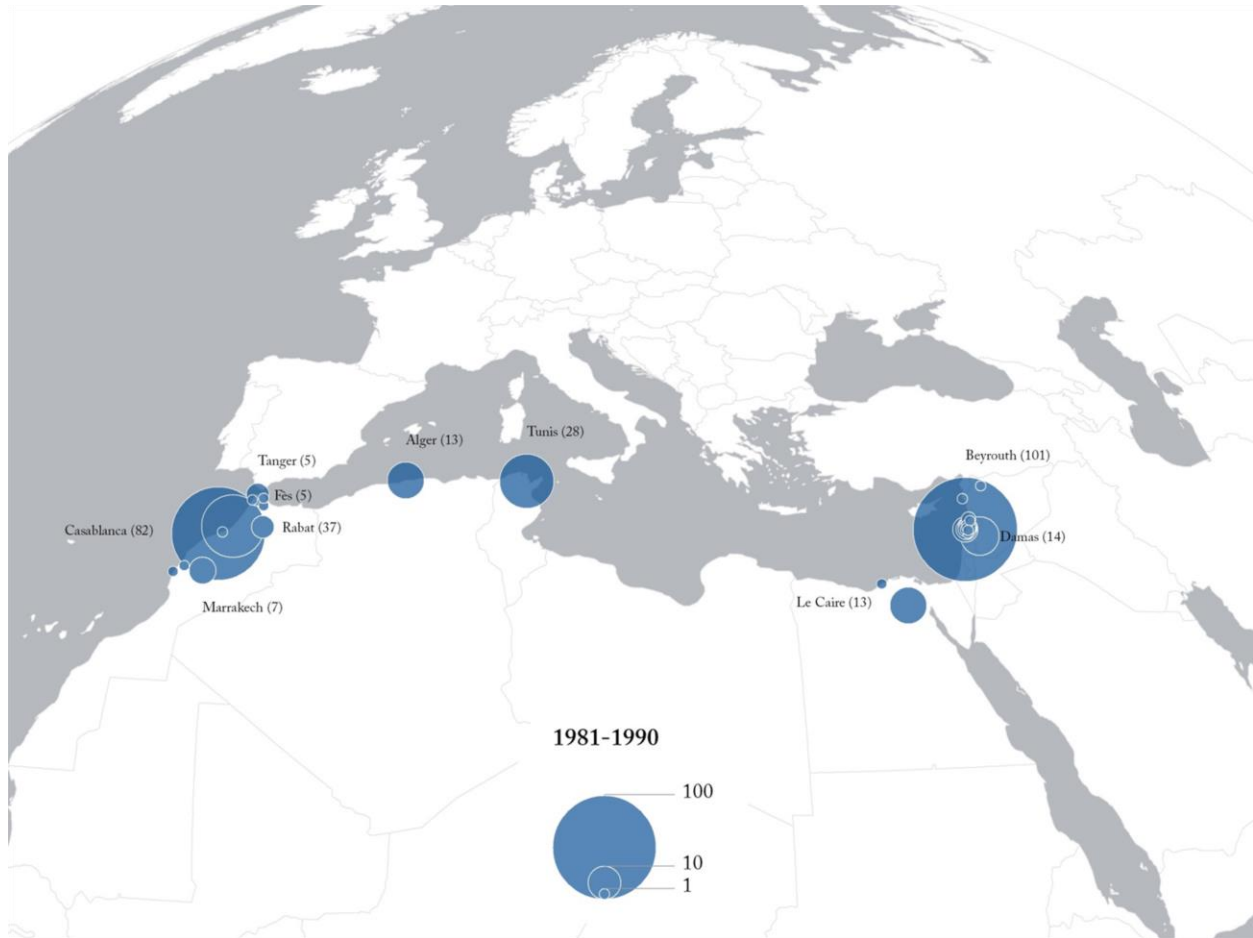
Map 1. Modern Art Exhibitions in Morocco, Algeria, Tunisia, Egypt and Lebanon in the 1980s. Current State of the Artl@s Team Retrieval work, 2019.

of Art History, this time gendered: exhibitions of women artists.[39] The titles and themes associated with the exhibitions found in both cases suggest a wide variety of styles and genres practiced by artists from these geographical and gendered peripheries. Can we speak of imitation in the face of such diversity?

