

2CO3-COmmunicating COmplexity

Selected contributions to the Conference
September 8-9, 2022

Edited by Nicolò Ceccarelli

Serie di architettura e design

FrancoAngeli 

2CO3 Conference

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The present publication contains the communications presented at the 3rd edition of the International Design Conference 2CO-COMmunicating COMplexity, which took place from 8 to 9 September 2022 at the Department of Architecture, Design and Planning (DADU) of the University of Sassari, in Alghero, Sardinia, Italy.



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All contributions were reviewed and selected through a blind peer-review process by the Conference's Scientific Committee.

www.2coconference.org

*Conference Chair: Nicolò Ceccarelli
Volume Editor: Nicolò Ceccarelli
Graphic Design: Viola Orgiano and Marco Sironi*

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Keynote speakers

Pau García
Founding Partner
at Domestic Data Streamers

As leader of the consultancy firm Domestic Data Streamers, Pau works in research and communication projects for cultural institutions, organizations, and companies such as California Academy of Sciences, Western Digital, UNICEF, Nike or the Mobile World Congress in gathering and communicating information in new data languages.

Federica Fragapane
Independent data
visualization designer

Federica designed data visualizations for Google, UN, Scientific American, BBC Science Focus, Penguin Books and La Lettura. Federica is co-author of the infographics children's book "Planet Earth", published by National Geographic Kids and White Star and co-author of the "Geopolitical Atlas of Water".

Many of her projects have an experimental approach and explore the relationship between data visualization and people.



Darjan Hil
Founders of Superdot
Basel, Switzerland

Darjan Hil is an information designer. He co-founded Superdot while working as a researcher at the University of Applied Sciences, Northwestern Switzerland. Since 2017, he has taught at various Swiss Universities, lecturing on data visualization and information design principles.

Nicole Lachenmeier
Founders of Superdot
Basel, Switzerland

Nicole Lachenmeier is a Swiss information designer and co-founder of the data experience agency Superdot, founded in 2011. Alongside her team, she has developed over a hundred visual tools and design systems for large companies, NGOs and governmental organizations.



Special guests

Matteo Bonera

A multi-disciplinary creative with backgrounds in art, design, multimedia and knowledge visualization, Matteo loves driving the creativity of complex projects in advertising, communication and information design.

Matteo lectures at international companies, universities and masters, and is adjunct professor in data visualization at the Design School of the Politecnico di Milano.

Isidro Ferrer

Widely recognized as one of the most extraordinary graphic designers around, Isidro Ferrer's work sits perfectly between art and design. Member, since 2000 of the hyper prestigious Alliance Graphique Internationale (AGI), visual design's first class club.

His distinctive style revolves around free creative assemblages of spare objects and things, with which Isidro creates amazing visual sculptures full of energy and meaning.

His work as illustrator and graphic designer has been widely awarded internationally.



Three COMplexities

Nicolò Ceccarelli

Intro

Once upon a time, long before the Internet, Instagram, Pinterest and the like had made their appearance, the canonical way for graphic designers to gather visual reference was to collect books and magazines. The number of shelves in the image library of a design studio could then be a way to gauge its prestige and success. One particular magazine stood out, among the others, in that analogue visual design era. Published in Zurich for over 40 years starting from 1944, in its refined, exquisitely Swiss visual style, Walter Herdeg's prestigious and coveted publication *Graphis* was one of the most authoritative sources of good design in the wonderland of visual communication.

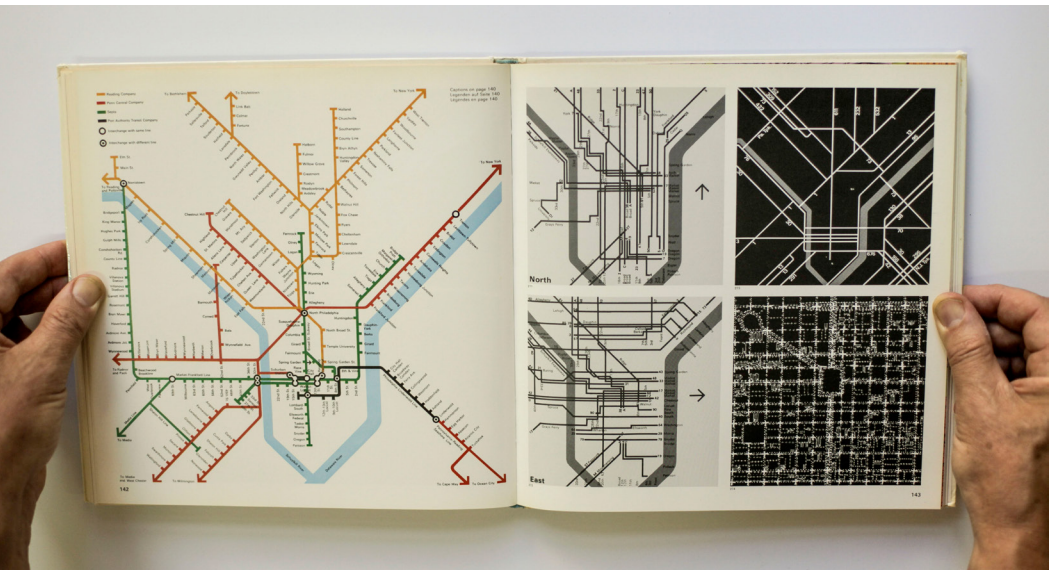
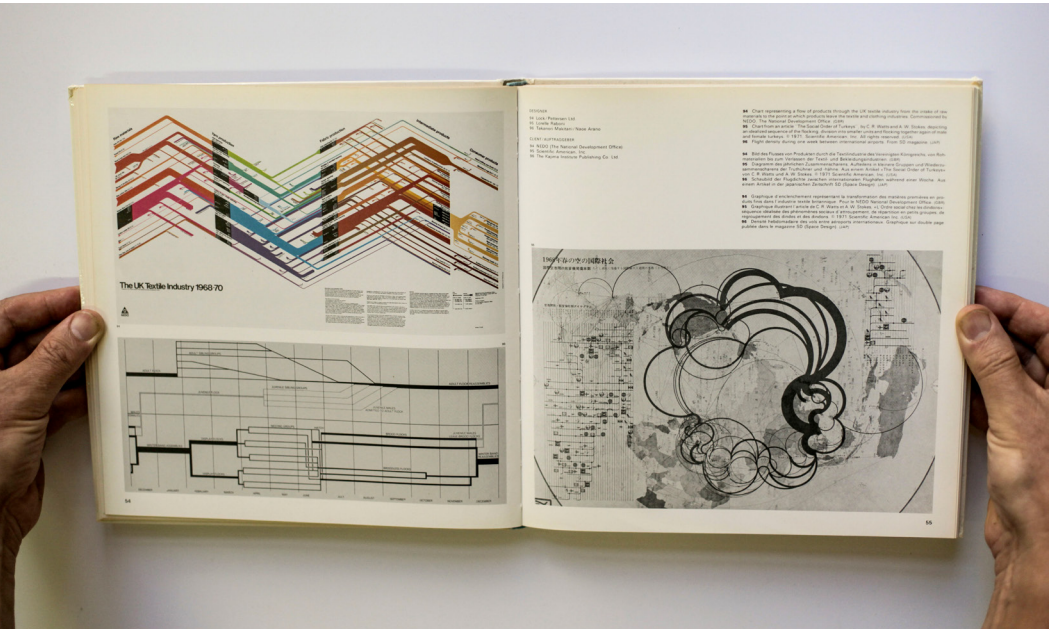
The 1974 issue: *The Graphic Visualization of Abstract Data / Die graphische Visualisierung abstrakter Gegebenheiten / La visualization graphique de données abstraites* – the simple fact that *Graphis* was published in the three languages bears witness of the project's universal ambitions – offers us an enlightening *ante litteram* peek on the designer's work in the visualization of abstract data.

Long before data *visualization*.

The issue features works by the designers of its time including, among various different examples, living legends Massimo Vignelli, Otl Aicher, Saul Bass, Herbert Bayer, Wim Crouwel, as well as iconic design organizations such as Unimark and, of course, the timeless Pentagram. Some of Richard Saul Wurman's map-based info-architecture early work is displayed too, side by side with a diagram from his mentor, the celebrated Architect Louis I. Kahn. The selection encompasses authentic treasures with trivial solutions: some truly pioneering works – even by today's standards – are flanked by meaningless, poorly functional and entirely commercial projects (although at times, of fine workmanship indeed) pertaining more to the world of illustration or advertising than that of information graphics (but after all isn't this the case today too?).

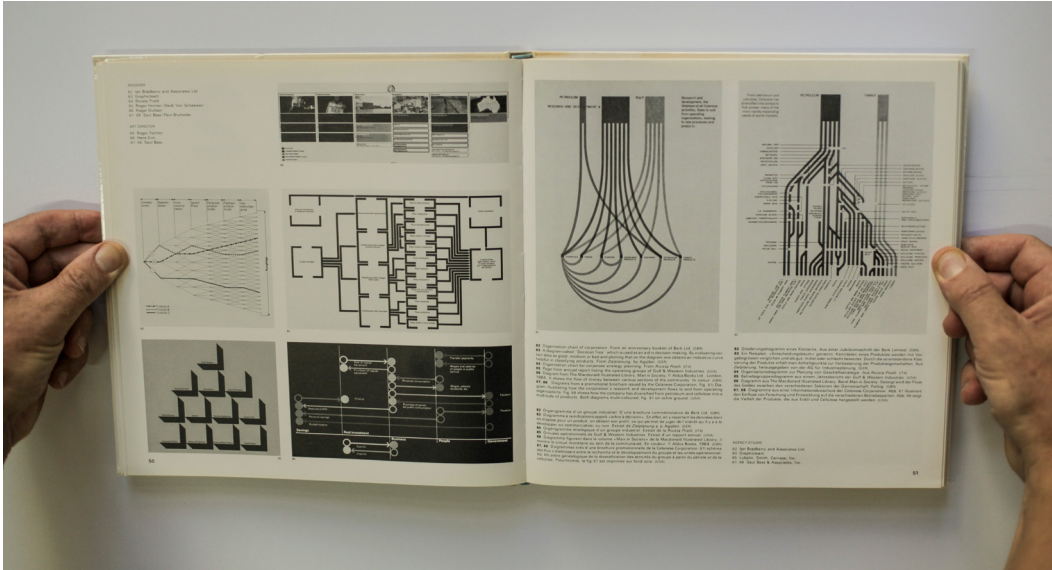
In the 1970s, *information graphics* was still in its infancy.

Overall, the 183 page publication offers a valuable insight on the relatively scarce relevance of "datavis" in the revenues of a graphic design practice in the golden age of visual communication. The study of the material suggests that, in the minds of their respective authors, most of the projects included in the publication were probably mainly considered as just another gig in the whole of the studio's professional assignments. Carried out occasionally, and subject more on the specificity of a client's area of activity than on a clear program these appear like isolated projects diverging from the possibly more obvious (and lucrative) tasks of designing a logo, an advertising campaign, or any other fancy and expensive publication.



Above: In the 1974 publication are displayed some extremely sophisticated works.

