

# Mapping Communication Design through the Web

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## Abstract

Design is by nature an interdisciplinary, dynamic, and fluid discipline (Cross, 1982; Friedman, 2003). To define what design is has proved to be a very difficult—if not impossible and meaningless—exercise (Friedman, 2000), making also the understanding of the evolution of both the design discipline and practice a complex challenge. A rapidly changing technological landscape increases the breadth of design both in geographical terms and by extending to new domains, merging with different and new disciplines.

Communication Design especially, being closer to the information and the media spheres, is the most sensitive and receptive design area. Communication Design finds online a fertile ground for its growth and developments, thus the online environment and the Web especially can be explored, dug, and mapped as mirrors of that evolution. The aim of our research is to map through the Web the complexity of the intersections between design as a discipline and design as a field of practice. Our exploration and representation of the online design territory covered four online environments: Behance, Wikipedia, Google, and the websites of the top one hundred design universities. The study has been conducted by using digital, statistical, and visualization methods. This exploration seeks neither to confirm theories nor predict the future, rather, it wants to make explicit and observable what Communication Design has become today. It aims to screenshot the state of the art, the emerging paths, in order to understand where and how it is going to develop. The attempt is to make design as a complex phenomenon visible, through the construction of a set of maps and representations for professors, students, and associations. These representations are tools to trigger reflections on the discipline and the profession, bringing a contribution to the experimental research in this field.

*Keywords: Communication Design, Digital Methods, Web Research, Data Visualization, Design Education*

The Internet and the new technologies that have accompanied it have led to new social contexts, new forms of interaction, and new knowledge structures based on speed and change. Social media platforms, especially, have demonstrated considerable growth in the last few years and, thanks to the development of digital methods of research, they can be seen as rich sources of knowledge. According to the Digital Methods Initiative (DMI) —a Web studies research group based in Amsterdam—these platforms can be “repurposed” as rich and easily accessible sources for data that open up hidden knowledge about culture and society. We believe that embracing this approach—widely used in other disciplines such as sociology—also can open up new perspectives to design research, leading to new reflections on a discipline that finds online the most fertile ground for its development.

This paper presents the process and the results of a study that exploits Digital Methods of research to understand if and how a disciplinary and professional complex domain can be explored and represented through the Web. Digital Methods and Data Visualizations are the main methodologies that have been integrated to enable the observation of design as a discipline and a field of practice.

To test and validate a new and different approach to design research that takes advantage of these digital and cartographic methods, is also a goal of the research. The research refers to data and information collected between May and June 2016.

## **Aim and Objectives**

This research aims at investigating and mapping what Communication Design is today through the Web, how it appears, and how it is perceived on that venue. The Web thus becomes the exploration field, the focus, and the source of data for this study. The final attempt is to build a useful and accessible tool that could lead to a first orientation on the Web dimension of the Communication Design field. It can also reflect the discipline in its current state, contributing to the orientation of further research activities carried out in this specific area. Thanks to the new research methods and tools developed in the social and cultural sciences and offered through the Web, we can observe the Communication Design area from an unprecedented number of diverse points of view.

The results of this research are not error proof, and the study does not aim at providing a comprehensive representation of the discipline on the Web. Rather, it tests new methods of analysis and new investigation approaches. Therefore, this project doesn't have the ambition of being considered as conclusive and complete. Rather, it should be considered as the starting point for further explorations.

## **Expected results**

The research output has two functions: 1) to support anyone interested in exploring and learning about the discipline; and 2) to create the starting point and the conditions for anyone who wants to engage in this type of research, by providing a methodological basis. Therefore, the attempt is not to deliver a final result but to create a series of maps for students, professors, and associations that will develop their own findings. Moreover, this research could serve, on the one hand, as an *input* for new reflections on the discipline, and, on the other hand, as a validation *output* for the future: being able to watch what the design discipline and the profession have become today could facilitate thinking about their future. In the future, having a screenshot of the past could help to make visible the changes that have occurred in this area.

## **Research Methodology**

In potential, the Web offers endless ways to do a digital research, also in the specific context of Communication Design. For this reason, it was necessary to narrow the field. Four online environments have been chosen to explore Communication Design, which correspond to four significant points of view to observe the online phenomenon. These environments are:

Behance, Google.com, Wikipedia, and the websites of the top 100 design universities of the QS World University Rankings. The choice of the online environments was a fundamental and decisive step for the research developments, as the *a priori* study of them has been indispensable for understanding the type of data and information to extract.

The research environments have been chosen after several trials. Indeed, the entire research has been conducted with an empirical approach. Initial questions have been constantly defined and then redefined. It has been a research based on experimentation and observation, which has seen lots of back and forth moments. Sometimes these moments corresponded to new questions, other times to new environments to explore. When it was discovered that some paths did not lead to any result, it was necessary to go back and start over (Figure 1).

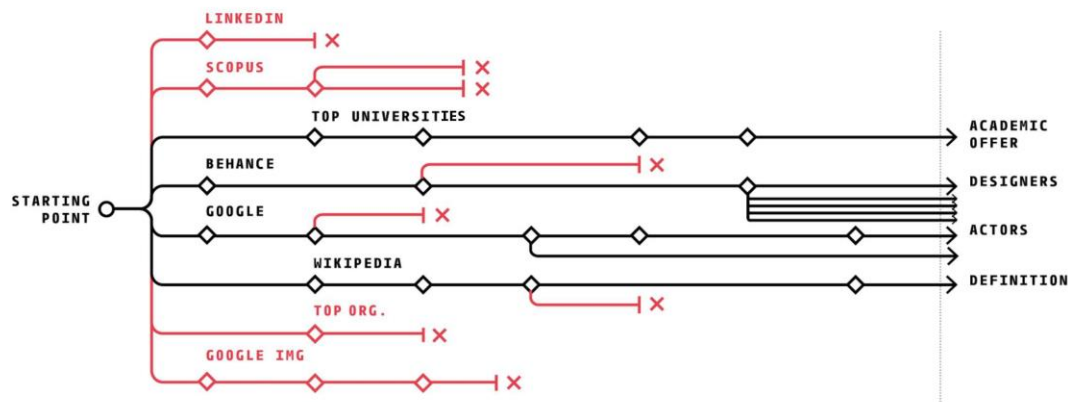


Figure 1. Diagram showing an overview of the process made of blocked and free paths (inspired by Wolfgang Jonas trial and error process diagram)

The research process consisted of these main steps: the formulation of initial questions, data gathering, data analysis, and visual exploration. However, the process was not always that linear. Sometimes it was necessary to go back and reiterate some steps: Initial questions → Data Collection → Redefinition of initial questions → New data collection → Data analysis → Data visualization → New data collection → etc. (Figure 2). Between the initial questions and the data collection, there was always the definition of the methods and tools to collect the data.

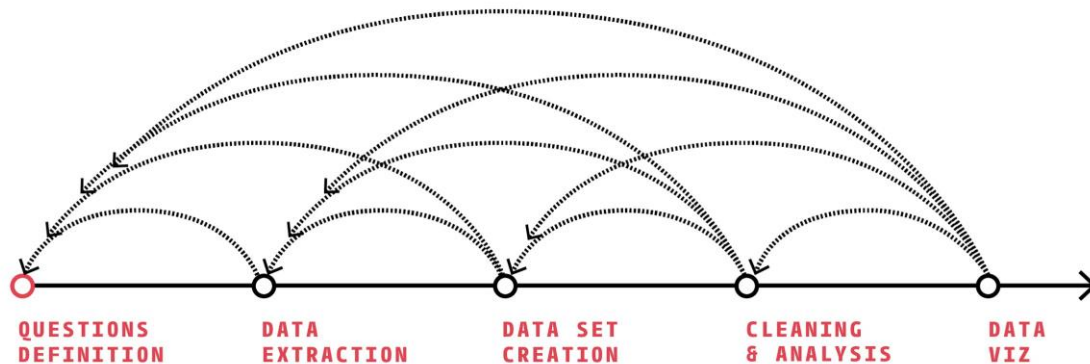


Figure 2. Diagram showing the process main steps and its cyclic nature

This observation has an interdisciplinary nature since it borrows computational, statistical, and representative methods and models. Visualizations, in particular, play a fundamental role. They are used both as useful tools in the process and as communication devices.

## Research Phases

In the following sub-chapters, we will explain the reasons why the four online environments were chosen; we will then outline the specificities that could be taken into consideration from each environment for the analysis and show the insights derived from these. The general questions that we sought to answer were: 1. How is Communication Design described on the Web (Wikipedia)? 2. Who are the relevant actors that emerge from the Web regarding this topic (Google)? 3. What can the Web tell us about the academic offer (QS rank—Universities websites)? 4. Who are the designers of today and where are they located (Behance)? It is important to keep in mind that the four explorations have been simultaneously conducted and that they are configured as four separate views, which followed different protocols, methods, and approaches.