The Circulation of Styles does not Prove Influences. The case of Fauvism and German Expressionism

The third preconceived notion about global Art History is that there would have been diffusions from "centers" to "peripheries": production in the centers, reception and imitation in the "peripheries." Indeed, a visual diffusion does not prove symbolic domination; nor does it prove what we would call a contagion. The case of Fauvism and German Expressionism, seen first through the distant analysis of exhibition catalogues and artistic circulation, is a telling example of this result.

German and French art historians have argued a great deal about which movement first revolutionized modern art, around 1905: Parisian Fauvism, or German Expressionism? Many could argue that the Germans imitated the Parisians, since the Parisians started to make very colorful works in 1904, before the Germans. But they were never able to prove that the Germans had seen or even heard about Fauvism before moving on to Expressionism.[40] Looking at the question from

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[39] Catherine Dossin and Hanna Alkema, "Women Artists Shows·Salons·Societies: Towards a Global History of All-Women Exhibitions." *Artl@s Bulletin* 8, no. 1 (2019): Article 19. https://docs.lib.purdue.edu/artlas/vol8/iss1/19/.

[40] See Gabrielle Linnebach, "La Brücke et le Fauvisme. Une querelle dépassée" in *Paris-Berlin 1900-1933: rapports et contrastes*, exhibition catalogue (Paris: Centre Georges Pompidou, 1978), 70-77.

another angle, an international and circulatory one, changes the perspective. Why and how did some artists go to Fauvism or Expressionism, while others remained with impressionist painting?

With a given corpus of exhibition catalogues, we can overtake an international prosopographical study—the study of the careers of social groups—and better understand the trajectory that could lead, or not lead, to fauvist-like painting.[41] The best international careers of the 1900s, for instance, did not lead to fauvist-like painting. What where the main successful trajectories at the time, that lead to such careers? We can analyze the social trajectories of the artists the most frequently exhibited in the most famous and modern Salons of the time. A representative list of such Salons and their exhibitors can be retrieved from the exhibition catalogues of several shows that were considered the best and most modern international salons

from the 1880s to the 1900s, such as the Société nationale des beaux-arts in Paris, the Brussels Salon des Vingt and the Libre Esthétique, the Berlin Secession, or the International Society of Painters, Sculptors, and Gravers in London.[42]

Network analysis of artists' exhibition frequency suggests that those who could exhibit more than the others in these selective modern salons were very few. They were distributed by cliques (Map 2). Moreover, a social and demographic comparison of this international artistic elite points to an accelerated process of social closure: the older artists among our corpus come from modest social classes, whereas the youngest ones come from higher social strata, the aristocracy and the bourgeoisie. As a consequence, to have direct access to great modern, international careers around 1900, one had to be born rich, aristocratic, and living in the most expensive districts of the
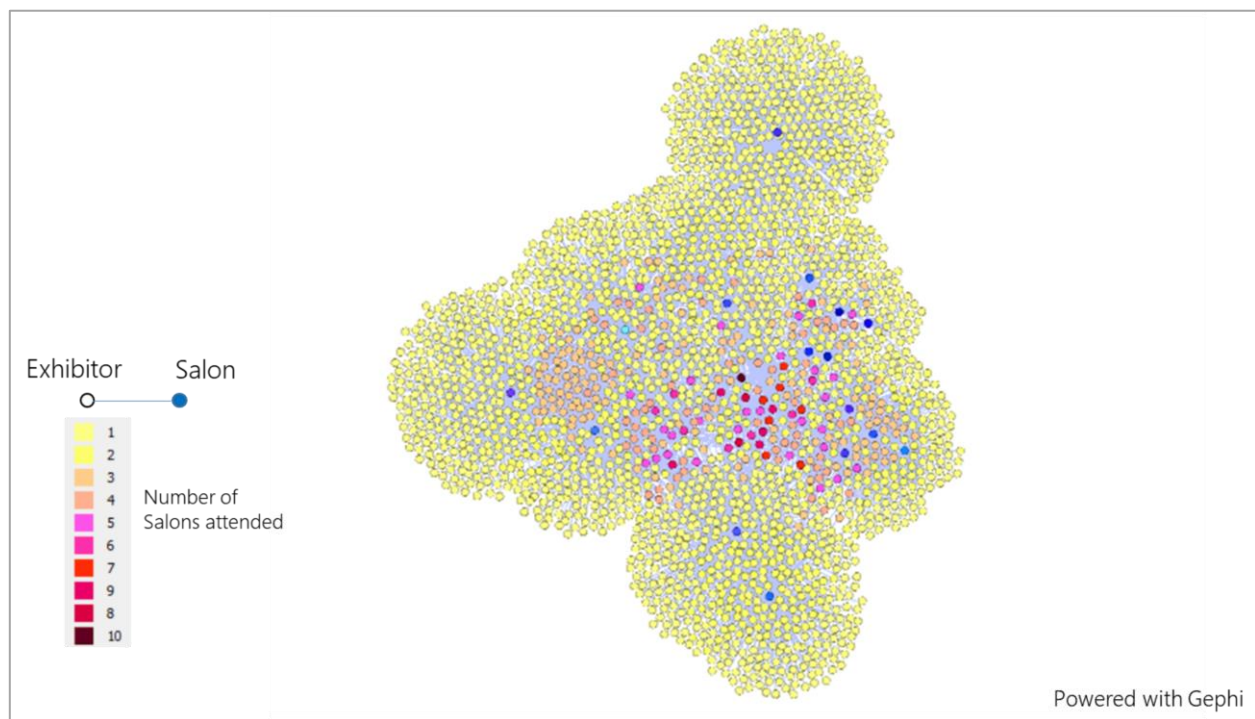
Map 2. Network analysis of 16 modern art exhibition catalogues' lists of exhibitors. Artists' frequency of prestigious exhibitions. Source: complete catalogues of the Salon des Vingt (Bruxelles), Berliner Sezession, Libre Esthétique de Bruxelles, London International Society of Painters, Sculptors, and Gravors, and the Société nationale des Beaux-arts de Paris, two catalogues for each Salon for the period 1888-1902.