Below: This double page from the 1974 Graphis Diagram displays some early maps by (right) Richard Saul Wurman as well as a scheme by his mentor, the celebrated American Architect Louis I. Kahn.



Excerpt from *Graphis Diagrams*. Among many others, the double page presents works by Lubalin and Bass.

The very fact that in *Graphis'* long, extremely vast and honorable history only one thematic issue has been devoted to this area of visual design confirms its substantial negligibility in the graphic communication landscape of that time¹. As a final consideration, let's point out how this specific domain of the design practice, nowadays so central, at the time didn't even yet have a proper definition or a name.

From the text accompanying the visual selection, which was indeed always rather scarce in every issue of the Magazine – another interesting hint – ...we gather that *"The purpose of this book is to show the designer how abstract facts or functions which cannot be simply depicted like natural objects may be given visual expression by suitable graphic transformation. It also reviews the means of visualizing physical and technical processes which are not perceptible to the eye. The optimum synthesis of aesthetics and information value remains the essential objective in every type of diagrammatic presentation"* (pag.6).

The general definition for this area of design can be summarized as some kind of *diagrammatic presentation*, meant to present natural objects (as in scientific illustration) and physical and technical processes which are not perceptible to the eye (as in scientific and technical visualization).

The role of the designer therefore can, in this light, be interpreted as to translate the otherwise unavailable content, the *abstract facts or functions*, into accessible information through a *suitable graphic transformation*.

¹ A further, rather disappointing "Graphis Diagram 2" would follow in 1996 under the new management that took over the project after Herdeg had sold its creature ten years before and the consequent move of the new *Graphis* to New York, ending up for the project in losing most of both its magic and meaning.

On slowness... again

Over the years we have always thought the slow pace of the 2CO gatherings (2013, 2017, 2021...2024) as a shortcoming in need to be fixed². The reality is that the time gap between each step has helped projecting our framing of information visualization's development in a very interesting perspective.

Whereas the first edition of 2013 in Alghero took place at the height of a visual purist, mannerist, season... by the 2017's Tenerife edition, timid forays into a more personal, intimate way to data visualization, were starting to emerge.

By the last Alghero's 2021 edition the talk of town was Data physicalization.

In the views of the forthcoming edition of 2024, we are about to sail towards the new and shaky seas of Artificial Intelligence.

Data-shop

One thing for sure is that the discipline keeps its ascent in the heavens of visual design...and beyond.

Displaying and presenting data, almost of any kind, seems to have become a main source of authoritativeness for companies and organizations. Data related displays have nowadays evicted an artifact – the historical timeline – that was for decades at the core of the narrative that any company, organization, even museum, was embracing to claim for public trust and recognition. Installations, showrooms and the display of corporate data rooms increasingly dress up the facades of commercial ventures, public institutions and private foundations. This trend is not limited to the digital domain: data are increasingly presented in the form of data-shop windows, just as if they were a product on sale!

Meanwhile we are drowned with ads promoting the new good/commodity:

(...) unlocks the power of data to create opportunities for consumers, businesses and society.

We empower consumers (...) to manage their data with confidence so they can maximize every opportunity.

We gather, analyze and process data in ways others can't.

Wow!

² See Ceccarelli, N., *Slow Complexity*, 2CO: COMmunicating COMplexity - Contributions from the 2017 Tenerife Conference, Servicio de Publicaciones de la Universidad de La Laguna, 2020, pp. 11-23. The volume can be downloaded in .pdf from 2CO's website.

The pervasive proliferation of data's rhetorical presence is paramount. Which is funny as, don't we know that? Data is in its very nature such a volatile (and dangerously, if you allow me...malleable) abstraction.

Towards a data-based world?

Data visualisation's glorious success, and the accompanying trend that has, over the years, assigned to data a new, almost exclusive, centrality as the element for understanding and interpreting the new complexity of our world is a fact.

Data and information ubiquitous presence, from the simplest fancy charts and diagrams to highly sophisticated interactive digital gizmos and spectacular installations, clearly translates into more professional design work.

Leading to a consequent increasing demand of education (or at least... 'accreditation') in the field, which in turn produces a proliferation of seminars, workshops, textbooks and manuals, and of course of academic publications. And hey, conferences...clearly, we cannot call ourselves as immune from this movement.

Setting up a conference itself means taking responsibility.

The mere sorting out and ordering of different tracks has meaning...

Think of the exercise in drawing boundaries behind the act of labelling tracks (*informative-animation; info-graphics; interactive data visualization; informative environments*), which ends up in giving somehow right of citizenship to a given sub-domain of human activity...

The same is true for picking keynotes, speakers and guests.

Just like for what happens with putting together an exhibit on a given theme, any topic (more, or less...)worthy of its own conference automatically gains the status of proper discipline...

And yet, it would be incorrect to state that each presentation given in the three editions of 2CO has brought a solid advancement in the field.

We had ourselves our ups and downs (we too are human, after all).

2CO is 100% built on volunteering: we do it in our personal time, we have poured in it some personal money to make it happen, so over the years we have always tried to carry out the delicate and complex task of running the conference with integrity, by following a few simple founding elements:

favor design, over pure theory, (whereas carried out with rigor);
 always have doubts about the paradigmatic formulas that often – a little too often,
 lately – conceal behind methodologies;
 prefer research to commercial applications;
 make everything as much as possible free and available to the general public.

For instance, although this can represent a cost in terms of academic reputation (or payback...), we have always kept our distance, and we plan on keep doing it, from the monopolistic pirates that have diverted the beautiful concept of a free distribution of ideas and information in the current academic commercial circus. The emerging discipline of data visualisation has brought us some exquisitely fine work. On the other side, as this emerging discipline clearly wears at times itself in sterile, almost hysterical, expressions of iconographic idolatry, the buzz that has emerged around it has encouraged a movement of visual plagiarism which easily pertains to the domain of Tufte's classic chartjunk definition.

On-line

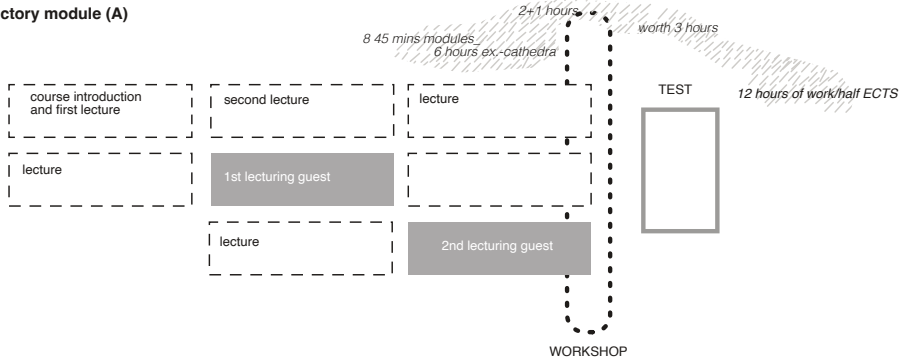
In the winter of 2021, during one of the various 'phases' of the pandemic lockdown, we started asking ourselves about ways to stay in touch with the 2CO community. Partially ignited by the experiences in on-line education we have carried out because of the lockdown itself, the idea brought us to the conclusion of organizing a 2CO 'branded' on-line introductory course on the culture of info-design.

The idea of exploring some sort of educational programme in the general domain of Communicating Complexity (a 2CO Academy?) has always been a part of the vision behind the 2CO endeavour. At its very heart, ours is a community of friends/colleagues sharing scholarly interests and striving, from time to time, for opportunities to spend some time together. And since we mostly work for different universities this is everything but straightforward. Besides getting, from time to time, to meet each other at conferences, whenever possible, we intentionally set up opportunities to share ideas, co-run workshops, sometimes even get to design something together. Still, in practice, being able to share and lead a proper teaching program proves almost impossible.

Setting up and sharing an on-line educational program appeared hence the perfect opportunity.

Originally thought as an experiment in blended education, involving the Junior Track community in an effort combining a cycle of on-line lectures, a virtual workshop to a final 'in-the-flesh' workshop during the Alghero 2CO3 conference (this original idea being actually almost a template for today's Erasmus+ funded

introductory module (A)



Preliminary diagram of the 2CO on-line course structure and organization (Property of the author).

Blended Intensive Program, BIP), we had to modify our plans. Due to a lack of strength and resources we in fact eventually decided to limit the exercise to the two on-line basic modules presenting a series of ex-cathedra communications – mostly held (in Italian) by members of our scientific board – by case-studies presentations given by some selected external guests, and by a final individual exercise at the end of each cycle.

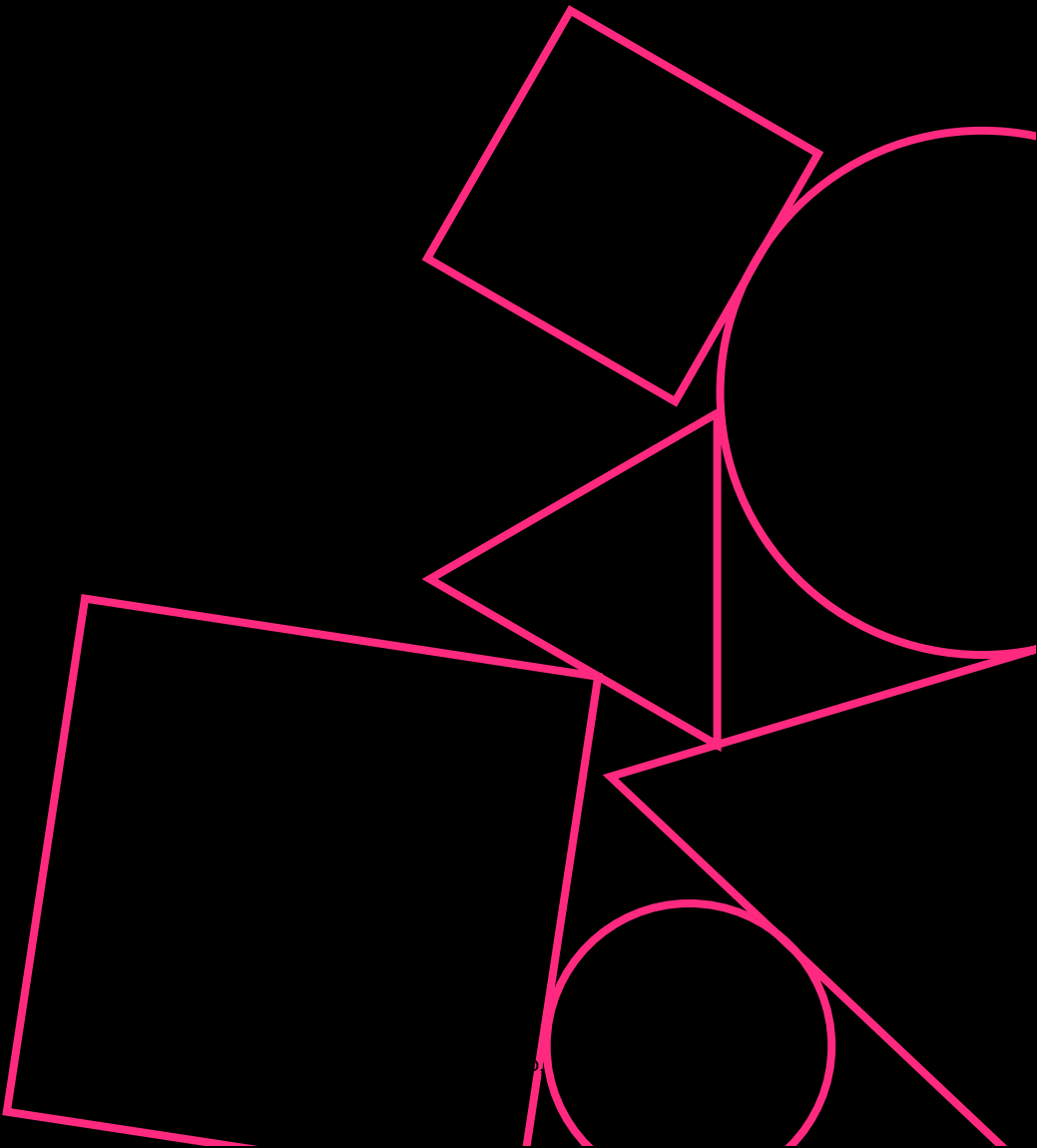
The program was offered for free, and was opened to both students and professionals (the idea was that the actual 'field' experience brought by professional could greatly enrich the experience, as it in fact was the case). The response was rather good as almost one hundred people attended the two cycles and a smaller group went through the whole 'program' by carrying out original research and presentation work on a subject of their choice.