### Wikipedia

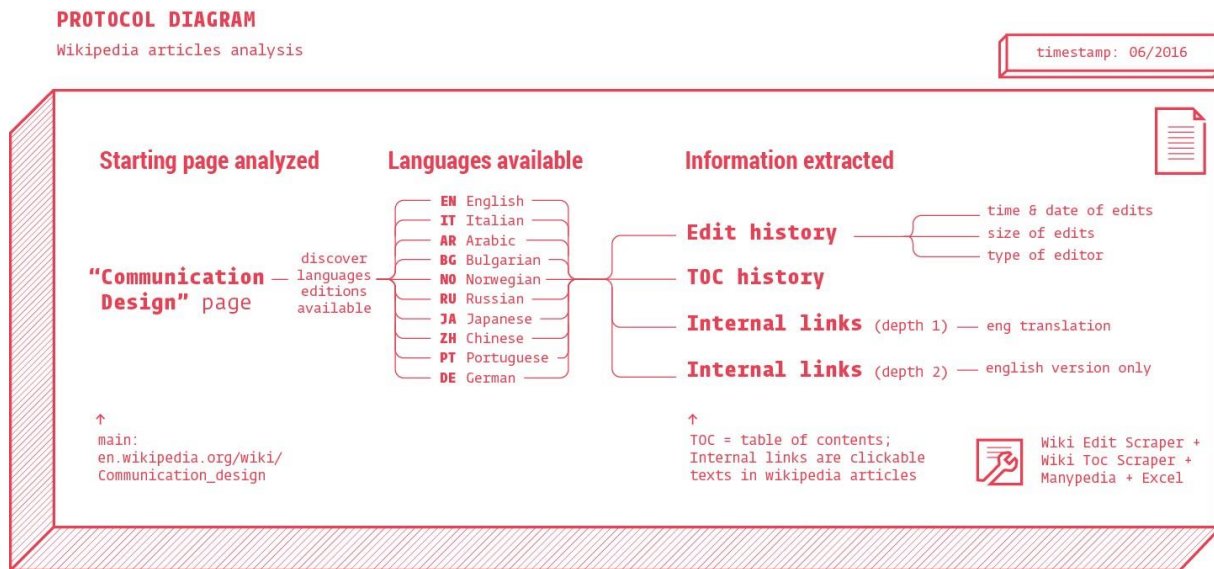
According to Alexa, Wikipedia is the largest free, public encyclopedia, as well as the fifth most visited website of the Web<sup>1</sup>. The platform, unlike traditional encyclopedias, works as an open system where anyone is allowed to edit<sup>2</sup>. Wikipedia collects more than 44 million articles, and it includes 295 different language editions. When querying Google.com with “Communication Design,” Wikipedia’s definition is the first one to which we have access and this constitutes the importance of its analysis. So the question is: How could this open system be exploited for digital research? What can it tell us about this context of research? Several tools have been developed in order to study this platform. For instance, Contropedia for studying controversial articles or tools such as Manypedia and Omnipedia to compare the diverse linguistic points of view. The questions we seek to answer are: How is Communication Design defined on Wikipedia? Are there different linguistic understandings of the topic? Which concepts emerge among the different editions?

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<sup>1</sup> alexa.com/topsites, accessed on March 17th 2017

<sup>2</sup> meta.wikimedia.org/wiki/List\_of\_Wikipedias, accessed on March 17 2017

Figure 3. Communication Design on Wikipedia: data gathering protocol



The aim of this protocol of research (Figure 3) was to highlight the similarities and differences between each of the language editions of the “Communication Design” page. Firstly, we identified the languages in which the page was available. Consequently, for each page, we scraped the edits’ history page in order to understand the evolution of the articles over time. By using a tool developed by the DMI, Wiki Edit Scraper, it was possible to scrape the complete edit history for the given pages returning some information, such as time and date of the edit, size of the edit (calculated in bytes), comments, and type of user editing (registered, anonymous, or BOT). Other digital objects we analyzed are the internal links of each Wikipedia article.

Internal links have been often “repurposed” for digital research. The same Wikipedia guidelines tell us about the importance of these Wiki objects: internal links should be used to increase readers’ understanding of the topic at hand. The aim of this phase was to investigate different linguistic understandings of the topic. In order to make a comparison, it was indispensable to translate all these concepts in a common language. Through the use of Manypedia, it was possible to scrape these items of information directly in English.

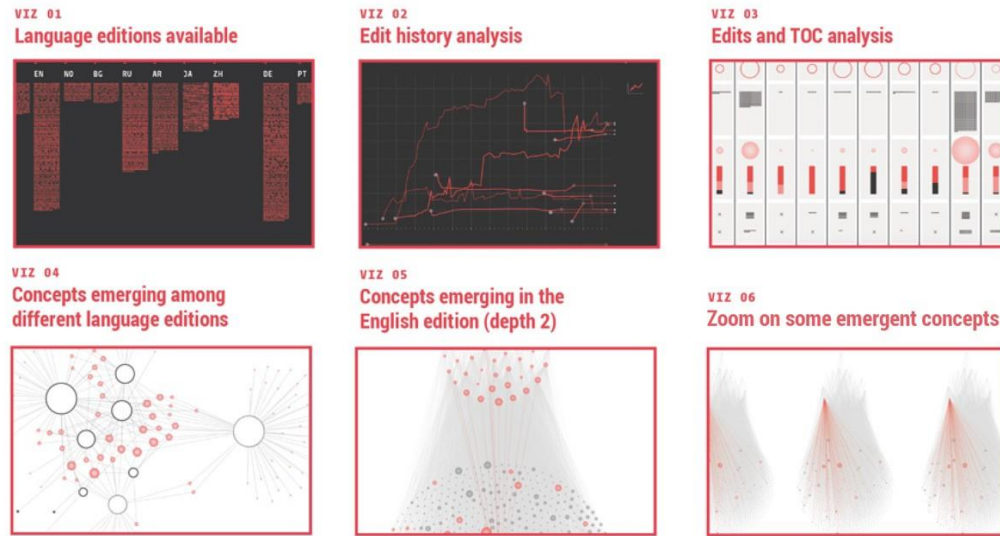


Figure 4. Set of visualizations for the exploration of Communication Design on Wikipedia

The output of this protocol of research is a set of six visualizations (Figure 4). We present here two of them. The first visualization (Figure 5) represents the article length of each language edition available. What can be seen is that the English article appears as the longest article. The English edition is indeed the Wikipedia's largest edition, representing about 13% of the total number of articles. The Italian article is instead very short and not really explanatory. For the German and Portuguese versions, Wikipedia redirects instead to other pages, respectively to the "Grafikdesign" page (which corresponds with the English "Graphic Design") and the "Comunicação Visual" page (which corresponds with "Visual Communication"). This is an important item of information itself because it means that no page called "Communication Design" exists in these languages—as in many others—and that "Graphic Design" and "Visual Communication" are concepts that appear as substitutes for "Communication Design."

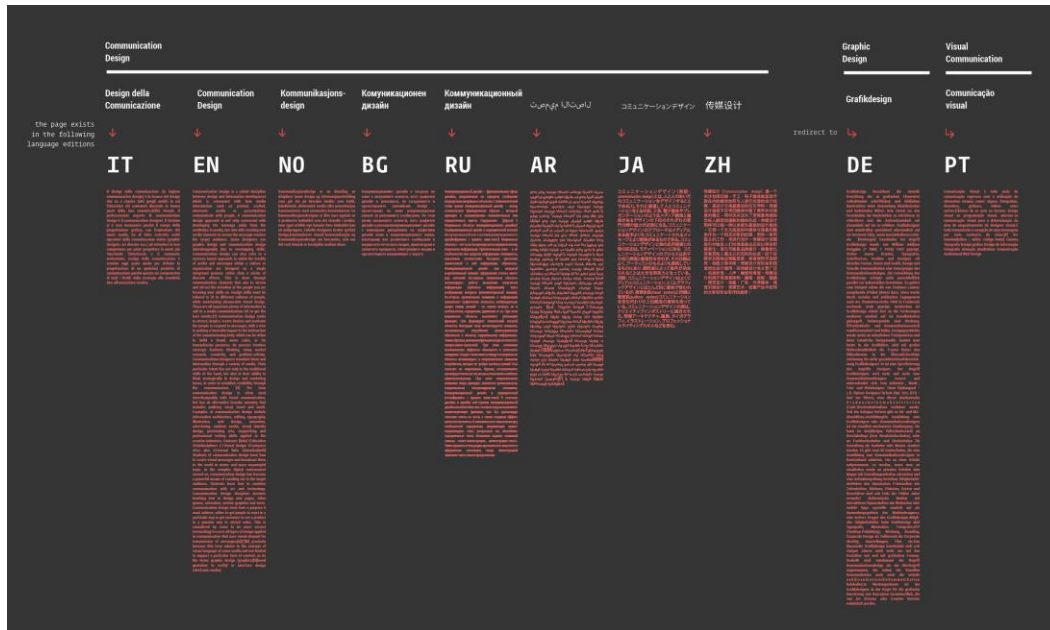


Figure 5. “Communication Design” article: language edition available and length

Although the English edition has a content advantage, the other languages can contain unique information. This network (Figure 6) shows all common and unique links of the different language versions of the article “Communication Design.” The network, built with Gephi software, aims to highlight the concepts that different languages mention (Figure 6.1) and the ones mentioned instead by a single edition (Figure 6.2).