[41] The methodology and corpus are presented in: Béatrice Joyeux-Prunel, "Apports, questions et limites de la prosopographie en histoire de l'art," in: Bernadette Cabouret-Laurioux (ed.), *La prosopographie au service des sciences sociales* (Lyon: Presses universitaires de Lyon), 339-357.

[42] I used the following exhibition catalogues: Brussels, Salon des Vingt, 1888 and 1891; Paris, Société nationale des Beaux-Arts, 1890, 1892 and 1902; London, International Society of Painters, Sculptors, and Gravers, 1898; Berlin, Sezession, 1900 and 1902; Brussels, Salon de la Libre Esthétique, 1899, 1900.

capital cities of the time—this is confirmed by the addresses given by these artists in the catalogues. As a contrast, in the 1880s, it was possible for artists born in lower-middle classes to rise socially, all over Europe. Young artists coming from modest backgrounds in the *fin de siècle* and the 1900s could nurture great expectations, considering that older painters coming from similar social classes had found international recognition, were established and well-off. Their high expectations led generally to higher disappointment, when they came to realize that access to elite careers was monopolized now by richer artists and who were better equipped socially.

This distant and prosopographical reading of exhibition catalogues induces a new point of view on traditional art historical sources. The artistic press and correspondence of the 1900s in France, Germany, Belgium, Switzerland, and Russia, smells like social conflict: access to successful careers was blocked by an international clique with strong social, cultural and cosmopolitan capital.[43] Novels and fiction of the time confirm this issue. The problem was structural: young people no longer had a horizon on the international art scene. Some founded cooperatives, such as the Union international des arts et des Lettres, which was founded in 1904 in Angers and Paris by Alexis Merodack-Jeaneau and exhibited Wassily Kandinsky and Alexei Jawlenski at their hardest times in Paris, and developed a surprising international network.[44] Whatever the place of production or artist, around 1900-1904, painting at this time also looks depressing. We think of Henri Matisse's green, despaired self-portraits; of Van Dongen's caricatures of the poor in anarchist periodicals; of Picasso's blue period, painted in women and prostitutes' hospitals; of Kandinsky's small riders lost in mountains and dark colors. This may suggest the sudden and unplanned international explosion, between 1904-1906, of part of the younger generation—the provincials, the poor, the foreigners, in Germany, France,

Belgium, and even Russia. All reacted in a similar way: in the peripheries of modern art capital cities, groups of artists who had not succeeded in finding a place at the table of international artists came together and decided to oppose the system. They reacted with words, with politics, and with art, with their paintbrushes, all in a similar way: against the impressionist *tâche* and its color sweetness with bright colors through virulent flat tints; against urban and worldly art, by referencing folk and primitive arts; against the interest in bourgeois interior portraits, by painting the poor, lower and working class people outside.