The combination of the success of the 2CO's educational cycle of on-line course and the lively participation of a growing Junior Track community at the 2021 Alghero has lit some small fires on the idea of shaping some sort of a formal education inter-university *something* around 2CO.

We shall see.



1. Full papers



1.1 Infographics



Visual narratives for positive impact on public ecosystems

Gianni Sinni¹ (0000-0002-6672-4859),
Ilaria Scarpellini², Marco Maria Pedrazzo³

¹University Institute of Architecture of Venice, gsinni@iuav.it

^{2,3}Department for digital transformation, Presidency of the Council of Ministers,
ilaria.scarpellini@teamdigitale.governo.it, marco.pedrazzo@teamdigitale.governo.it

Abstract. Currently, there is growing attention towards the phenomenon of digital transformation within the public sector, namely eGovernment (eGov). It becomes then of key importance for government to have a good understanding of its citizens and the context they live in every day since. The design discipline, with its methodologies and tools, has an unprecedented opportunity to essentially contribute to the public benefit on both sides, by fostering change and ultimately improving the relationship between citizens and institutions. Information design and visual narratives can especially contribute to understanding and conveying the complexity of public services' ecosystems. Data visualisation techniques and tools can both: make sense and portray the complexity of fields like healthcare, education and mobility, but also inform decision makers and big players. These are the premises of the experimental didactic project Atlante della trasformazione digitale della PA (The Atlas of digital transformation of Public Administration), which involved the collaboration of the Department for digital transformation, Presidency of the Council of Ministers and students of the master's degree in Communication Design at Iuav University of Venice. The Atlas is the result of a deep investigation of the field and is a resource meant to create awareness and sensitising those who operate for the government to ultimately foster change.

Keywords. Design for eGovernment / Digital transformation / Service Ecosystems / Data visualisation / Visual storytelling

1. Digital transformation of public administration

This paper explores a specific application of data visualization to the digital transformation on the public sector, namely eGovernment (eGov), which could be defined as "the use of technology to enhance the access to and delivery of government services to benefit citizens, business partners and employees" (Silcock, 2001).

1.1. Context

In the wake of the Corona-virus pandemic and related crisis, the ongoing efforts by the public administration in Europe, aimed at ensuring a broader and more effective offering of digital governmental services (eGov), have been fostered out of need. In fact, while the unsafety of using most of the physical service delivery channels has definitely been the main driver, the byproduct of this situation has been a deeper need for understanding and agency both of the general public, the civil servants and the politicians. Nevertheless, for the Italian case, we can see that while the 'online service completeness' indicator, as measured by the Digital Economy and Society Index (DESI), is in line with the European average (63%), the actual usage indicator is way lower (36%, almost half of the average). Main reason for this can be found in the lack of digital literacy and the overall quality of the user experiences.

1.2. Intro

This paper, presents an experimentation of how design and visual storytelling can be applied to digital transformation processes of the public sector on one hand to sensitize and empower the professionals working on eGov, via a better understanding of the public domain, on the other hand actively engaging newer generations, namely students, in making sense and facilitating to public sector data for the general public, overall fostering a positive impact on the delivery of a better citizen experience.

2. Design to foster a positive change

Ongoing digital transformation means undergoing change, sometimes even radical, of procedures, processes and practices within the public administration. As change can easily raise concerns and resistance, this transformation has to be guided so as to avoid replicating the complexity and redundancy of analogue dynamics but taking instead the opportunity to radically innovate the delivery and access to public services by means of digital tools and platforms.

2.1 Vision

As the public sector is typically coping with wicked problems, "an environment presenting characteristics of Volatility, Uncertainty, Complexity, and Ambiguity (VUCA) (Bennett & Lemoine, 2014), it highly benefits from a design approach, therefore the design discipline with its methodologies and tools, has a core role and the key characteristics to support this change and essentially contribute to the public benefit (Krawchuk, 2018). "Innovation has to be design-driven to achieve an actual shift in meaning, embracing progress both at technological and sociological level"

(Verganti, 2018), ultimately improving the relationship between citizens and institutions.

Its systemic approach allows to frame problems considering the overall context of actors and touchpoints involved in the delivery of a service, because, “in the ‘infosphere’, individuals, as informational organisms, are part of a shared environment” (Floridi, 2017).

2.2 Key principles

The design practice is traditionally based on bringing together technology, business and customers, its adaptation to serve the digital transformation of public services has the potential to bring together technical requirements, legal regulations and citizen needs while ensuring consistency, harmony, integration and optimisation of the exchanges of value and information within its ecosystem.

Its participatory nature implies along the process the involvement of all stakeholders, even if with different backgrounds, competences and roles, in order to develop solutions together with those whom will be impacted by them.

In public ecosystems, this allows to address the needs not only of final users, namely citizens, in terms of usability and accessibility, but also of the public servants and IT providers which are involved in processes and procedures, and contribute to the delivery of digital public services.

Being iterative allows to quickly make changes to improve digital solutions, by following loops of design, development, testing and monitoring their performance.

In the public domain is key to save money and time, a step-by-step implementation process can avoid re-workings or unsuitable solutions. At the same time it is important not to reinventing the wheel every time, instead decision making has to be informed by a good understanding of the current context and existing solutions.

3. Informing and sensitizing decision makers

“It is not easy to persuade people to change if research insights are not well explained and supported by data” (Dykes, 2020), and these data have to be effectively presented to be grasped, often numbers and charts are not enough to make sense and gain an understanding of a complexity.

We live in a time when there is an unprecedented availability of data. In the public domain, the issue of the collection and use of citizens’ data is particularly sensitive and the subject of discussion today, not least because of the critical issues associated with the extraction and economic exploitation of personal data and the increasingly evident risks of social control. Regulation that ensures transparency and careful oversight of the use of citizens’ data thus becomes essential to enable their use. Indeed, data can be used in the interest of citizens, to inform and raise awareness among decision makers of the public administration, helping them to better

understand the context in which they operate, and to make more appropriate decisions.

3.1 Mission

Information design can especially contribute to understanding and conveying the complexity of public services' ecosystems. Data visualization techniques and tools can both: make sense and portray the complexity of fields like healthcare, education and mobility, but also inform decision makers and big players. However, informing alone is not enough to orient public servants towards change, designers should leverage metaphors and storytelling to engage viewers.

"Storytelling is fundamental to the human capability of connecting the dots and establishing collaborative networks of individuals that follow a shared purpose: religion, economy and finance are some expressions of it" (Gottschall, 2012; Shaw & Reeves-Evison, 2017).

"Data visualization and infographics heavily rely on visual narratives, the most effective way to bring out connections and guide the reader to intuition which otherwise will stay concealed in the fuzzy mess of data" (Cairo, 2016).



Fig. 1. Communication Design Lab, University Institute of Architecture of Venice, Italy, 2021/22.

4. Visual narratives to explain public ecosystems

These are the premises of the experimental didactic project *Atlante della trasformazione digitale della PA* (lit.: The Atlas of digital transformation of Public Administration), which involved the collaboration of the Department for digital transformation, Presidency of the Council of Ministers and students of the master's degree in Communication Design at Iuav University of Venice.

4.1 Goal

The goal of this project was to identify archetypical models for the design of strategies, resources and tools to support the information of public organizations across different aspects of civic life, by enabling students, through design methods and tools. While leveraging visualization techniques to explore, make sense and communicate the state of the art and multifaceted nature of complex ecosystems such as those of digital public services.

The project was developed during the Communication Design Lab throughout the semester and involved 62 students divided into 13 groups¹.

Due to the reach, variety, heterogeneity and complexity which characterizes the domain of public administration in Italy, the project scope was limited to five main fields of delivery of public services, namely: district management, education, healthcare, culture and mobility. For each field different topics were identified, for a total of 13.

The focus was to investigate the matter from a sociological, anthropological and ontological point of view, rather than from a historical, legislative and scientific one. A systemic approach was adopted to handle the complexity and granularity of the field of study, to enable the identification of recurrent patterns and representative elements and the expression of the visual language and storytelling to communicate the dynamics of each service ecosystem. This approach is borrowed from eminent examples of ontology in complex fields and in particular from the work of Christopher Alexander *A city is not a tree* (Alexander, 1965), which shows how a complex set of elements such as cities cannot be represented hierarchically, but rather according to a globally interconnected structure (semi-lattice); a concept taken up in his later work *A Pattern Language*, where the identification of recurring patterns formed the basis of software development according to object-oriented programming (Alexander, 1977).

4.2 The process

The design process of the lab was conducted in two main phases: an explorative one, where visualization techniques were leveraged as a tool to understand the field of

¹ The Lab was led with the assistance of Irene Sgarro.

exploration, and the conceptualisation one, where visual narratives were used as means to convey the characteristics of the different services ecosystems.



Fig. 2. The Atlas of digital transformation of Public Administration, 2022. (Communication Design Lab, University Iuav of Venice).

Research phase

The first phase began with a participated workshop organized with experts in digital transformation of public services, the aim was to help students to gain familiarity with the domain of public administration and create a shared framework to consistently carry out the research phase.

The workshops represented the first step for an immersion in the complexity typical of extended and branched organizations such as those of the PA and at the same time allowed them to familiarize themselves with the numerous design kits made available by Designers Italia, the platform of the Department for digital transformation, Presidency of the Council of Ministers to promote design culture in the Public Administration. The kits were extensively used in all phases of the work.

The main activity was to map service ecosystems to identify all the actors, touchpoints and digital infrastructures that play a key role in the delivery and use of public service, to delve into the context and its dynamics, to identify the characterizing patterns of each domain, and to delineate the archetypes of systems, organizations and people.