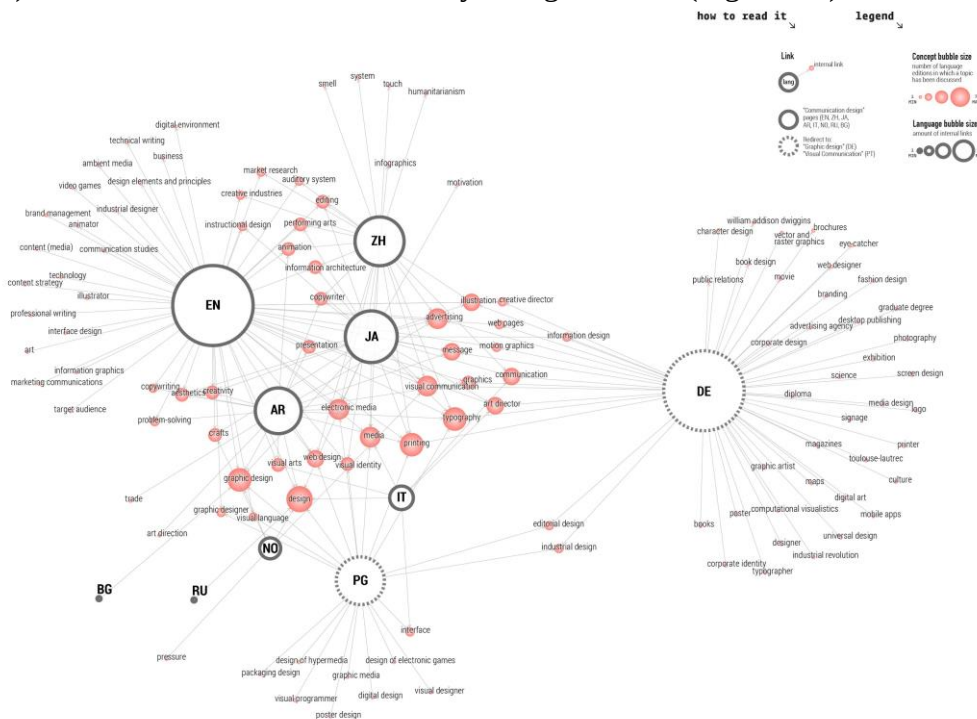


Figure 6. Concepts emerging among the different language editions available



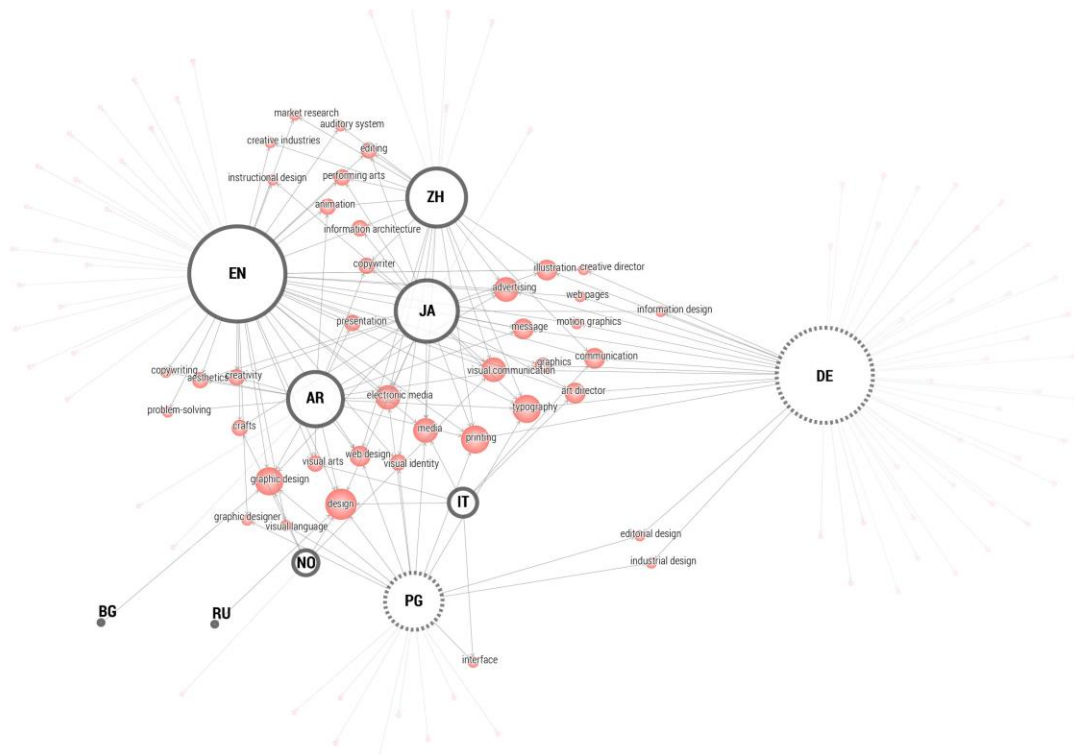


Figure 6.1. Focus on common concepts

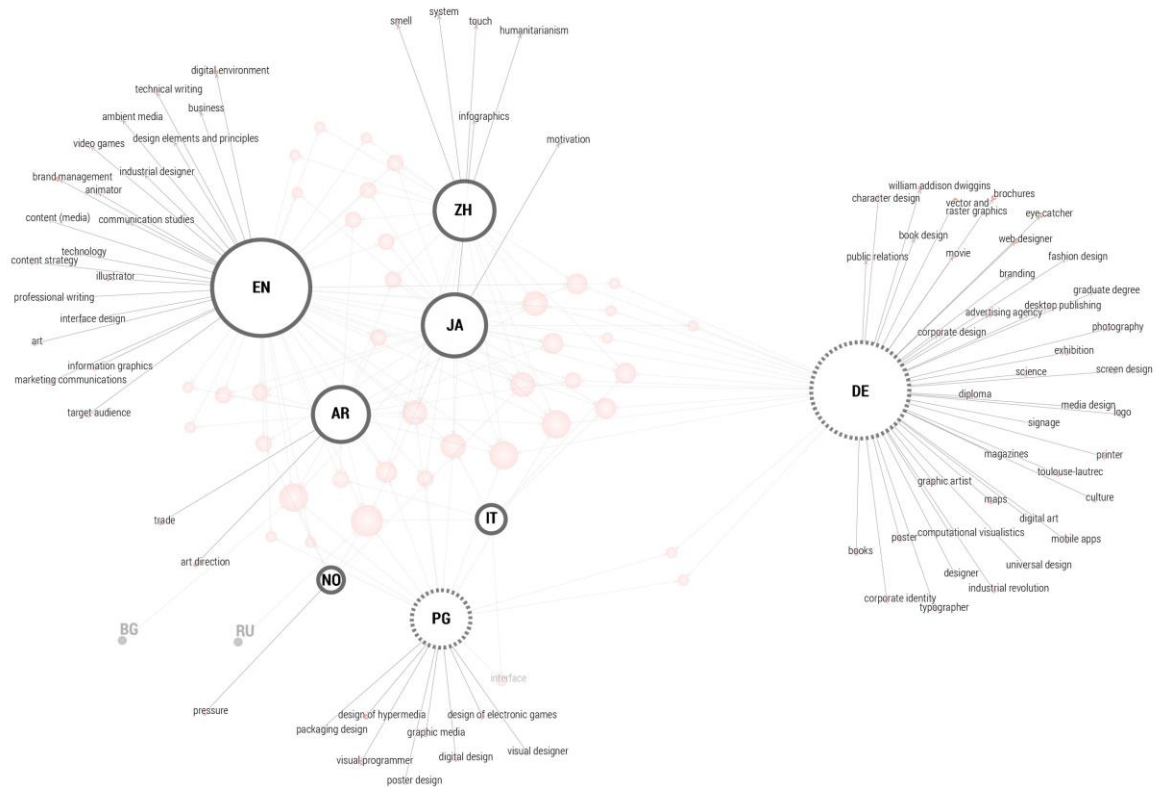


Figure 6.2. Focus on unique concepts



## Google.com

Google is today the leading search engine across the world. It is the first point of access to information and it contains actors that can be analyzed. Mapping who is at the top of Google rank when talking about Communication Design could be a way to understand who mainly talks or is involved with this topic today on the Web. How is it possible to practically collect and organize a quantity of results that are so internally various? And how to take advantage of the rich sources of information such as URLs? Scrapers and crawlers serve as devices capable of bringing order to the Web, as they make it possible to collect and restructure large quantities of data. If with scrapers it is possible to retrieve a list of URLs, with crawl tools it is possible to make the syntax of these URLs a suitable field for analysis (Weltevrede, 2016: 25–51). The web crawler specifically used in this research is Hyphe, developed by Sciences Po's Médialab. Hyphe allows harvesting of the hyperlinks of a collection of Web pages by performing a series of "crawl jobs." The typical output is a network of Web entities to be analyzed through network analysis softwares such as Gephi.