This leads to the interpretation of international stylistic diffusions in a more complex way than as a matter of influence. In the case of Fauvism and Expressionism, similar social structural contexts were decisive. These conclusions also incite an understanding of symbolic artistic revolutions (that of Parisian Fauvism or German Expressionism) in a social and transnational way, and to place the question of the "first inventor" or the "isolated inventors" where it belongs: to mythology. There is much more to discover in artworks than individual genius and invention.

Images in Globalization: Towards a Massive Study

From Texts to Images. Applying Artificial Intelligence to Big Visual Data

Looking critically at digital methodologies applied to exhibition catalogues or even to images databases, shows that they have a crucial limitation: most of the time, scholars use the textual descriptions of images; not the images themselves. This is not to say that the images themselves have been neglected, but we art historians have worked on visual material by hand, on images one by one, and when we computed the images, we counted

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[43] See Béatrice Joyeux-Prunel, '*Nul n'est prophète en son pays?' L'internationalisation de la peinture des avant-gardes parisiennes 1855-1914* (Paris: Musée d'Orsay/Nicolas Chaudun, 2009).

[44] On this period see Béatrice Joyeux-Prunel, "Alexis Mérodack-Jeaneau, dans la plèbe des avant-gardes," in *Alexis Mérodack-Jeaneau, En quête de modernité*, exhibition catalogue (Angers: Musée des Beaux-Arts, 2019).

words and textual expressions or descriptions as a part of this data. With the BasArt Database that is made of text, when we map addresses, exhibitions or artwork circulation, we are not in a "distant viewing" of visual sources. Rather, we are in a "distant reading" of images' textual descriptions.

Another limitation: exhibition catalogue databases, as well as image databases, are mainly focused on original works. Now, the global circulation of images has run faster with visual reproductions (printed illustrations, photography, postcards, copies of original works, etc.,) than with the circulation of original artworks.

Catalogues still very frequently contain illustrations. A catalogue, when illustrated, indicates for some artworks a twofold circulation: the circulation of the artifact, and the circulation of its reproduction. Recent digital technologies can help us retrieve the illustrations in our sources. They allow us to automatically date and localize the images' circulation—its publication and its exhibition. Thanks to prior training, computers also allow us to automatically tag images by author[45] and by style.[46] Through similar deep learning algorithms, they can automatically guess what object is represented, or if an image is figurative or abstract, and what it contains (faces, smiles, bodies, animals).[47] Finally, artificial intelligence algorithms make it is possible to analyze images as images, that is to say as pixels, colors and shapes, and to do so on a broad scale. The union of these methodologies, adapted to the issues and to the knowledge of Art History, are dramatically promising for the study of the circulation and contagion of images on a global scale, and throughout extended periods of time.

Since 2017, the Artl@s research group has begun this task, collecting representative visual corpora and their metadata as to places and dates of circulation from illustrated catalogues and art journals. One individual catalogue, especially after

1950, can sometimes contain a hundred illustrations. Art journals have propagated images at an even broader scale, especially since the 1880s. With thousands of catalogues and journals taken at a global scale and throughout a long period of time, an incredible corpus of images dated and localized will be available to work on the global circulation of patterns and artistic images. The Artl@s research group is currently elaborating a methodology where digital and analogic traditional approaches are combined, in order to study and understand the global circulation of images.

The current objective of this project named VISUAL CONTAGION is to apply neural network algorithms to group together images that look similar. In order to trace the visual transmission of specific patterns, we have chosen to apply the EnHerit algorithm developed by Mathieu Aubry at École des Ponts Paris Tech in France. The tools of EnHerit can identify recurring patterns in heterogeneous image databases, in particular parts of artworks that have been copied from other artists.[48] The manual identification of such parallels and borrowings would otherwise be an extremely arduous and time-consuming process, even when carried out on smaller scales. With tools such as EnHerit, it is possible to carry out such identification in a short time and across vast corpora. From a given database, they can produce a list of all the images that have been reproduced several times, and which ones have therefore been most widely distributed internationally. They can also display lists of images that are not the same, but that are similar; and they can help us see how a pattern circulates, or how a style is diffused. Our objective is thus to group images not only according to their visual proximity with one another, but also according to their spatiotemporal and semantic proximities.

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[45] Gjorgji Strezoski and Marcel Worring, "Omniart: Multi-task Deep Learning for Artistic Data Analysis," arXiv preprint, 2017. arXiv:1708.00684.