Fig. 3. The Atlas of digital transformation of Public Administration, 2022.
(Maddalena Pesaresi, Giulia Guy, Cristina Simone, Gianmarco Gallina, Gaia Graziotto).

Many methods and tools borrowed from service design and user research were used in this phase: from service ecosystem maps to actor maps, from empathy maps to user's journeys and scenarios (Stickdorn et al., 2018; Stickdorn & Schneider, 2012). Within an evaluative approach (necessary for an initial definition of stakeholders to be confirmed by subsequent field research) special attention was paid to defining archetypal service figures, those representations of roles that we can consider universally shared in our culture, expressions of common needs, desires, and potentials, according to a narrative practice that has been repeatedly reflected in recent years, for example, in participatory design, design fiction or brand identity projects (Hartwell & Chen, 2012; Mark & Pearson, 2001). This allowed us to further investigate archetypes involved in the domain of digital public ecosystems, those roles and traits which can be universally recognized and shared within Italian culture, these represent common needs, desires and values.



Fig. 4. The Atlas of digital transformation of Public Administration, 2022. (Maddalena Martani, Giulio Villano, Giulia Giordano, Ruggero Perenzin, Marcello Sponza).

Desk research investigated legislation, thematic literature, and quantitative research with the census of datasets related to different public service domains to understand and make sense of the context. This information base formed the starting point for the qualitative field research phase. An extensive corpus of interviews, more than 130 in total, was thus conducted with civil servants and users using the tools for conducting structured and semi-structured interviews.

Design phase

In the very beginning of this phase a second participated session was dedicated to map and analyze the quanti-qualitative data available, understand their value, create a fluid narrative and identify the appropriate visual models to express it.

Processing involved how the data were translated and how they were structured narratively within the available space (32 pages for each group).

Convincing people that change is necessary is not easy, and only through a skillful combination of the 3 key elements of data storytelling — data, narrative, and visual — will resistance to change be overcome (Dykes, 2020, p. 51).

Data storytelling is a step in which many of the designer's skills come into play: the basics of data visualization, but also the narrative construction of data exposition or,

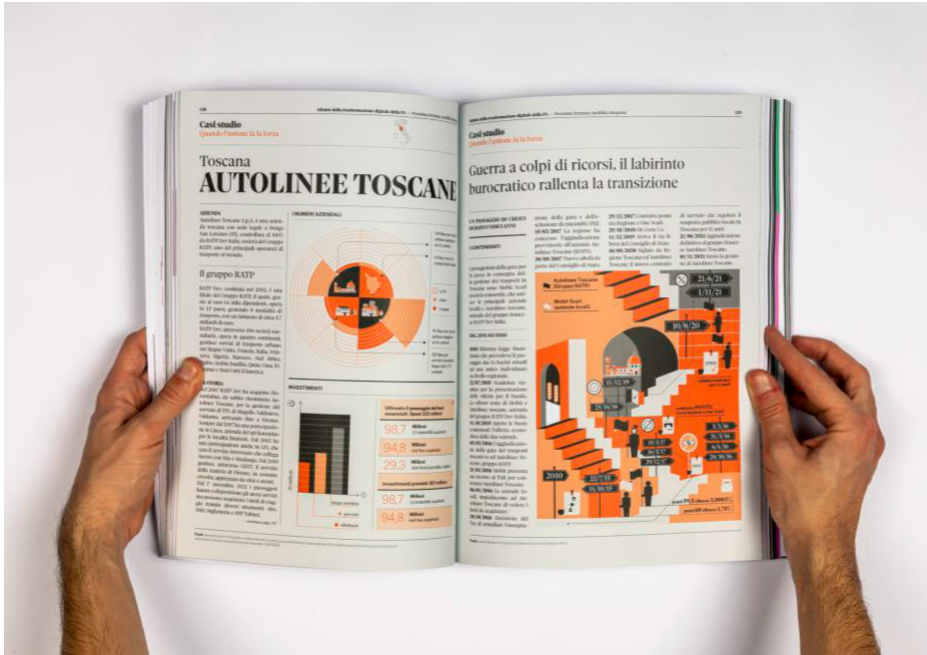


Fig. 5. The Atlas of digital transformation of Public Administration, 2022. (Sveva Stanghellini, Francesca Pilon, Sara De Barba, Luca Di Benedetto, Caterina Sartorello).

to put it another way, a data based storytelling, rather than the telling of data (Manchia, 2021).

Essentially “design is storytelling” (Lupton, 2017), therefore the articulation of the narrative of each service ecosystem needs a narrative arc. The students had to articulate the infographics along a narrative flow and describe each context by the unfolding of the plot, also transposing rhetorical figures such as the Hero’s journey or Freytag’s pyramid (Feigenbaum & Almalhodaei, 2020), that adequately constructs the crescendo of the action. “The main purpose of data visualization is to lead the reader toward insight (the “aha moment”) and not pictures per se” (Cairo, 2016, p. 59), allowing him or her to discover hidden connections and patterns. The revelation of the insight constitutes the turning point of the narrative that finally leads to the epilogue with useful suggestions to change the status quo. The final layout of the Atlas, through a collective construction, finally defined the editorial structure through a graphic rhythm that visually emphasized the narrative progression (Smith, 1983). Matching the principles of traditional narrative patterns and leveraging metaphors allows the infographics to be understood by a wide target audience, by leveraging these aspects to create a ‘common ground’ with the user. Moreover, during the design phase special attention was paid to the accessibility of colors, font size and overall readability and usability aspects, to make it usable to a broad target.

4.3 The artifact

This project combines a strong focus on quanti-qualitative research with a tangible output: a large 412-page Atlas², a collection of maps and infographics to guide the reader in the realm of the public sector. The Atlas is the result of a deep investigation of the field and is a resource meant to create awareness and sensitizing those who operate for the government to ultimately foster change.

The collection of infographics

The Atlas is a collection of maps and infographics to navigate the ecosystem of public administration services by facilitating an understanding of how public service ecosystems work, with a particular focus on the role of digital, and the citizen experience of using public services. The Atlas photographs and connects the more rational dimension of data and the emotional dimension of motivations that drive PA actors. It was created especially for planners who relate to the world of Public Administration in the context of the project and helps them determine the scope of action, orient themselves, study a strategy and properly set up the process to achieve their goals.

The Atlas is intended to be a working tool, a path that allows future designers to approach the complexity of the mechanisms that regulate public administration and, at the same time, accompanies those who are called upon to play a decision-making role in the public sector through those territories, still not much frequented, of visualization and graphic representation.

That is why the visual restitution of the investigations carried out on ecosystems, archetypes, and touchpoints, which constitute the data storytelling of the Atlas, are only the synthesis of an extensive research work.

Beside the main volume, in fact, there is a collection of the reports made by students, about their research and design process, this is invaluable to start to build shared knowledge about the domain and validate the methodology. In each report, students collected, for each service area, the main documents collected, data sets, extensive interview transcripts, elaboration of the data, narrative structure, data visualization choices, graphic grid, final layout and, last but not least, the photographic backstage of the work done.

As described earlier, the Atlas is divided into 5 main sections (related to the main fields of civic life) and 13 chapters that visually map collective archetypes, such as communities and organizations, their context, and the organizational and procedural aspects of each public service field, tracing recurring patterns.

² The Atlas is distributed in open source and can be downloaded from <https://designers.italia.it/progetti/atlane-della-trasformazione-digitale/>

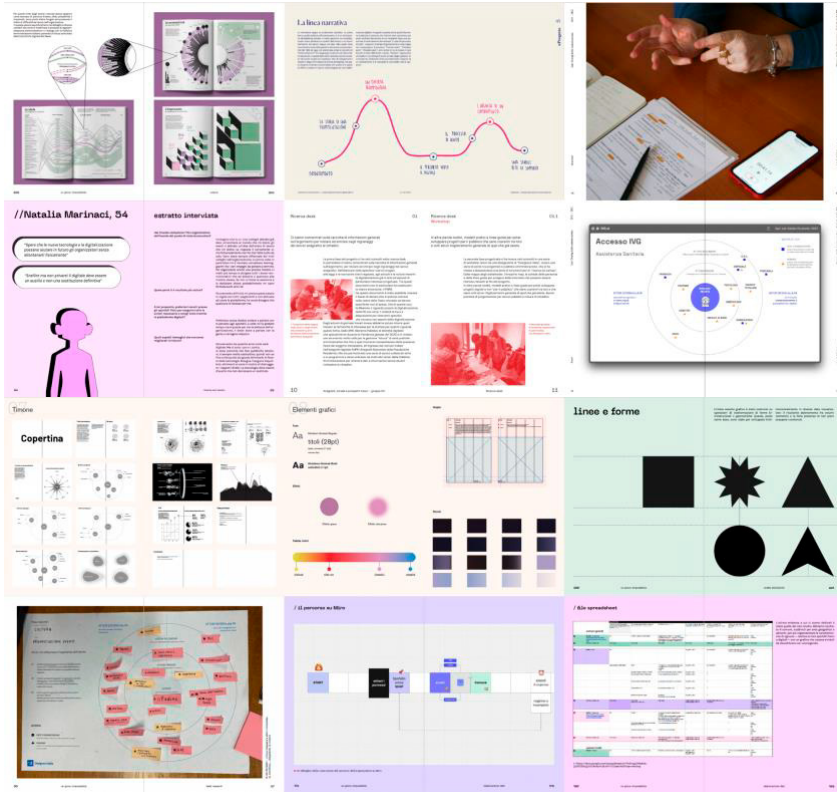


Fig. 6. Preparatory materials developed by students, 2021/22. (Communication Design Lab, University Iuav of Venice).

In order to investigate the expressive possibilities of visual translation in the broadest way, students were given complete freedom to develop their own narrative metaphors in relation to the subject matter. Thus, the story of integrated mobility becomes a journalistic investigation, the registry life of a citizen is retraced in an isometric city model, the university is transformed into a cosmic map, and the analysis of school services refers back to the pages of a textbook.

The Atlas is not meant to connote itself as an exhaustive ontology of PA services, but rather refers back to a militant form of thematic knowledge. Every form of taxonomy and organization of information contains a component of ideological interpretation, but information is conveyed only where a space of uncertainty opens up, where visualization “places at its center that residual category (‘other’) that so disturbs statistics” (Burgio, 2021, pp 69–112). In this approach, the Atlas while certainly falling into the sphere of “design for politics,” as defined by Carl DiSalvo (2019), retains its own connotation of “political design” in a properly agonistic sense, an experiment in civic design that stretches its gaze to include differences and otherness.

5. Conclusions

The model tested in this collaborative project between the central public administration and the university of design constitutes an innovative approach aimed at proving the relevance that the design discipline can have for the public domain. The interest that followed the publishing of the Atlas, with several requests and mail of appreciation coming from civil servants in central and local Public Administration, can be considered a sign of the effectiveness the Atlas has in bringing together the languages and different sensibilities of those who practice the field of design with those who work within institutions. A landmark in the endeavor of promoting a unity of purpose capable of renewing the principles of public benefit through digital transformation.

All the material produced during the course of the project has been made available online and in a series of public dissemination events, in the open source spirit that animates PA digital transformation activities.