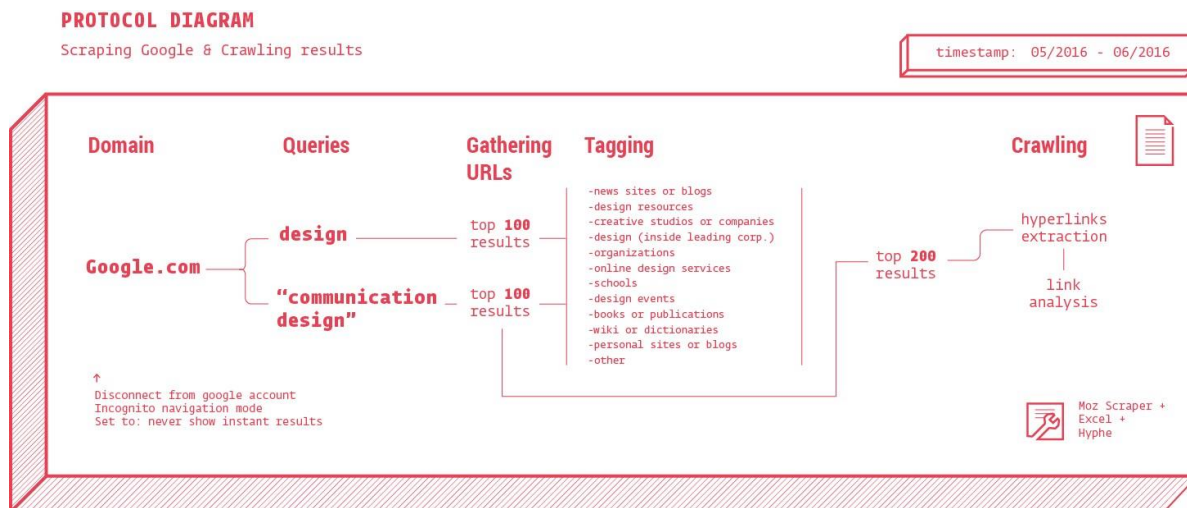


Figure 7. Communication Design on Google.com: data gathering protocol

This analysis followed the protocol shown in Figure 7. Starting from Google.com, the query used was "Communication Design." In order to obtain unbiased results, it was important to follow three initial steps: 1. disconnect from any Google account; 2. open a new window in incognito mode; and 3. set "never show instant results." After this procedure, it was possible to formulate the query and to collect the top 200 results. Once the data set was created, each website was tagged for its nature in order to define the actors. After this step, a crawling was performed for "Communication Design" results. The output of this protocol is a set of three visualizations that allow the exploration of the phenomenon (Figure 8).

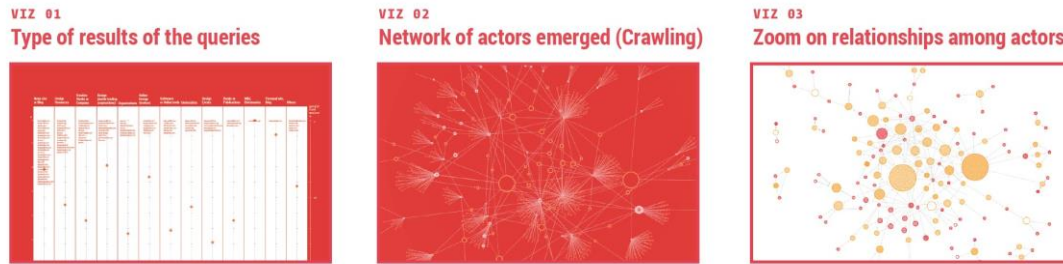


Figure 8. Set of visualizations for the exploration of Communication Design on Google.com

“One can profile an actor according to the links it gives and receives” (Rogers, 2010: 224). This network map (Figure 9) is the result of the web crawling performed from the list of URLs obtained from the query “Communication Design.” The red bubbles represent the starting websites, while the orange ones represent the discovered actors, which are those websites that the starting URLs link to. The size of the bubbles represents the in-degree, which is the number of links that each bubble received: the most linked entities correspond indeed to the biggest bubbles.

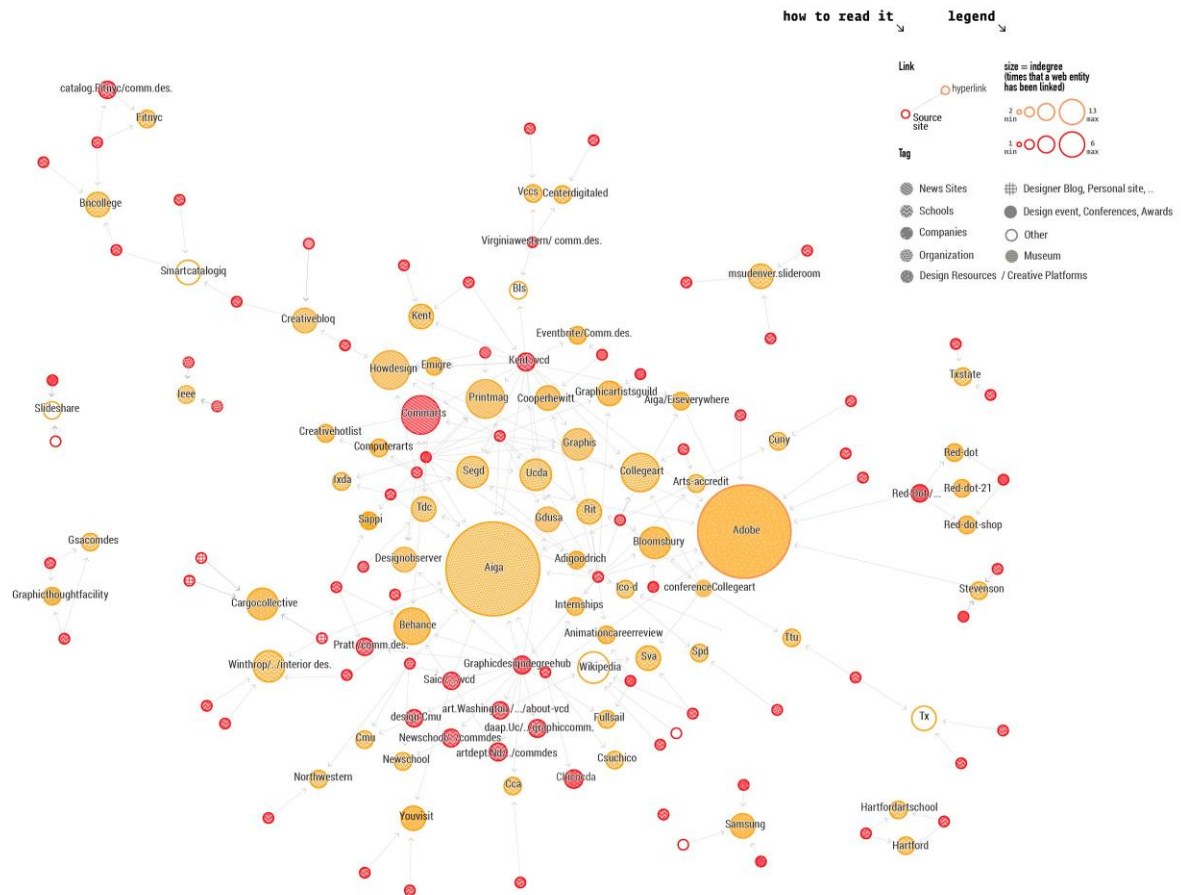


Figure 9. Network map showing the relationships among actors that emerged from a crawling job of 200 top Google results of the query “Communication Design”

The map provides indications about the actors that appear in the network and about their importance and overall centrality. The largest nodes are “AIGA,” the professional

association for Design, and “Adobe,” the leading developer company of software for Design uses. Social media and other companies such as “Google” have been taken off from the network since they were linked almost with everything, and they made the readability of the other nodes too difficult. The emergent actors have been categorized by type. This way, we could see that most of the results were universities.

## QS Rank and Universities websites

The world of Design is analyzed here by questioning the state of Design education. The list of universities considered in the analysis was extracted from the QS World University Ranking. By typing the query “top Design universities” on Google.com, the first result was indeed the “QS World University Rankings by Subject.” Highlighting the world’s most prestigious universities through a range of popular subject areas, the QS ranking is the most trusted among the universities’ rankings. Based on academic and employees’ reputations, research impact, and student opinions, the QS ranking has been published annually since 2011 by Quacquarelli Symonds, a company specializing in education and studies abroad. Only in 2015, they introduced the subject of “Art & Design” under the category of “Arts & Humanities.” The questions that led this exploration are: What is the state of Design education? Which are the Design fields existing according to the top 100 Design Universities of the world? What and where are the boundaries among Art, Design, and Science in the Design education field? This analysis compares universities’ Design programs to figure out which are the most frequent disciplines, which are the emerging ones, and if there is a common pattern in education and in the level of specialization of the current degrees.