[46] Sergey Karayev, Matthew Trentacoste, Helen Han, Aseem Agarwala, Trevor Darrell, Aaron Hertzmann and HolgerWinnemoeller, "Recognizing image style," preprint arXiv:1311.3715. https://arxiv.org/abs/1311.3715; Hui Mao, Ming Cheung and James She, "DeepArt: Learning Joint Representations of Visual Arts," in: *Proceedings of the 2017 ACM on Multimedia Conference*, 2017, 1183-1191.

[47] Elliot J. Crowley and Andrew Zisserman, "The Art of Detection". *European Conference on Computer Vision – Computer Vision – ECCV 2016 Workshops*: 721-37. https://link.springer.com/chapter/10.1007/978-3-319-46604-0_50

[48] Shiry Ginosar, Xi Shen, Karan Dwivedi, Elizabeth Honig, and Mathieu Aubry, "The Burgeoning Computer-Art Symbiosis. Computers help us understand art. Art helps us teach computers," *XRDS: Crossroads, The ACM Magazine for Students - Computers and Art archive*. Volume 24, Issue 3, Spring 2018, pp. 30-33. Doi: 10.1145/3186655 .

A Case Study: The Iconography of Venus

A research project always starts with small experiments. We chose to work with the historical database of images representing Venus gathered since 2006 by K. Bender: around 20,000 images, from the Renaissance to the present day.[49] This database was even more interesting since Bender, a professional statistician, had already analyzed his own database statistically using text descriptors, and had also already manually classified the images according to common patterns or themes. We could therefore compare our machine vision results with his statistical results and human visual samplings.

In a few minutes, our algorithm gathered the most frequently cited and imitated patterns in the Venus database. Out of the 20,000 images, the algorithm has very effectively highlighted eight main clusters, first featuring the *Birth of Venus* by Botticelli, the *Sacred Love and Profane Love* by Titian, etc. (Table 1). This "machine sampling" is clearly powerful, as it gathers images much faster than usual sampling modes.[50] Still, the algorithm in its current state will overlook some images that the eye could easily recognize—for instance, identical but inverted or reverse images are not always included, and the algorithm does not always recognize compositions

Rank		Artist	Title of the work	Date of the work
1		BOTTICELLLI	Nascita di Venere	1482-1485
2		TITIAN	Amor sacro e Amor profano	c. 1515
3		GIORGIONE	Venere dormiente	1507-1510
4		Annibale CARRACCI	Sleeping Venus with cupids Venus, Adonis and Cupid	c. 1603
5		Lorenzo COSTA	Standing Venus	1515
6		Alexandre CABANEL	Naissance de Venus	1863
7		Sandro BOTTICELLLI	Primavera	late 1470s or early 1480s
8		Guido RENI	Reclining Venus with Cupid	c. 1639

Table 1. Eight main clusters identified automatically by EnHerit algorithm in K. Bender's Venus Image Database. Source: See Footnote 49.

[49]K. Bender's *The Iconography of Venus from the Middle Ages to the Modern Times',* includes some 40,000 works of art, 20,000 of which have been ordered and published in six *Topical Catalogues.* All works have been described according to their author, their date and place of creation, ownership, their dates and place of exhibition and possible sale, if known. At the same time, K. Bender compiled all the images of these works representing Venus when they were available. All data are preserved as a "Dataverse" in the open access repository heiDATA of the University of Heidelberg (https://heidata.uni-heidelberg.de/dataverse/root?q=bender+venus&fq0=authorName_ss%3A%22Bender%2C+K.%22&types=dataverses%3Adatasets%3Afiles&sort=score&order=).

[50] As long as our partner lab will keep it online, the whole database clustering can be consulted on http://imagine.enpc.fr/~bounouo/html/ordered_clusters.html. Consulted 19 December 2019.

that differ from the original but are inspired by the original theme. We, Digital Art Historians, will have to find strategies to maximize the pertinence of automatic sampling, and to gradually correct the algorithm in order to make it meet our expectations before any generalization.

However, these first tests already raise interesting questions about the reproduction, the geographical diffusion, and the meaning of Venus iconographies.