The model of collaboration between the design and PA worlds, as well as the application of data storytelling techniques, established with this project can thus be tested and improved in further educational tracks and with other levels of public administration for a desirable incentive for change and to iterate the research and keep the data constantly updated.

Some improvements that the process could use can already be identified:

A better involvement of the users' of the Atlas throughout the process, in order to better scope the research and co-create a solution more based on their needs.

A system should be developed to gather feedback from final users of the Atlas, in order to verify its effectiveness in conveying information through visual language and ultimately evaluate its potential impact on decision making within the field of public ecosystems.

A dissemination strategy, based on formats to both spread the mission of foster state-university cooperation through other educational tracks and at the same time promoting the work done to all the public administrations which could benefit from it.

References

- Alexander, C. (1965). A City is Not a Tree. *Architectural Forum*. 122. 1, 58-62.
- Alexander, C., Ishikawa S., Silverstein M. (1977). *A Pattern Language: Towns, Buildings, Construction*. Oxford University Press.
- Bennett, N. & Lemoine, G. J. (2014). What VUCA really means for you. *Harvard business review*, 92.
- Burgio, V. (2021). *Rumore visivo. Semiotica e critica dell'infografica*. Mimesis.
- Cairo, A. (2016). *The Truthful Art: Data, Charts, and Maps for Communication*. New Riders Pub.

- DiSalvo, C. (2019). Design, democrazia e pluralismo agonistico. In Facchetti, A. (Ed.). *Design & Conflicts*. Krisis Publishing.
- Dykes, B. (2020). *Effective Data Storytelling: How to Drive Change With Data, Narrative and Visuals*. John Wiley & Sons Inc.
- Evans, D. & Yen, D. (2006). E-Government: Evolving relationship of citizens and government, domestic, and international development. *Government Information Quarterly*, 23, 207-235. Retrieved from 10.1016/j.giq.2005.11.004.
- Feigenbaum, A., & Alamalhodaei, A. (2020). *The Data Storytelling Workbook*. Routledge.
- Floridi, L. (2017). *La quarta rivoluzione: come l'infosfera sta trasformando il mondo*. Raffaello Cortina Editore.
- Gottschall, J. (2012). *The Storytelling Animal: How Stories Make Us Human*. Mariner Books.
- Hartwell, M. P., & Chen, J. C. (2012). *Archetypes in Branding: A Toolkit for Creatives and Strategists*. How Design Books.
- Krawchuk, F. (2018). Design Thinking: How to Thrive in a VUCA World. In Elkington, R., van der Steege, M., Glick-Smith, J.L. & Breen, J.M. (Eds.) *Exceptional Leadership by Design: How Design in Great Organizations Produces Great Leadership*. Emerald Publishing Limited, 119-142.
- Lupton, E. (2017). *Design Is Storytelling*. Cooper-Hewitt Museum.
- Manchia, V. (2020). *Il discorso dei dati. Note semiotiche sulla visualizzazione delle informazioni*. FrancoAngeli.
- Mark, M., & Pearson, C. S. (2001). *The Hero and the Outlaw: Building Extraordinary Brands Through the Power of Archetypes*. McGraw Hill.
- Shaw, J. K., & Reeves-Evison, T. (2017). *Fiction As Method*. Sternberg Press.
- Silcock, R. (2001). What is E-government. *Parliamentary Affairs*, 54, 88-101.
- Smith, K. A. (1983). *Structure of the visual book*. Keith Smith.
- Verganti, R. (2018). *Overcrowded. Il manifesto di un nuovo modo di guardare all'innovazione*. Hoepli.

Sitting around a table.

Data visualization for cross sectoral exchange in European Projects

Luca Casarotto¹ (0000-0002-7235-4380),
Giulia Ciliberto² (0000-0003-0668-766X),
Raffaella Fagnoni³ (0000-0003-4743-0086)

^{1,2,3}University Institute of Architecture of Venice,
luca.casarotto@iuav.it, giulia.ciliberto@iuav.it, rfagnoni@iuav.it

Abstract. Since the most ancient times, the visual display of information has been applied in a broad array of disciplines as a vehicle to address sector-specific epistemology. However, this interpretation should not be considered as exclusive, especially in today's day and age: in fact, the exponential increase in the quantity and quality of information that we are experiencing brings to attention the cross-sectoral potential of data visualization. This contribution applies such perspective to the dimension of European Projects, where the heterogeneity in stakeholders' backgrounds often prevents a mutual understanding between those involved. A specific example is brought: that of the RISTyling project, promoted by the Universities of Padua, Verona, Venice Ca' Foscari and luav, in agreement with the Veneto Region, in order to redefine the local Research and Innovation Strategies for Smart Specialisation (RIS3). In particular, we will focus on the work carried out by the luav University design team, aimed at identifying, and transposing into a visual form, the most relevant concepts which came to light within the multiple opportunities of discussion and debate arranged within the project. The contribution will firstly dwell on the technical tools used for producing the data visualization outputs, and secondly highlight the difficulties and criticalities encountered during the process; finally, the impact of the methodology on the whole RISTyling project will be presented and discussed.

Keywords. European Projects / Cross-sectorality / Focus groups / Project language / Qualitative research

1. Introduction

Since the most ancient times, the visual display of information has been widely applied in a broad array of disciplines, spanning from mathematics to linguistics, from engineering to architecture, going up to biology, geography, astronomy, sociology, psychology, and many others. As stated by Jean-Paul Benzécri, a pioneer in the field of contemporary data management, the analysis of data – including the processes

related to their visualization – should be considered not only as a means of knowledge, but first and foremost as a mode of being (1980). It is therefore no coincidence that this particular branch of visual communication has been historically practiced across such a wide range of disciplinary fields, finding its prominent usage in the form of a vehicle instrumental to address sector-specific epistemology.

However, this interpretation should not be considered as exclusive, especially in today's day and age: in fact, the exponential increase in the quantity and quality of information that we are now experiencing (Floridi, 2017) brings to attention the cross-sectoral potential of data visualization. Through the design of infographic outputs such as tables, graphs, charts, diagrams, and maps, data visualization formalizes a taxonomy whose inherent principles can be somehow considered as universal, since they “are not tied to unique features of a particular language or culture” (Tufte, 1990, p. 10). This prerogative can proficiently come into play in determining the “common lexicon” that digital transition would inherently require, in order to make explicit and decodable the relational dynamics, whether human or structural, that come into play into such a transition (Nanda et al., 2021).

Moving from these premises, this contribution applies this perspective to the specific dimension of European Projects, which is increasingly establishing itself as one of the most relevant contemporary sources of operational sustenance for researchers, professionals, and organizations. Despite a high diversification from a thematic and contextual point of view, the setting of European Projects determines, on a case-by-case basis, actual “actor constellations” characterized by a complex competence distribution and multiple coordination modes (Braun, 2015).

On such assumptions, and through the presentation of an inherent case study, this contribution will argue how data visualization can play an important role in enabling these actors to transfer knowledge across cultural, translational, and disciplinary boundaries (Lima, 2013).

2. Data visualization for, and within, public projects

In the last decades, European Projects have become more and more established as a “funding and policy space of research activities and actors, within which the rules of knowledge production, knowledge legitimacy and knowledge use are negotiated” (Wedlin & Nedeva, 2015, p. 4). By their own organizational setting, European Projects are often characterized by a high compositional complexity, involving highly articulated networks of stakeholders among whom “collaboration is increasingly being incentivized (funded) and governed (controlled)” (Mangez & Vanden Broeck, 2014, p. 111). Nevertheless, the heterogeneity in stakeholders’ backgrounds, on the one hand, and the scarcity of shared protocols aimed at properly managing and addressing this heterogeneity, on the other hand, often prevent a real mutual understanding between those involved.

Such communication issues arise also on behalf of a widespread principle of “projectification” which “has directly affected the terminology of European policy

making, including the emergence of a particular *vocabulary* of European funding policy” (Büttner, 2019, p. 177). Widely encompassing concepts which are characterized by a high rhetorical value (just think, for instance, of those of *innovation*, *sustainability*, or *digitalization*), the establishment of such terminologies mirrors a lexical paradigm which often risks resulting more divisive than cohesive.

Assuming that each single project configures a language system of its own (De Sardan, 2008), more structural and conscious efforts are needed in order to facilitate the stakeholders involved in European Projects in dialoguing with – and actually understanding – each other. From this point of view, if appropriately integrated within individual experiences, the enactment of data visualization processes can fruitfully take part in assisting those participating in such experiences in semantically and contextually situate concepts as those mentioned earlier.

Indeed, the value of data visualization is beginning to be rather acknowledged in the field of public policy-making, especially with regard to aspects that are strongly related to emerging technologies, such as Big Data, Artificial Intelligence, web-based access and dissemination (Raineri & Molinari, 2021). In contrast, less attention tends to be paid to the involvement of data visualization in supporting qualitative data processing: this is the main issue the present contribution points out, highlighting the need to define methodologies for enhancing its basic interpretation as a shared ground for exchange.

3. The experience of the RISTyling Project

In support of these arguments, a specific example is brought: that of the RISTyling Project, promoted by the Universities of Padua, Verona, Venice Ca' Foscari and Luav, in agreement with the Veneto Region, in order to redefine the local Research and Innovation Strategies for Smart Specialisation (RIS3) for the seven-year period 2021-2027.

In accordance with the reformed European Cohesion Policy, RIS3 are place-based economic transformation agendas aimed at enabling regions to turn their needs, strengths and competitive advantages into marketable goods and services (European Commission, 2017). Aimed at the distribution of funding which are programmatically meant to enhance and empower the specificities that characterize European territories, the definition of RIS3 implies a research approach that should necessarily be articulated through an active involvement of local stakeholders.

On this basis, the RISTyling Project has been connoted by an extremely articulated structure, both in terms of composition and expertise: in this contribution, we will focus on the work carried out by the Luav University research team, emphasizing its breakdown according to two main layers. On the one hand, a general team has been constituted gathering experts in European Project Management, whose planning skills would have been useful in detecting RIS3 best practices at regional, national, and continental levels, as well as in handling the interactions with the involved administrations.

On the other hand – and here we get to the point – a specifically-oriented design team has been constituted, in order to facilitate, through co-design techniques, the interactions between the actors involved in the project, starting from the luav general group to the other actors involved in the project.

In light of the expertise of the group's composition, as members of the luav University design team we chose to handle this task precisely through the support of data visualization, with the goal of defining a methodology aimed at fostering communication and mutual understanding between the participating actors. In particular, such methodology was designed in order to identify, and transpose into a visual form, the most relevant concepts which came to light within the multiple opportunities of discussion and debate which have been arranged during the course of the RISTyling project.

In fact, while European programming agendas increasingly need cross-discipline academic work, collaboration across different industries, and new forms of partnerships between the public and the private sectors (Mazzucato, 2018), data visualization could eventually play an important part in this respect.

4. A multiplicity of tables

As previously clarified, the processes addressed towards the definition and the review of RIS3 cannot be separated from a direct involvement of the stakeholders who are active in the target territories, and the RISTyling Project has been no exception in this regard. One of the most relevant methods put into play was the focus group, a qualitative research technique that derives information from in-depth team discussions attended by eight to twelve participants, selected on the basis of the ability to bring knowledge arising from their own expertise (Zammuner, 2003).