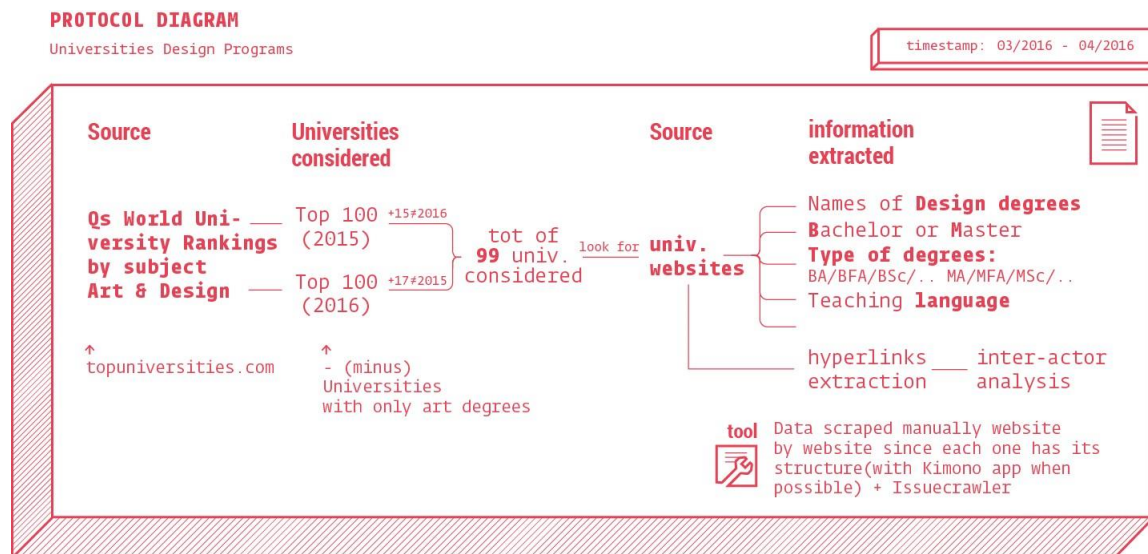


Figure 10. Communication Design and QS Ranking Universities: data gathering protocol

The data set was created by merging the rankings of the years 2015 and 2016 in order to have a list of the top 100 design universities. Some universities were deleted since they do not offer Design degrees but only Art degrees, a consequence of the wide subject “Art & Design.” The information extracted from each university consisted of a) the names of the degree programs offered; 2) the degree level (we considered only Bachelors and Masters);

and 3) the type of degree (Art, Science, Fine Arts, Design, etc.).

The visualizations created (Figure 11) aim to map the current state of Design in the academic system by showing the diverse types of Bachelor and Master's degrees existing in the field. The intent is to discover which are the most recurrent programs, offered by many, and which the unique ones; and if universities have adapted to the technology changes that have inevitably affected the Design profession by inserting new programs, or if they are still based on the most traditional ones.

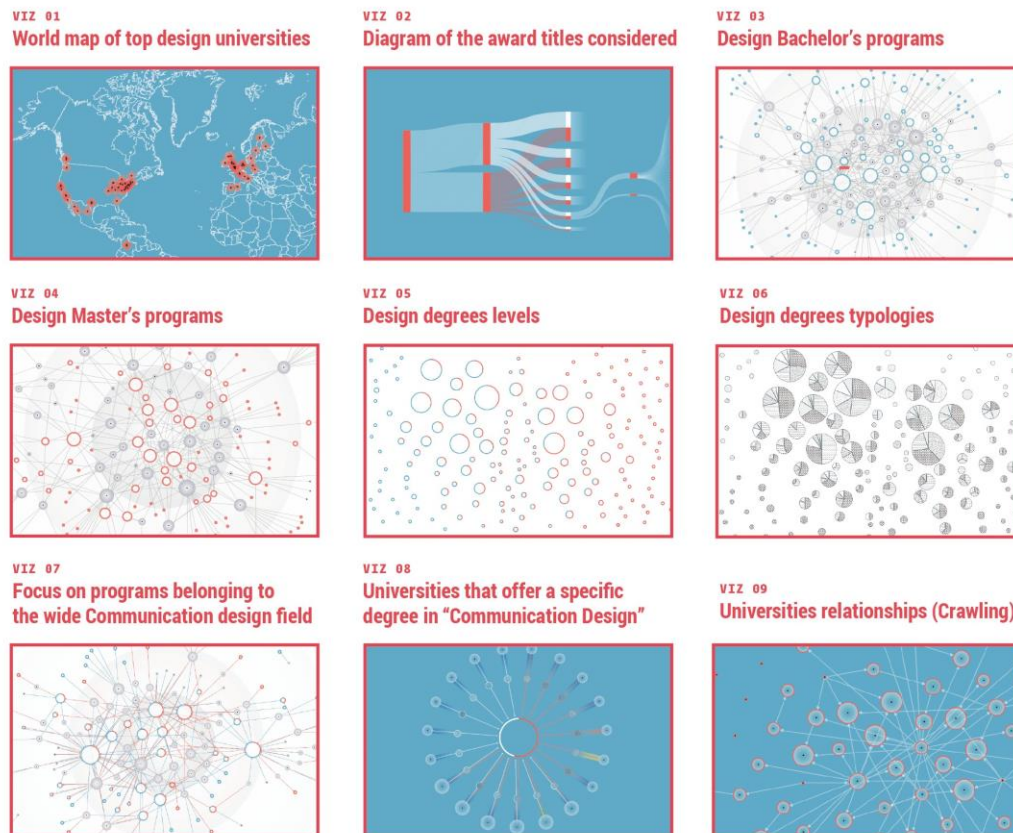


Figure 11. Set of visualizations for the exploration of Design education

The visualizations (Figures 12–13) show all the Design degree programs existing among the universities considered. The first one represents all Bachelor programs and the second one all Masters. The names of the programs are linked to the universities that offer that specific type of degree. The programs that occur the most are represented with big bubbles while the ones linked to a single university appear as very small nodes. The size of universities' nodes, instead, indicates the number of design degrees that a school offers, while their central position indicates the fact that it has many degree programs in common with the others. In fact, while the network of the Bachelor degrees tends to be compacted toward a central area, the network of Master degrees loses centrality. In other words, programs at a Master level tend to be more diversified— at least in the way they are designated. So, for instance, the program that, at Bachelor level, in many is called “Fashion Design,” at Master level becomes “Design for Fashion Systems” or “Fashion Design Management.”