First, a chronology of the images gathered quickly demonstrates that copying and painting Venus has not been a mere ancient and classical attitude. The high relative frequency of repetitions of motifs after 1945 (or even, after 1960, for example on Figure 1, which shows a chronological ordering of the first images of the cluster "Venus Birth by Botticelli"), shows that we art historians should stop tending to think that copying was a gesture of academic periods. It also questions the modern ideology of autonomy and originality.[51] The contemporary period has copied old paintings representing— even mocked at times, but not always—Venus. Since the modern times, and up to the contemporary period, artists have deeply reflected on their visual heritage.[52] Of course, our corpus is made of reproductions of reproductions. Consequently, the results of its analysis inevitably reflect the biases of the corpus' constitution (i.e. which works were the most available at the time K. Bender collected his images), as well as the fact that they are the result of the reality of reproduction and copying in art history. Besides, not all pictures have equal value. We will consider how to weigh the difference between facsimile, pastiche, quotation, misappropriation, etc. in order to measure and assess the impact of an image in its visual avatars.[53]
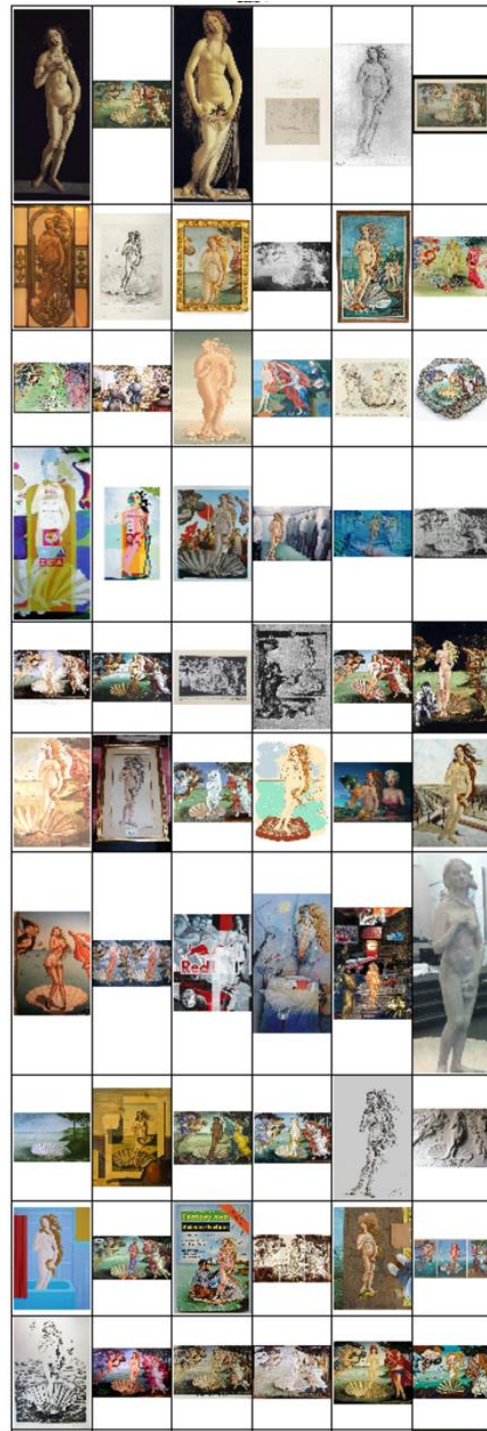

Figure 1. Sample of images retrieved by EnHerit algorithm, from K. Bender Venus Database, first cluster (*Birth of Venus* by Botticelli). A collaboration between Mathieu Aubry, K. Bender, Oumayma Bounou, Béatrice Joyeux-Prunel and Xi Shen. Images are ordered chronologically. Source: K. Bender, "Image Set: Iconography of Venus from the Middle Ages to Modern Times," https://doi.org/10.11588/data/ZPCZ19, heiDATA, V1, 2018.

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[51] In his book *The Culture of the copy*, *Striking Likenesses, Unreasonable Facsimiles* (Cambrige: MIT Press, 1996), Hillel he drew similar conclusions (among others) by different methods. I would like to thank Marco Jalla for pointing me to this book.
[52] See for instance Juliette Bertron, "De la Parodie dans l'art des années 1960 à nos jours." Unpublished PhD thesis, Dijon: Université de Bourgogne, 2014. Accessible through HAL.

[53] Georges Roque and Luciano Cheles propose to classify images recycling other images, in *Figures de l'Art. Revue d'études esthétiques*, 23 (Pau: Presses de l'université de Pau et des Pays de l'Adour, 2013), special issue *l'art recyclé*. Here again thanks to Marco Jalla for suggesting this title.

By expanding the study with larger image banks it should be possible to know if only the theme of Venus has been repeated so much, or if other works or old references have also been copied, and which ones. If Venus is one of the most widespread themes, what does it reveal about the relationship of artists to women in the 20th century? The study opens the door to a broad and global study on the long-term evolution of the canons of female beauty.