Starting from these premises, two distinct series of focus groups were held – both managed with online tools due to the restrictions imposed by the Covid-19 pandemic – which internally within the overall working team have been referred to as *discussion tables*.

A first series of focus groups has involved the organization and the conduction of three main discussion tables, each of them addressing a targeted topic consistent with one of the current European medium and long-term programming priorities, namely:

- innovation and Digitalization;
- industrial Transition;
- european Opportunities and Partnerships.

Labeled as *institutional tables*, these focus groups engaged stakeholders corresponding to the four major categories of actors identified in the innovation framework known as the Quadruple Helix Model (Carayannis & Campbell, 2009): academics, government entities, industrials, and citizens.

A second series of focus groups has involved the organization and the conduction of nine main discussion tables, each one addressing a targeted topic consistent with a significant aspect emerged from the implementation of S3 in Veneto during the 2020-2014 seven-year term, namely:

- industry and Digital Transformation;
- circular Economy and Green Chemistry;
- communication, Cultural Industries and Entertainment;
- technologies for Culture and Tourism;
- technologies for Sustainable and Inclusive Living Space;
- technology and Services for Creative Industries and Made in Veneto;
- energy, Climate and Sustainable Mobility;
- food: Agriculture, Fishing and Farming;
- technologies for Health.

Labeled as *thematic tables*, these focus groups engaged stakeholders corresponding to the most relevant categories of actors involved in the Veneto region's knowledge economy, such as companies, academic institutions, networks, associative forms, foundations.

The multiplicity of themes and stakeholders, on the one hand, and the management issues brought by the online holding of the focus groups, on the other, determined a condition of extreme complexity, in which it was very difficult for those attending to effectively communicate with each other.

These are, in summary, the preconditions underlying the definition of the previously mentioned methodology proposed by the Luav University design team. The following paragraphs will go into more detail about the development and the implementation of such approach, firstly dwelling on the technical tools used for producing the data visualization outputs, and secondly highlighting the difficulties and criticalities we encountered during the process; finally, the impact of the methodology on the whole RISTyling Project will be presented and discussed.

5. The proposed methodology

The concerns associated with not having a concrete opportunity to interact in person have definitely been one of the main factors that guided us in setting up our approach within the RISTyling Project, both internally to the design team and towards the overall working group. That's why, from the very beginning – even before the arrangement and holding of the two series of discussion tables described above – we decided to implement into the general workflow a set of tools which were, at the same time, highly connoted in visual as well as in collaborative terms (Fig. 1).

Afterwards, having noticed the communication issues that emerged during the conduct of the focus groups, we have consolidated and encouraged this approach

even more, coming to the definition of a reporting process articulated according to two main methodological stages.

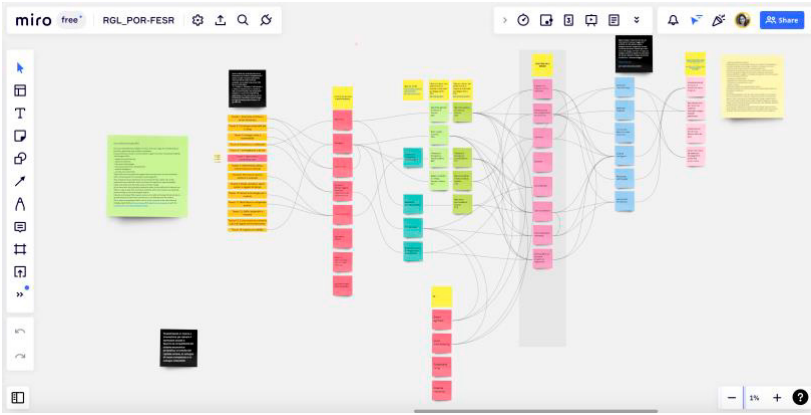


Fig. 1. Screenshot of the Miro.com board through which we catalogued, and shared with the overall working group, the keywords deriving from the RIS3 literature analysis.

A first methodological stage involved the analysis of the textual reports resulting from the various working sessions, in order to identify the most recurrent keywords emerging from the tables as a whole, as well as the tables in whose context these concepts appear to have been most frequently mentioned. In the face of a rather uneven textual reporting, the use of professional tools for carrying out the keyword extraction could not have been considered as a viable option: an online free tag cloud generator was employed, which allowed to obtain clean spreadsheets indicating the keyword frequency (Fig. 2, 3).

Weight	Word	Color (hex)	URL
14	prodotti		
9	digitalizzazione		
7	cultura		
6	clienti		
6	tecnologie		
5	competenze		
5	innovazione		
4	comunicazione		
4	investimenti		
4	modelli		

Fig. 2. Screenshot of the WordClouds.com interface, through which we processed the focus groups' textual reports, in order to detect the most frequently mentioned keywords.

1	Tavolo	Keyword	Frequenza	Enti regionali	Fondazioni	Forme associative	Imprese	Istituzioni accademiche
2	Comunicazione, industrie culturali digitali ed entertainment	arti	11	0	0	0	0	4
3	Food: Agricoltura, pascolo e allevamento, trasformazione e default	brand	4	0	0	0	1	2
4	Energie, clima e mobilità sostenibile	partecipazione	2	0	0	0	0	0
5	Tecnologia e servizi per imprese creative e il Made in Veneto	design	0	0	0	0	4	0
6	Food: Agricoltura, pascolo e allevamento, trasformazione e default	competenze	6	0	0	0	2	4
7	Comunicazione, industrie culturali digitali ed entertainment	competenze	5	0	2	0	0	1
8	Industria e trasformazione digitale	competenze	4	0	0	0	0	1
9	Tecnologia e servizi per imprese creative e il Made in Veneto	competenze	3	0	0	0	0	1
10	Tecnologia per l'ambiente costruito e spazi di vita sostenibili e inclusivi	competenze	7	0	0	0	2	0
11	Tecnologia per la salute	competenze	7	0	0	0	5	1
12	Energie, clima e mobilità sostenibile	competenze	2	0	0	0	0	0
13	Industria e trasformazione digitale	competitività	3	0	0	0	1	1
14	Cultura e tecnologia per il turismo	comunicazione	4	0	0	1	1	2
15	Comunicazione, industrie culturali digitali ed entertainment	comunicazione	4	0	0	0	1	1
16	Tecnologia e servizi per imprese creative e il Made in Veneto	comunicazione	3	0	0	0	0	2
17	Tecnologia per la salute	comunicazione	3	0	0	0	3	0
18	Food: Agricoltura, pascolo e allevamento, trasformazione e default	contabilità	5	0	0	0	0	0
19	Tecnologia per l'ambiente costruito e spazi di vita sostenibili e inclusivi	costruzioni	7	0	0	0	1	2
20	Cultura e tecnologia per il turismo	cultura	4	0	0	0	0	1
21	Comunicazione, industrie culturali digitali ed entertainment	cultura	7	0	1	0	1	3
22	Tecnologia e servizi per imprese creative e il Made in Veneto	cultura	7	0	0	0	0	3
23	Cultura e tecnologia per il turismo	dati	12	0	1	0	4	3
24	Comunicazione, industrie culturali digitali ed entertainment	dati	4	0	0	0	1	1
25	Industria e trasformazione digitale	dati	4	0	0	0	1	1
26	Energie, clima e mobilità sostenibile	dati	0	0	0	0	0	0
27	Cultura e tecnologia per il turismo	digitalizzazione	8	0	1	0	3	3
28	Comunicazione, industrie culturali digitali ed entertainment	digitalizzazione	20	0	4	0	3	3

Fig. 3. Screenshot of the spreadsheet, compiled in Google Docs, through which we categorized the keyword deriving from the focus groups' text analysis.

A second methodological stage involved the production of a series of infographics aimed at revealing proportions and hierarchies between the identified keywords, as well as their correlations with the various categories of stakeholders which attended the focus groups (Fig. 4, 5, 6, 7, 8). In this case, instead, a specialized tool has been used: RAWGraphs.io, a web-based open-source software, widely known and used by those operating in the field of data visualization, which made it possible for us to obtain a set of diagrams illustrating, in different ways, the focus groups' outputs. It is important to remark that, again, the advancements in this process have constantly been shared with the overall RISTyling team: although it has not always been simple to obtain meaningful and constructive feedback, it is possible to consider our final work as the outcome of a collective effort.

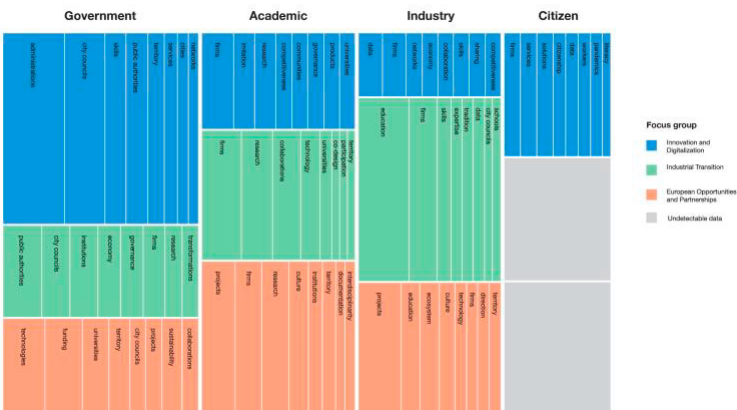


Fig. 4. Treemap depicting the 8 most recurring keywords within each *institutional table*. The degree of documentation available for each table is also illustrated.

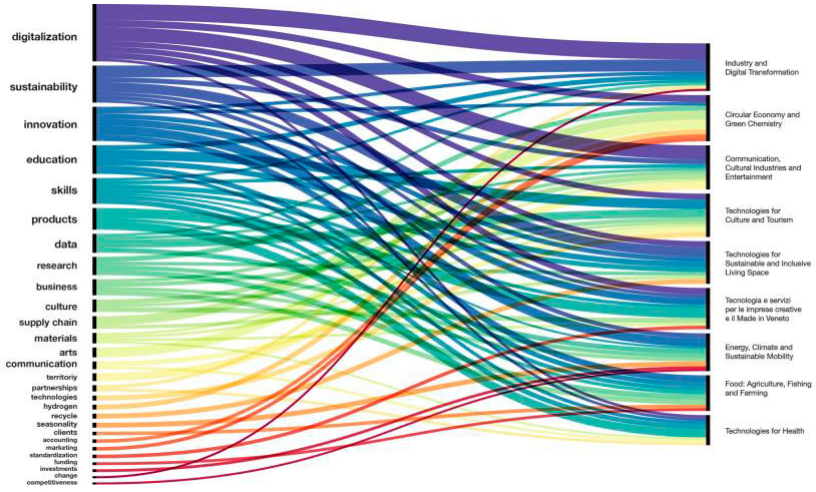


Fig. 5. Alluvial diagram depicting the 8 most recurring keywords within each *thematic table*, as well as their correlation with the tables where they appear to have been most frequently mentioned.