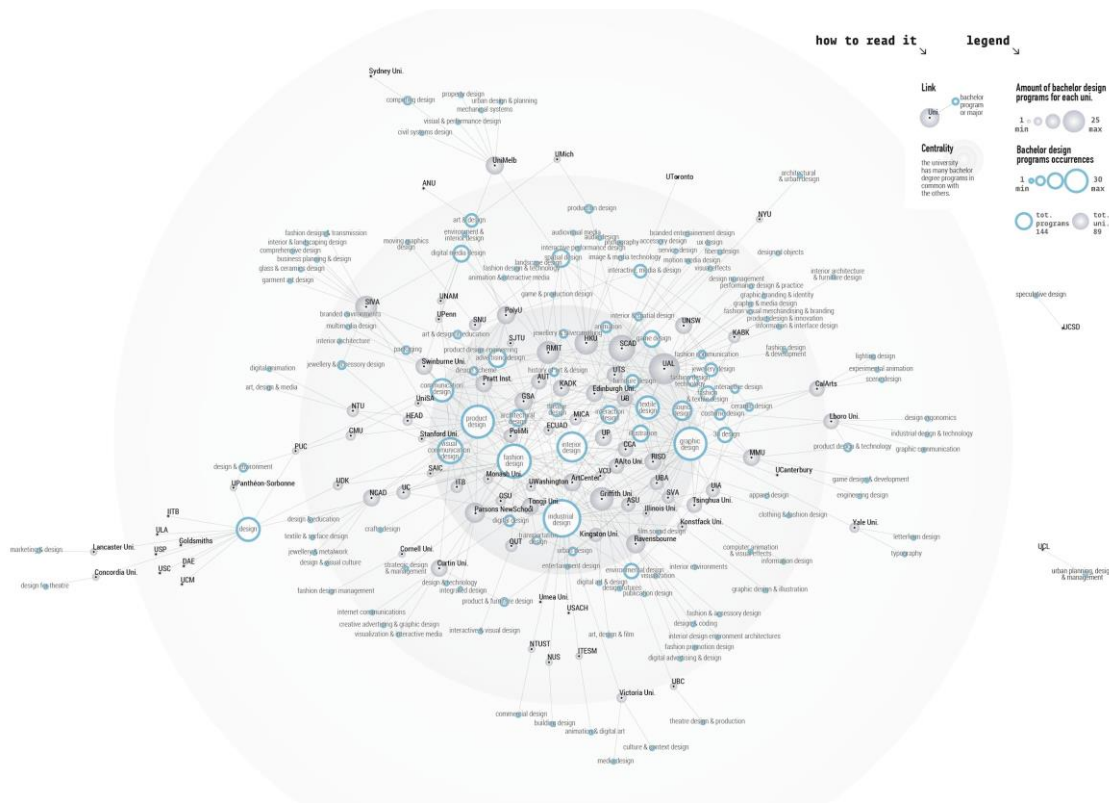


Figure 12. Network map of Design Bachelor's programs and Universities

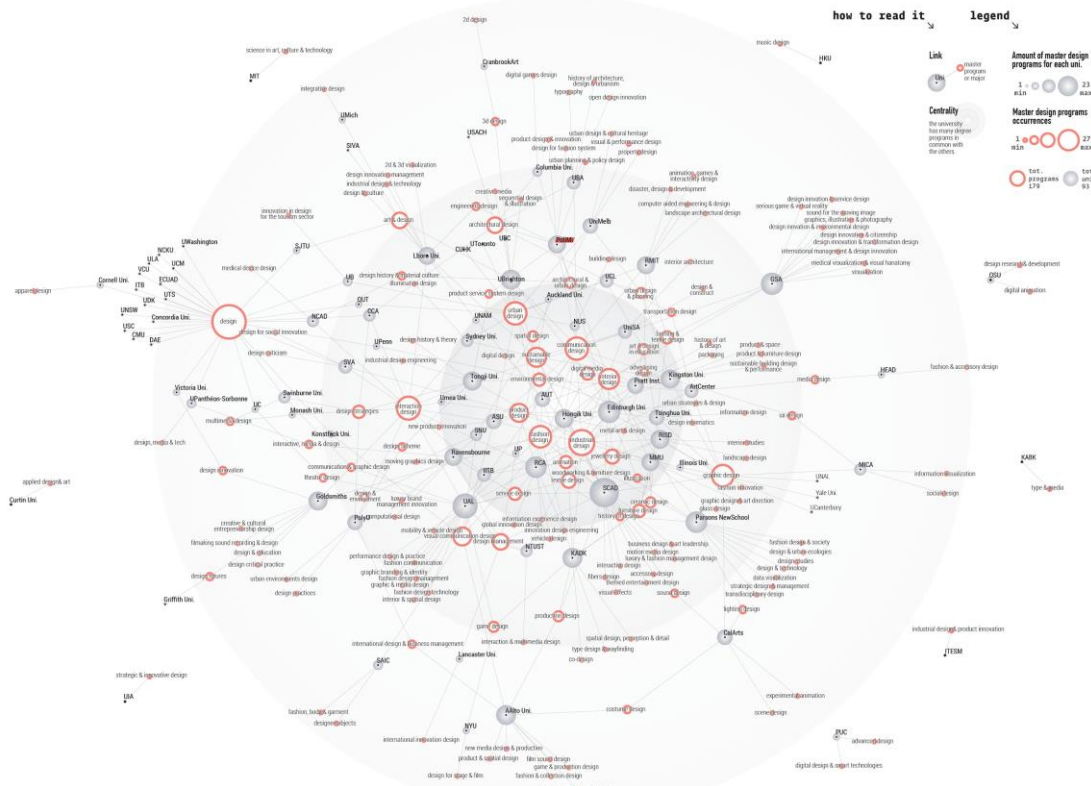


Figure 13. Network map of Design Master's programs and Universities

## Behance

Adobe's Behance social network is one of the biggest online communities for creatives. Students, freelancers, and companies use it to showcase their works on a global scale. In 2015, it counted over six million members around the world.<sup>3</sup> In such a well-organized and already structured system, data access is even easier, so we can easily obtain insights from this creative world. By embracing what E. Weltevrede (2016) defines as a "device-driven digital research," we are able to account for the specificity of the platform and the way information is already structured, in order to derive analytics. The questions we wanted to answer are: Where do the most appreciated designers come from? Who are the UI/UX, Interaction, Web, and Graphic designers? Which other creative fields do they master?

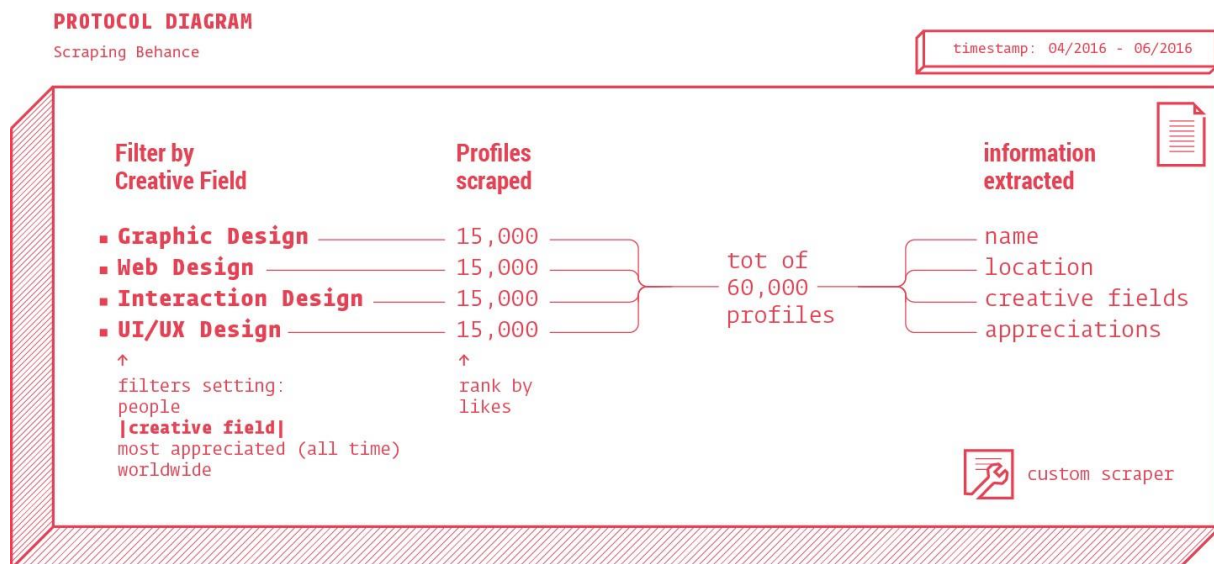


Figure 14. Communication Design on Behance: data gathering protocol

The platform organizes the creative world through a filter system, which allows searching for a series of variables. There are exactly 67 fields available on the platform, of which 12 are highlighted as the most popular. This analysis takes into consideration only four of them, which currently belong to the popular ones: "Graphic Design," "Web Design," "Interaction Design," and "UI/UX Design." The fields chosen are representative of this type of research, which aims to explore the different areas of Communication Design. From a more traditional "Graphic Design" to the most recent "UI/UX Design," "Interaction Design," and "Web Design," the aim is to show for each one the number of people that selected it, the country where these people come from, and the number of likes they received. The analysis considers a large sample as the number of profiles scraped—15,000—which required a custom scraper for obtaining the data. Once the data were collected, it was also possible to determine the gender of first names. By using Genderize.io API, based on a database of 216,286 distinct names across 79 countries and 89 languages, it was possible to recognize the gender. The API returned indeed "male" or "female" together with a number representing the frequency of the

<sup>3</sup> behance.net/yearinreview - Behance "year in review," 2015

specific name in their database.