Following the geographical questioning of our project, we have also evidenced a quick Americanization of the topic Venus after 1960. Is this a result our sources —and of the relative over-representation of US art in the sources available to a scholar, K. Bender, who is based in Belgium? Further statistical inquiry should help us evaluate this possible consequence.

As we strive to chart these exchanges in a more detailed way, the diffusion channels of certain motifs should be demonstrated with digital, cartographic mapping of images from similar clusters. Did some regions communicate visually with each other more than others? Will our maps highlight specific centers or, on the contrary, several? What will be the spatial logics of these broadcasts? With a Geographic Information System that arranges recurring images according to time and space, we will be able to highlight channels of artistic circulation for a large and never-before studied number of images.

Enlarging the Study to Printed Periodicals and Visual Studies

The study of visual reception, styles and iconographic circulations cannot be limited to the arts. Since the 1990s, "visual studies" scholarship has insisted on the importance of reciprocal contagions between all types of images, be they artistic or non-artistic, belonging to high, low or everyday culture. [54] The implicit logic of the VISUAL CONTAGION project is to broaden the scope of its sources, to get a distant viewing of "what circulates" globally.

Printed material periodicals are quite representative of the visual regime of static image circulation for the period of the 1880s to the 1990s. For the project VISUAL CONTAGIONS, they will be the main corpus of another experiment. Scholars have highlighted the development of weekly illustrated supplements after the 1880s,[55] and their impact on the transnational diffusion of ideas and the circulation of models.[56] We can describe the circulation of literary supplements with some accuracy. For instance, in France, the weekly supplement to the *Petit Journal* was offered starting from 28 November 1890 with a color engraving on the first and last page; specialists consider that all the *illustrés* of the time "copied" this one.[57] The most striking imitation of this layout is perhaps by the Romanian *Universul illustrat* (1892-97).[58]

Still, here, too, working globally and quantitatively has been the exception. A new generation of historians has done considerable work over the past few decades on the history of illustrations circulating in periodicals, but they have done this work manually, and with singular case studies. Visual studies also have had little time to fully exploit the potential of computer vision, even though the discipline has developed in parallel with the revolution of digital technologies.[59] Considering the availability of digitized collections of illustrated periodicals, and the current progress of statistics applied on images, all ingredients are there for a global study of visual circulations over 100 years.

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[54] David Freedberg, *The Power of Images: Studies in the History and Theory of Response* (Chicago: The University of Chicago Press, 1989); Hans Belting, *Bild und Kult: Eine Geschichte des Bildes vor dem Zeitalter* (Munich: C. H. Beck. 1990); Horst Bredekamp, *Antikensehnsucht und Maschinenglauben. Die Geschichte der Kunstkammer und die Zukunft der Kunstgeschichte* (Berlin: Wagenbach, 1993).

[55] Jean-Pierre Bacot, *La presse illustrée au XIXe siècle. Une histoire oubliée* (Limoges: PULIM, 2005) ; Évanghélia Stead and Hélène Védrine (ed.), *L'Europe des revues (1880-1920). Estampes, photographies, illustrations* (Paris: Presses universitaires Sorbonne université, 2008).

[56] Évanghélia Stead and Hélène Védrine (ed.), *L'Europe des revues II (1860-1930). Réseaux et circulations de modèles* (Paris: Presses universitaires Sorbonne université, 2018).

[57] See the collection on Gallica Website:
https://gallica.bnf.fr/ark:/12148/cb32836564q/date1890 (consulted 18 December 2019).

[58] Jean-Pierre Bacot, "Les mystères d'une irreprésentation nationale. Sur les gravures de la presse populaire en Roumanie, *l'Universul Illustrat* (1892-1897)," *Media-Global,* Bucarest, 2000.

[59] "Visual Culture Questionnaire," *October*, vol. 77 (Summer 1996), 25-70; Quentin Deluermoz, Emmanuel Fureix, Manuel Charpy, Christian Joschke, Ségolène Le Men, Neil McWilliam, and Vanessa Schwartz, "Le XIXe siècle au prisme des visual studies," *Revue d'histoire du XIXe siècle*, 49 (2014),
http://journals.openedition.org/rh19/4754 ; DOI : 10.4000/rh19.4754.

From Images to Ideas and Pathos

Much remains to be done in order to better assess the way visual culture was built and circulated across the world. To really study visual epidemics, we have to work on the millions of reproductions that have circulated through print, and today, through digital images. Our challenge is to put in place and to articulate the digital and historical methodologies that will allow us to study this visual globalization, in a massive way, before we go deeper into representative case studies and apply the traditional humanities methodologies or complementary approaches such as epidemiology and cognitive sciences.