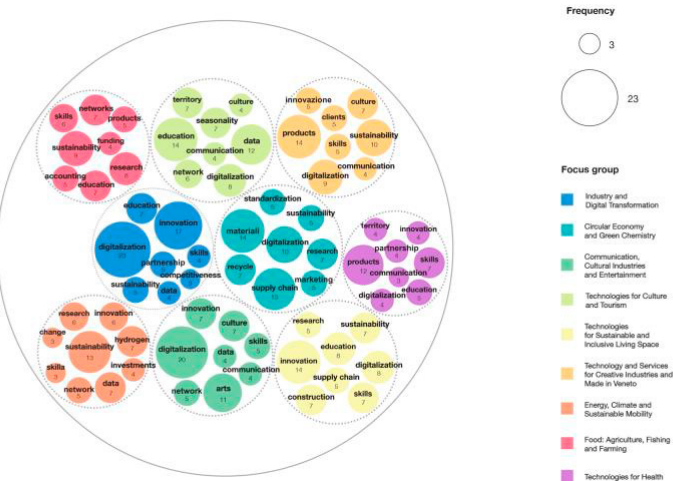


Fig. 6. Circle packing depicting proportions and hierarchies of the 8 most recurring keywords within each *thematic table*.

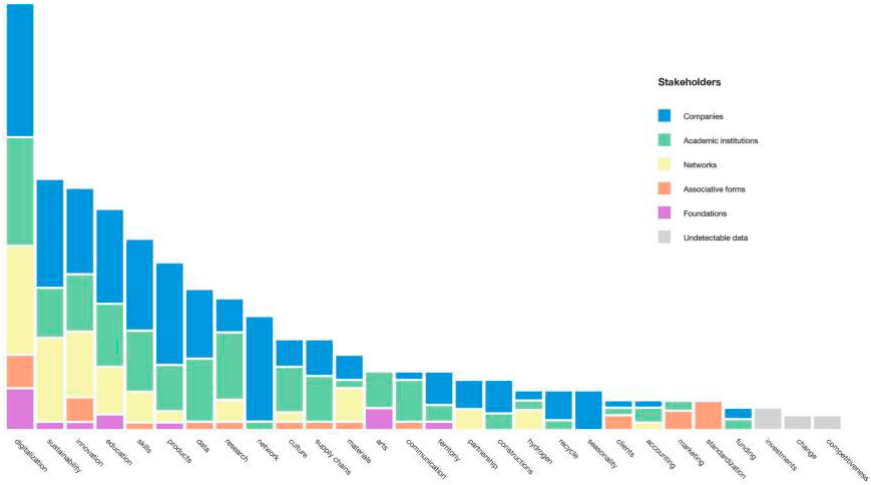


Fig. 7. Bar chart depicting the distribution of the keywords in relation to the interventions made by the various categories of stakeholders involved within the *thematic tables*.

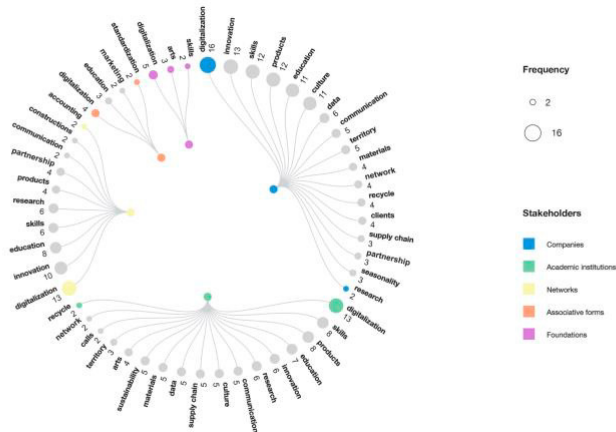


Fig. 8. Circular dendrogram illustrating the total amount of the keywords that the various categories of stakeholders respectively mentioned.

6. Conclusions

As seen, in frameworks characterized by a high degree of sectoral heterogeneity – just as the RISTyling Project was – data visualization could establish itself as a practice around which an effective informative and relational ecosystem might be built. Albeit according to basic modes of visual representation, and following a rather artisanal

procedure, the diagrams we realized clearly relate the identified keywords to the discussion tables from which they emerged, as well as to the different categories of involved stakeholders.

Furthermore, this kind of approach could enhance the understanding of patterns and trends in the area of RIS3 literature, facilitating unlocking interesting research in a domain which covers a diverse area of research and represents various disciplines (Janik, Ryszko & Szafraniec, 2020).

Ultimately, our visualizations have represented a significant operational tool for surveying and interpreting the results of the focus groups organized within the RISTyling Project, taking an active part in the process geared toward defining the new Research and Innovation Strategies for Smart Specialisation of the Veneto region. In particular, they contributed to the identification of strategic elements for a greater inclusion of communication design in the regional research system, affirming culture and creativity as factors to be enhanced in order to strengthen the region's competitive advantage (Regione del Veneto, 2022)

In addition, the use of an Open Source toolkit throughout the whole process fosters the replicability of the proposed methodology within similar projects; certainly, it would be appropriate to employ tools that are more specialized, especially with regard to those related to the dimension of textual analysis. With the present contribution we also take the chance to strongly address the need for a more consistent and structured approach in drafting the textual reports associated with public discussion opportunities, in order to make them more suitable for infographic display. In this sense, if traditionally the outcomes of qualitative, participatory processes find their expression in oral and written form (Krueger, 1997), it would be useful to systematically integrate into this framework also the research on how to visualize data that emerged from such experiences. While the importance of understanding the audience during the data visualization process is often overlooked (Pontis, 2019), it is desirable that European projects – or public projects broadly – equip themselves with the best tools to properly understand what emerges from the tables around which it is so commonly used to sit and discuss.

References

- Benzécri, J.-P. (1980). *Pratique de l'analyse des données. Analyse des correspondances & classification. Exposé élémentaire*. Dunod.
- Braun, D. (2015). Actor constellations in the European Funding Area. In Wedlin L., & Nedeva M. (Eds.). *Towards European Science: Dynamics and Policy of an Evolving European Space*, 61-82. Edward Elgar.
- Büttner, S. M. (2019). The European Dimension of Projectification. Implications of the Project Approach in EU Funding Policy. In Hodgson D., Fred M., Bailey S., & Hall P. (Eds.), *The Projectification of the Public Sector*, 169-188. Routledge.
- Carayannis, E., & Campbell, D. (2009). "Mode 3" and "Quadruple Helix": Toward a 21st Century Fractal Innovation Ecosystem. *International Journal of Technology Management*, 46(3/4), 201-234.

- De Sardan, J.-P. O. (2013). *Anthropology and Development: Understanding Contemporary Social Change*. Zed Books Ltd.
- European Commission (2017). *Strengthening Innovation in Europe's Regions: Strategies for resilient, inclusive and sustainable growth*. Retrieved from https://ec.europa.eu/regional_policy/sources/docoffic/2014/com_2017_376_2_en.pdf
- Floridi, L. (2017). *La quarta rivoluzione. Come l'infosfera sta cambiando il mondo*. Raffaello Cortina.
- Janik, A., Ryszko, A., & Szafraniec, M. (2020). *Mapping the Field of Smart Specialisation and Regional Innovation Strategy Literature: a Bibliometric Analysis*. *European Research Studies Journal*, XXIII(4), 655-673.
- Krueger, R. A. (1997). *Analyzing & reporting focus group results*. SAGE Publications.
- Lima, M. (2013). *Visual complexity. Mapping patterns of information*. Princeton Architectural Press.
- Mangez, E., & Vanden Broeck, P. (2014). Meeting expectations. On the challenges of collaborative research through European funding. In Lawn M. & Normand R. (Eds.), *Shaping of European Education: Interdisciplinary Approaches*, 111-130. Routledge.
- Mazzucato, M. (2018). *Mission-Oriented Research & Innovation in the European Union. A problem-solving approach to fuel innovation-led growth*. Retrieved from https://ec.europa.eu/info/sites/default/files/mazzucato_report_2018.pdf
- Nanda, R., Gurumurthy, R., Golden, D., Roddick, S., Sniderman, D., & Kearns-Manolatos, D. (2021, September 23). A New Language for Digital Transformation. *CIO Journal*. Retrieved from <https://deloitte.wsj.com/articles/a-new-language-for-digital-transformation-01632855051>
- Pontis, S. (2019). *Making Sense of Field Research. A Practical Guide for Information Designers*. Routledge.
- Raineri, P., & Molinari, F. (2021). Innovation in Data Visualisation for Public Policy Making. *SpringerBriefs in Applied Sciences and Technology*, 47-59.
- Regione del Veneto (2022). *Strategia di specializzazione Intelligente (S3) della Regione del Veneto 2021-2027*. Assessorato allo Sviluppo Economico, Energia, Legge speciale per Venezia, Area Politiche Economiche, Capitale umano e Programmazione Comunitaria, Direzione Ricerca, Innovazione ed Energia. Retrieved from https://www.innoveneto.org/wp-content/uploads/2022/06/Dgr_474_22_AllegatoA_475732.pdf
- Tufte, R. (1990). *Envisioning Information*. Graphic Press.
- Wedlin, L. & Nedeva, M. (Eds.). *Towards European Science: Dynamics and Policy of an Evolving European Space*. Edward Elgar.

Design through code.

Exploring web-development as data visualization tool

Joanne Hayek¹ (0000-0003-4186-5652)

¹Dubai Institute of Design & Innovation, joanne.hayek@didi.ac.ae

Abstract. This paper proposes to explore web-development as a tool to design interactive data visualizations. Featuring a selection of five research and design projects conducted by the author along with her colleagues and students, the study proposes a cross-disciplinary design methodology that incorporates computational programming as part of the designer’s toolkit. The first three projects exemplify how approaching web-development from an architect’s perspective enables a dynamic multi-layered form of visualization of complex information through the creation of interactive co-mapping platforms. The fourth and fifth projects were realized by students of the ‘Digital Makers’ course taught by the author at the Dubai Institute of Design and Innovation. Exposing undergraduate design students to full stack web-development, the workshop runs like a digital maker lab and promotes self-learning through making. The paper presents the five projects as case studies to help understand the modalities of design of interactive data visualization in a context where advances in open-source software and coding languages are increasing the accessibility to specialized technical frameworks. The study concludes by advocating for an intrinsic link between data visualization and programming literacy. Promoting this connection in educational and professional frameworks is essential to foster effective analysis and communication of complex data. The paper highlights guidelines to accelerate this integration.

Keywords. Interactive Data Visualization / Real-time Mapping / Animated Storytelling / Geospatial Information Systems / Web Development

1. Introduction: Background and Context

1.1 Design: a return to the craft

Back in 1919, Walter Gropius published the Bauhaus Manifesto, advocating for the development of an intrinsic link between art and craft through design: “Architects, sculptors, painters—we all must return to craftsmanship!” (Gropius, 1919). Calling for a cross-disciplinary approach anchored around the crafts, the manifesto, which focuses particularly on the building, articulates the importance of understanding “its composite character”, both “as a totality and in terms of its parts”.