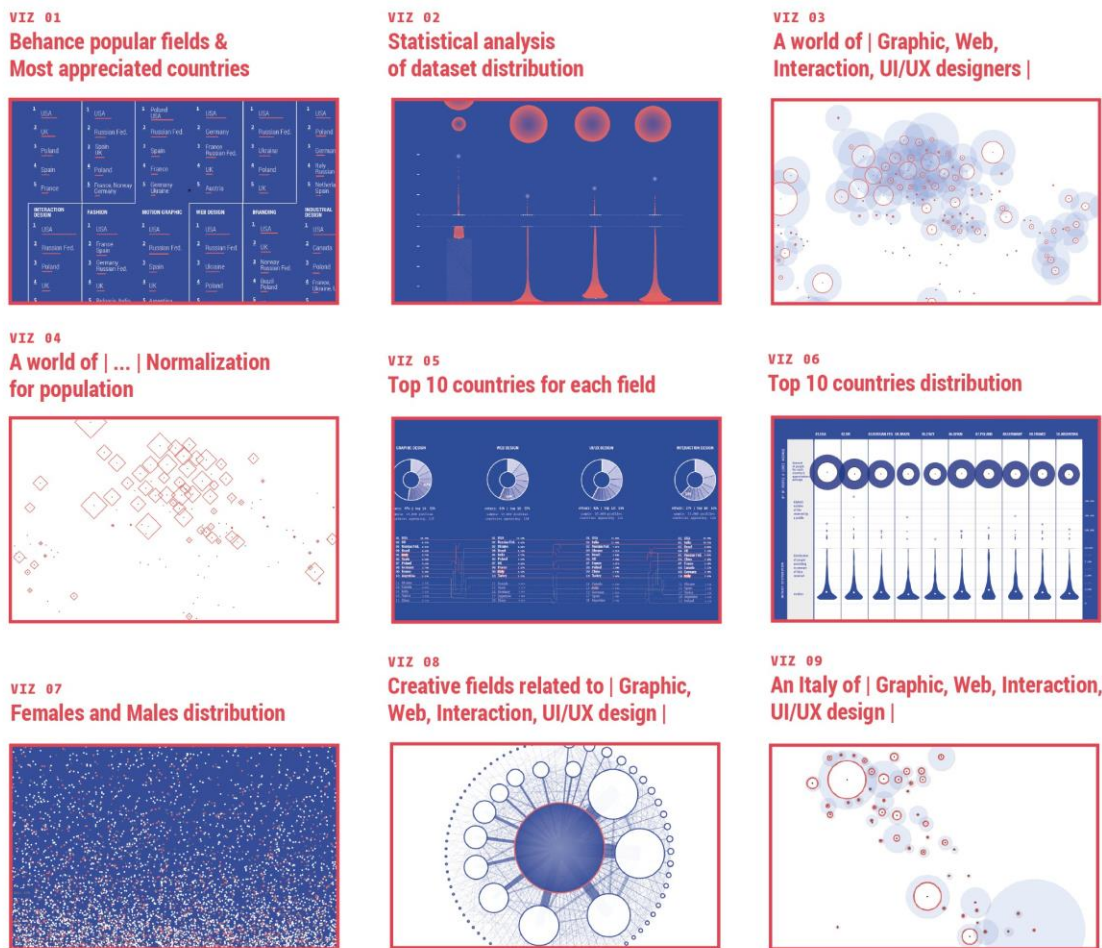


Figure 15. Set of visualizations for the exploration of Communication Design on Behance

Where do Graphic, Web, Interaction, and UI/UX designers come from? How much are they appreciated? In order to find answers to these questions, we designed four bubble world maps, one for each field (see Figure 16). Each country is thus represented by a circle, which is as big as the number of profiles indicating that country. The thickness of the outline of this circle represents instead how much that country is appreciated on average. Another map (Figure 17), for each field, shows through squares the number of people for each country normalized for population number. So it is possible to compare the two maps in terms of absolute and relative numbers.



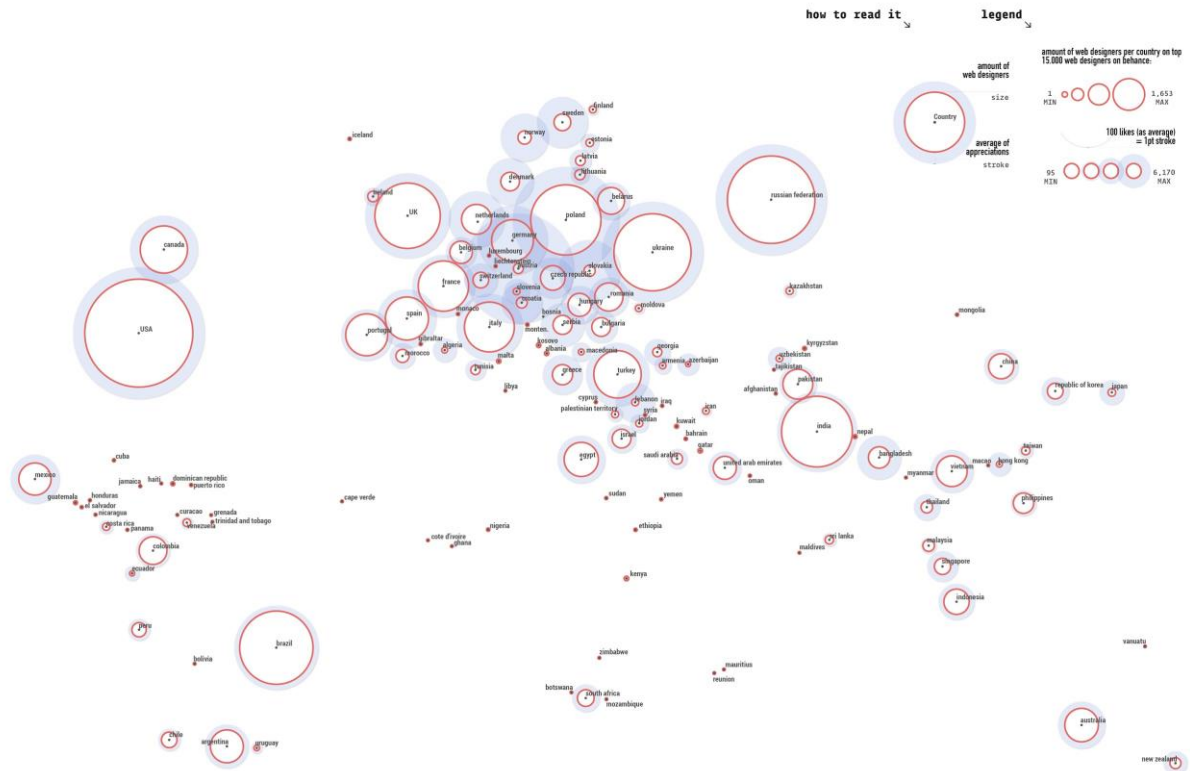


Figure 16. Behance bubble world map: “A world of Web designers.” Data: 15,000 most appreciated people with “Web Design” as creative field

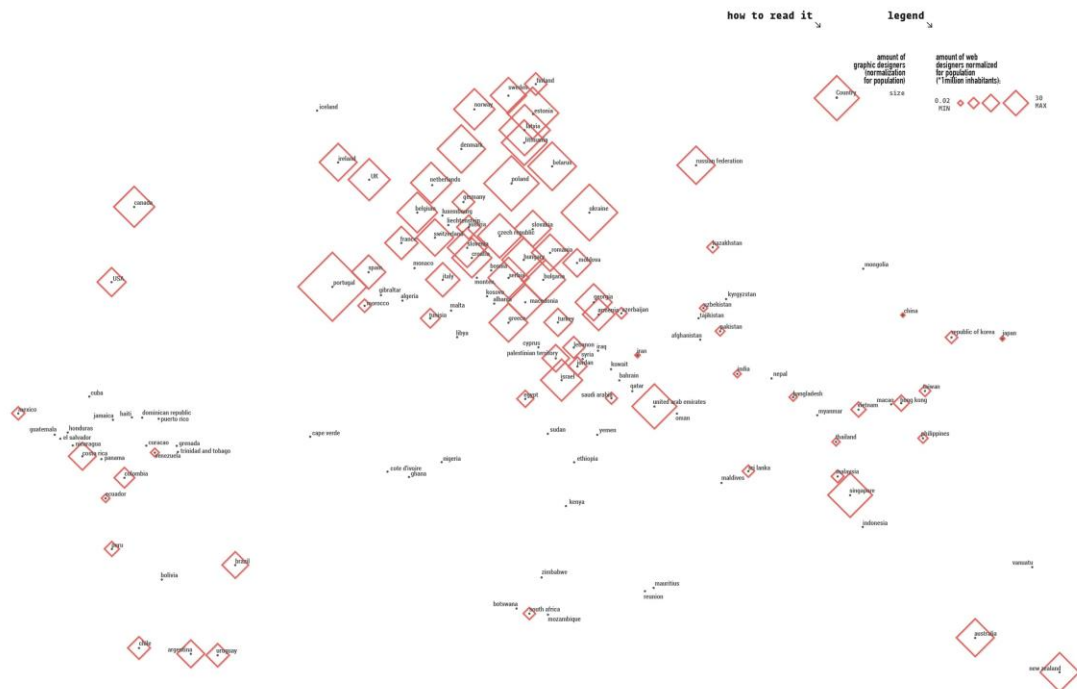


Figure 17. Behance bubble world map: “A world of Web designers – Normalization for population.” Data: 15,000 most appreciated people with “Web Design” as creative field

## Discussion

The main research findings confirm that: a) Communication Design is an ill-defined area, an often-confused disciplinary field with a series of new links and overlappings with other areas and disciplines (findings from Wikipedia); b) Communication Design is not used as terminology outside the academic domain (findings from Google); c) platforms like Behance offer a sub- categorization of design that pushes more and more toward a deeper specialization; and d) in the academic domain also, an increasingly large number of specific and diverse degrees has been activated. In the following pages, more specific discussions about each single Web environment will be presented.