What were the most copied images? The most inspiring? Was there any evidence of how quickly they contaminated other images, and which media were touched first, depending on the era (painting copy, engraving, photographic reproduction, pastiche, etc.)?

We want to reconstitute the geographical, cultural, social and commercial channels through which the most used images were disseminated. Beyond the question of centers and peripheries, the question of the factors impacting an image's dispersal that are external to its visual quality arises: have there been, throughout history, privileged routes for the diffusion of images? social milieus? media and commercial networks that are more important than others?

We also intend to study the profile of the artists producing the most contagious images. Did some artists innovate more than others? Are there artists who copied more than others? What were their socio-historical profiles?

We also want to understand what exactly circulates, when an image circulates. What are the most common visual elements that circulate? What do artists retain when they adopt a style, a gesture? A widespread theory in cognitive sciences explains that ideas spread most rapidly when they are well adapted to human cognitive abilities—for instance whether or not their content ensures maximum cognitive effect with minimal effort.[60] Do images function in a similar way? Cognitivist analyses have already identified simple patterns in images that the brain is capable of detecting faster than others; that is to say motifs, colors, and patterns that the brain can recognize and have an opinion of very quickly. The hypothesis seems to be valid on propaganda images, but is this valid for all images? Do images circulate all the more since they are characterized by simple patterns and colors? Our objective is to identify the statistical characteristics of successful images when we have gathered thousands of visual "hits." And to see if these visual characteristics depend on the time or not, which a historian's point of view would in theory say; what are their visual criteria; and if we can characterize their social and commercial criteria — because an image is a social object, too.

Last question, that of the ideas and feelings that accompany the images in circulation. Are there any ideas that are systematically associated with certain images and patterns? Not only ideas but also collective feelings are carried by certain images. Aby Warburg and his intellectual heirs have been interested by the diffusion of certain visual motifs that spread more than others, and that carried collective reminiscences that the humanities must study. Warburg, who completed his thesis on Botticelli, spoke of how the nymph's veils in ancient bas-reliefs are found in the Venus of the Renaissance. What are the equivalents of these veils in history, and today? The project VISUAL CONTAGION is taking part of a scholarly trend that wants to "operationalize," as Franco Moretti proposes, Warburg's concept of *Pathosformeln.*[61] VISUAL CONTAGION will bring to this project the spatiotemporal approach characteristic of Artl@s, a means to envisage the extent to which *Pathosformeln* and their circulation reveal elective affinities between certain cultural, geographical,

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[60] Dan Sperber, *La Contagion des idées. Théorie naturaliste de la culture* (Paris: Odile Jacob, 1996).
[61] Franco Moretti and Leonardo Impett, "Totentanz. Operationalizing Aby Warburg's Pathosformeln." Pamphlets of the Stanford Literary Lab 16, ISSN 2164-1757 (online version: https://litlab.stanford.edu/LiteraryLabPamphlet16.pdf consulted 13 December 2029).

economic, social— or, why not, historical— spaces. Some forms have been autonomous, have circulated, persisted, between eras, cultures and spaces, and despite all the upheavals that have taken place in history and in the human relationship to matter. By studying these forms, which our algorithms will have highlighted among millions of images, we should be able to better understand our cultures, the commonalities between them, and what may also constitute bridges between cultures (i.e. visual links between cultures and eras; cultural homogenization connections, or rather of meeting and mixing).

Conclusion

Images can be contagious. The issue is as relevant today in the age of social networks, as it was for early art historians interested in a better understanding of the history of styles, for art dealers anxious to trace "influences" and assert precedence, or for artists eager to situate themselves within or outside a shared visual genealogy. Whatever the position, making images or studying them, the field has always proven a rich and innovative world based on exchange, circulation and technical innovation. Several generations of art historians have sought to confront the circulation of motifs in a global and long-term perspective. Despite the monographic fate of their discipline, and the power of connoisseurship among image professionals, they have tried to treat images at larger scales, using all the means at their disposal, from drawing to print to photography, to computerized "distant reading" of image descriptions; and now we apply "distant viewing" algorithms on huge image databases. The quest seems endless to understand how images circulate, how they can be viral, what they carry, and what effect they have on us. It is likely that subsequent generations of researchers will also strive to make the most of the latest technologies to understand the amazing effect of images on humanity. And that we will never have a satisfactory answer to our questions.

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