### Wikipedia

This study has identified a scarcity of Wikipedia language versions for the subject “Communication Design.” The article is indeed available only in ten languages (out of 284 active), of which two, the German and Portuguese ones, redirect to the pages that correspond respectively to “Graphic Design” and “Visual Design.” This confirms what scholars have told us over the years about this specific area: that “Communication Design” as terminology has been introduced in relatively recent years and that it has been interchangeably used as a synonym of many other subjects, such as the ones just mentioned. Furthermore, it was found that, apart from the English and German editions, the other article versions are quite poor in terms of content and not very well-structured; it is also interesting to discover that in an area in which visuals are of primary importance, no images are actually present in the articles.

However, Wikipedia has been identified as an interesting forum for digital research and performing a co-occurrence analysis of common and unique concepts (identified with internal links) has brought to light some curious findings. For instance, all the language editions mention a common list of fields related to Communication Design, such as “Advertising,” “Illustration,” “Web Design,” “Graphic Design,” etc., which reflect the nature of this wide discipline. In opposition to common concepts, unique concepts also emerged, such as the concept of “Humanitarianism” mentioned by the Chinese edition. Another interesting fact is what is not mentioned: for example, the new areas of “UI/UX Design” and “Interaction Design,” as well as many others. It is difficult to say if the similarities and differences found across these different Wikipedias actually reflect the offline situation. but it seems that there are some cultural influences. As for further explorations, it would be interesting to see how the articles will evolve in the future, and if more designers will engage with this task of making the area of Communication Design more understandable within the open Encyclopedia.

### Google

By treating Google Web Search as a research tool, it has been possible to assess the importance that universities, organizations, companies, or other entities can have in the context of the use of the phrase “Communication Design.” The results that emerged from this query were significant in revealing that Communication Design is mainly intended as a discipline; in fact, this terminology was mostly used among universities: out of 100 results, 69 were referred to the web pages of universities, which typically showed their degree programs

in Communication Design.

Furthermore, the study in this chapter found that with link analysis it is possible to determine the impact of an actor (such as a university or an association) in the generic Web.

This means that it is possible to figure out which are the actors that sit at the “virtual roundtable” imagined by Rogers (2009) for the Communication Design topic. It was discovered, for instance, that AIGA and Adobe have a considerable online reputation, since they were the most linked of the networks. To summarize, through the analysis of the actors appearing on Google ranking and the links between them, it has been possible to discover who was actually dealing with this topic. Since the Web moves very fast, as a further step, it would be interesting to see how this network will evolve over a period, and also, how it will change by using as queries those synonyms utilized by many, such as “Graphic Design,” “Visual Design,” etc.

## Universities

With a view on the Design programs offered by the 100 top design universities of the world, a first mapping of the academic offer around this topic has been traced. Even if it is a partial view, a mapping of the program names belonging to the sphere of Design, represents at least a first sketch of an open dictionary made of terminological differences and similarities. What emerged from this mapping was a big diversification in the program names, in the areas covered, and in the levels of specialization. The maps showed 144 and 179 different names of Bachelor and Master degrees. This analysis also opens up a series of questions regarding the academic perspective on the boundaries between Art, Fine Arts, Design, and Science. Indeed, despite the fact that Design is today considered as a discipline separated from the sphere of Art, the greatest number of Design programs analyzed appeared to be under the titles of Art and Fine Arts, while only a few were considered as degrees of Design and Science (Figure 18).

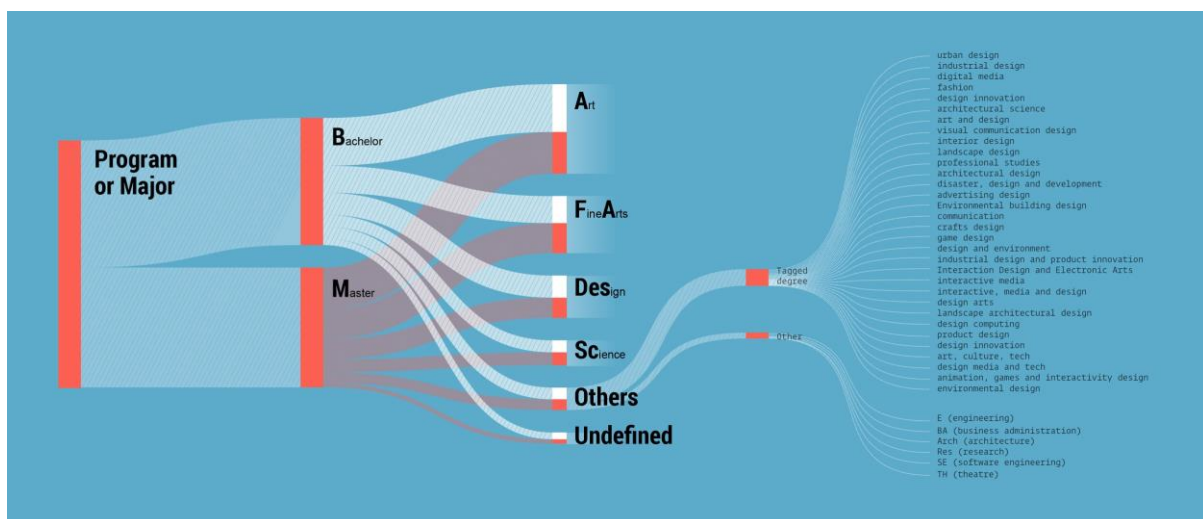


Figure 18. Alluvial diagram of the information extracted from the top 100 design universities of the QS Rank

The aim of this mapping was to discover the common and unique patterns of an ever more variegated academic offer, but further steps could be taken. First, the number of universities for analysis could be expanded in order to map all the existing ones in the Design field, and not just those of a certain rank. Also, for instance, what these programs actually offer in practice, what kind of courses, methods and approaches they use and how this changes over time, could be identified, in order to compare them at a deeper level.

## **Behance**

In this chapter, the architecture of Behance, with its search possibilities and digital objects, has been “repurposed” in order to respond to the initial questions. With this analysis it was made clear that this platform offers good opportunities for analysis from a digital research perspective. Thanks to its taxonomic classification of creative fields, its filter system, and its well-structured architecture, Behance offers a great environment for exploring the creative world. By following its structure, it has been possible indeed to observe the designers of today.

In order to focus on the area of Communication Design, we consider only four creative fields. Obviously, the same analysis could be reiterated for all the others available, in order to cover all Design areas. Additionally, since the platform works as a portfolio of visual materials, another type of analysis could be done on this platform. This would be the approach to research that Manovich calls “Cultural analytics” (2008): an analysis of images’ features in order to capture differences and similarities among projects and different countries, to see trends, or to see how all of this changes over a period, for example. In conclusion, it can be said that Behance, to use Weltevrede’s words (2016), is a “good digital device” for research on this field.

## **Conclusion**

To summarize, the research, result of the collection, analysis, and visualization of the data gathered from the Web, led to the creation of a tool, composed of a set of visualizations, which allows the observation of the complexity emergent from the four environments selected and analyzed. What has been found is that thanks to the new research possibilities that the Web offers and thanks to these new, easily accessible computational methods, we can take advantage of such approaches to achieve knowledge and awareness in a particularly fertile territory on the online sphere: Design.

The research here discussed is a first step, a first methodological experiment, which could lead to a systematic observation of the field on the Web sphere. The exploration could be expanded in the future and deepened at several levels. For instance, it might be interesting to systematically show the evolution of these data over time. Moreover, they could be explored, using the same protocols, along with other design areas, such as Product, Fashion, or Interior design. The same sub-fields that emerged from this research, such as UI/UX, Web design, Interaction design, Graphic design, etc. or other online environments could be deepened and explored.

This study doesn't pretend to provide a comprehensive view of the topic on the Web and its

results are not error proof. Rather, it tests a new approach and method of research in the Design research field, through visual experimentation. At the beginning, we talked about a first mapping, a first orientation; in fact, this research is only a small step in this direction. Although it was conducted with the support of different disciplines—from statistics to computational sociology—a design-oriented approach has been essential to conducting the research, from the definition of the questions to the design of a methodology and of a visual tool to communicate the results.

Design, therefore, has played a key role in this research, not only as an object of study: this was, indeed, a research both about design and conducted through design (Fryling, 1993/4; Findeli, 1995). We are fully aware of the limits and the novelty of such a research and of the fact that it represents only a partial view over a huge world that needs many more resources to be explored.

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Associate Professor at Politecnico di Milano, he teaches at the Faculty of Design in the Communication Design master degree. He has been visiting lecturer at Universidad de Malaga and The Royal Institute of Art (KKH – Stockholm) and participated to several postgraduate courses in other universities. Since 2000 he represents the Faculty of Design in the European program “MEDes” (Master in European Design). Head of the Communication Design Research group and member of the Design PhD board, both at Politecnico di Milano – Design Department. His research and publishing activities focus on the development of data, information and knowledge visualization tools and methods to support decision making processes in complex systems. He’s founder and scientific coordinator of POLiteca, the Design Knowledge Centre of Politecnico di Milano.