Almost a century after the *Bauhaus*, Gropius' manifesto was echoed by what could be understood as a digital version of it: "Designers, programmers, engineers, we must all return to programming!" (Noble & Biddle, 2002, as cited in Amiri, 2011). Similar to architectural design in the physical realm, interaction design in the digital realm requires a certain level of understanding and integration of the crafts, at different stages of the design process, which becomes key to enable performance and innovation.

1.2 Crafting digital interaction: a cross-disciplinary approach

The collaboration of the distinct disciplines of design and programming is at once challenging and vital for interaction design projects to succeed. The difference in nature and methodology between the two disciplines creates gaps both in the representation and interpretation of interactive digital systems (Maudet et al., 2017). The cross-disciplinary teams manifest a desire for smoother cooperation and communication between designers and developers, particularly in agile software development frameworks (Jones, 2016), thus highlighting the importance of creating bridges between these two intrinsically linked yet complementary opposite disciplines (Neto et al., 2020, 155).

In this context, programming literacy becomes key for designers to be able to successfully communicate with developers and enable the prototyping of their ideas into interactive innovative artefacts: programming languages "are particularly important for specifying interactive behaviour and generative processes [...] languages are critical to innovation" (Mitchell 2003, 95, as cited in Amiri, 2011, 5). This importance of convergence between the two disciplines has given way to a new breed of hybrid practitioners trained with both design and development skills, which led to the emergence of bridge terms such as "*devigners*" and "*designoper*" to describe the merging of the disciplines of designers and developers (Fain, 2008 as cited in Amiri, 2011). Given the complementarily opposed nature of the two disciplines, the blending of the skills of both design and development comes with a set of challenges. Particularly, if one compares two of their key frameworks: design thinking and agile software development. Although both iterative and collaborative by nature, these frameworks are inherently distinct as the first is anchored around problem finding, while the second is catered towards problem solving. Despite that difference, multiple studies advocate for a form of integrated framework which merges the two approaches in order to enable digital transformation and innovation (Gurusamy et al., 2016, Corral et al., 2018).

1.3 Research methodology

In this context, the paper investigates the potential of bridging between the two disciplines of design and development, with a particular focus on the use of web-development methodologies for the design of interactive data visualizations, both in professional and academic contexts. Featuring a selection of five research and design

projects conducted by the author along with her colleagues and her students, the study proposes a cross-disciplinary design methodology that incorporates computational programming as part of the designer's toolkit.

The first three projects exemplify how approaching web-development from an architect's perspective enables a dynamic and multi-layered form of visualization of complex information through the creation of interactive co-mapping platforms. The first, *Emerge Beirut*¹ is a pilot web-app that was released at the wake of the 4th of August 2020 blast of Beirut. It features an interactive map of the city and allows to generate and customize cross-sector data visualizations from user-generated content in real-time. The second, *The Immuno-Responsive City* and *Pulsing Ground*² are two series of dynamic maps that were presented as part of the *Beirut Shifting Grounds* project exhibited at the *17th Venice Biennale of Architecture* in 2021. Generated through web-development frameworks, using JavaScript, Mapbox GL and Turf.js, the maps composed a spatial and temporal narrative that retraces the momentum and hardship of the grass-root efforts that have charged the grounds of Beirut from 2019 to 2021.

The third project, *Shape your City*³ consisted of a physical installation paired with an interactive web-app that invited the visitors to take part in the making of the future of their city. Presented as part of the Dubai Design Week 2021, the data visualization of the visitors' input was aggregated and displayed in real-time through a screen situated at the end of the installation. The web-app was programmed using Javascript, HTML, CSS as well as Firebase, Mapbox GL, and Turf.js and was designed and developed through a collaborative framework that merged design thinking with agile software development methodology.

1 The pilot Project of the Emerge Beirut web-app was co-founded by Joanne Hayek, Rawan Bazerji, Adib Dada and Fadi Katergi, and was co-designed by the team with the support of Balsam Madi, Nayla Hage-Chahine, Mitcha Sleiman, Lynn Dakkak, Roula Salamoun, Hussain Zaarour, among others. It was coded by Joanne Hayek with the help of Michel Doumet. The Emerge Beirut initiative was not funded nor incorporated, and was fully based on collaborative volunteering contribution.

2 Beirut Shifting Grounds, research project was led by Sandra Frem and Boulos Douaihy in collaboration with ArD/ AUB faculty Carla Aramouny, Rana Haddad, Nicolas Fayad and Joanne Hayek- exhibited in the Co-Habitats Section of the 17th International Architecture Exhibition - La Biennale di Venezia curated by Hashim Sarkis. 'The Immunoresponsive City' and 'Pulsing Grounds' were created by Joanne Hayek in collaboration with Balsam Madi, with the help of Hussein Zaarour, Stephanie Achkar, Mahmoud Baghdadi, Hisham Ismail, Hawraa el Hussein.

3 The Shape your City project was presented as part of the Dubai Design Week 2021. It was created by RMJM in collaboration with DIDI (the Dubai Institute of Design and Innovation) – along with DesertInk, AESG, Invicta Studio and An Open Studio. The project was co-curated by George Arvanitis, Joanne Hayek, Marina Peres, Limi Suresh and Ivanna Volynets. The web-app was co-designed by the team and coded by Joanne Hayek.

The fourth and fifth projects were realized by students of the *Digital Makers – Fundamentals of Computational Media Design* course taught by the author at the Dubai Institute of Design and Innovation in the Spring of 2022. Exposing undergraduate design students to full stack web-development, the *Digital Makers* workshop promotes methods of self-learning through making. The course runs like a maker lab in the digital space; it invites students to write their own open-ended briefs and come up with strategies to execute the design. The third project featured, *Global Refuge*⁴, is an interactive web-page featuring an animated data visualization of the human migration and refugee statuses around the world. Paired with the UNHCR’s API, the website makes use of Globe GL to generate a globe-based three-dimensional dynamic data mapping. And finally, *Urban Soundscape*⁵, is a web-app designed and developed by a team of four students which offers the possibility to visualize the sounds of the city in real-time across different scales and mediums. The app was designed and developed using JavaScript, p5.js, three.js, Mapbox GL, Firebase, CSS, HTML and Bootstrap.

The following section explores the different case studies to investigate the processes of design through code when it comes to the systemization and visualization of complex dynamic information.

2. Processes of Design through Code: Systemization and Visualization of Complex Dynamic Information

2.1 Collecting and exploring data through code

Designing interactive visualization of complex information requires a systemic understanding of the data structure and collection process. In some cases, such as the visualization of actor-relational networks and dynamic data such as cross-sector city mapping, the visualization takes shape asynchronously, and evolves in parallel with the incremental data collection process. This paragraph describes the fluid integrated workflow adopted in the case studies, which incorporates code-based data collection as part of the design process through three distinct complementary methodologies: multi-source aggregated data, user-generated data, and real-time data.

⁴Global Refuge is a web-app conceptualized, designed and coded by Shahzaadee Valli as part of the ‘Digital Makers: Fundamentals of Computational Media Design’ course taught by Joanne Hayek at the Dubai Institute of Design and Innovation (DIDI) in the spring of 2022.

⁵Urban Soundscape is a web-app conceptualized, designed and coded by Aaliyah Mohammed, Areeba Shahid, Ahmad Saleh and Rand Kashlan as part of the ‘Digital Makers: Fundamentals of Computational Media Design’ course taught by Joanne Hayek at the Dubai Institute of Design and Innovation (DIDI) in the spring of 2022.

In the case of complex information mapping, the aggregation of data from multiple sources is key to maximize the accuracy of the depiction and validity of the information. Using web-development tools for data collection offers an efficient and flexible way to collect, analyze and aggregate complex datasets. For instance, in the case of the Pulsing Grounds mapping series (Fig. 1 and Fig. 2), multiple data sources were merged to create dynamic interactive data visualizations. The use of standard Geographic Information System (GIS) systems in tandem with spreadsheet software programs such as Excel and Google Spreadsheet offers a starting point yet comes with limitations when it comes to the collection and aggregation of rapidly evolving complex data with different structures and patterns. In the case of Pulsing Grounds, the various datasets were aggregated using the programming language Javascript and were stored in a non-tabular database, a JSON noSQL database, through the use of the backend as a service platform Firestore by Firebase.

The use of programming languages for the aggregation of data also enables the dynamic collection of information, particularly through the integration of application programming interfaces (APIs). For instance, the Pulsing Grounds timeline (Fig. 1, which compares the productive and the violent events that have marked the October 17 revolution of Beirut links to the Liveuamap API, which in turn aggregates data from social media and various media channels. Similarly, the project Global Refuge (Fig.3), which started with a static dataset of refugee information downloaded from the UNHCR platform, evolved to enable the automatic update of the data through the integration of the UNHCR API.

Furthermore, in the case of dynamic bottom-up mappings such as grassroots deployments and actor-relational networks, the incorporation of user-generated content is key to guarantee a holistic depiction. The mappings of the grassroots deployments of post-blast Beirut for instance (Fig. 5), The Immuno-Responsive City, were based on the aggregation of multi-source data complemented with user-generated content that was collected through the web-app Emerge Beirut. The web-app features a user authentication system and customizable data structure. The user-generated data sharing process is realized through a dynamic form that follows a system of tag-based categorization used to codify the cross-sector visualization of the

action on the map (Fig. 6 and 7). In this particular case, the creation of the web-app was instrumental to allow the bottom-up collection of information in real-time through sharing, vetting and editing of the information by the community. This methodology, which mirrors the actor-relational networks on the ground through coordination systems (Fig.8), promotes co-design and co-mapping, which is key to enable participatory approaches to city planning.

The project Shape your City (Fig. 9-13) exemplifies the idea of use of interactive mappings to enable co-planning: its code-based digital visualization portrays the contributions of the participants to the future of their city, in real-time. This project, which merges a web-app with a physical installation, is another example of the integration of coding in the design process. Relying on real-time data collection and visualization, the project invites to reflect on the challenge of designing for information that is yet to be collected. When creating a system of interactive data

visualization, one has to take into account a wide range of possibilities and outcomes, that only fully manifest once the project is deployed. In order to overcome this challenge, algorithmic data visualization is needed to adapt to the varying patterns, scopes and scales of real-time data. Paragraph 2.3 further elaborates on this idea.

2.2 Visualizing data through web development libraries

Although the basic version of some web-development languages such as Javascript, HTML and CSS, allows to code for interactive data visualization (as exemplified in the timeline in Fig. 1 which was coded using plain Javascript), the use of specific libraries could help achieve more advanced and refined results. This paragraph presents some of the libraries that were used in the case studies, and describes the workflows adopted in the context of each project.

In terms of geospatial data visualization, the library predominantly used in the case studies is Mapbox, which offers the possibility to code for GIS features on the web. Paired with its application Mapbox Studio, which allows to customize base layer maps, Mapbox GL offers a wide range of interactive features that allow the creation of dynamic maps on the web. This is enabled through built-in functions that rely on a rule-based design of the maps such as: clustering of data points and zoom-based visualizations (Fig. 14), tag-based graphic representations through color coding and symbols, and data-driven scaling of markers and layers opacities (Fig. 2 and Fig. 15). Similarly, when paired with time-based Javascript programming, animated storytelling of these maps could be achieved. As seen in the animated map of deployments that followed the August 4th 2020 blast of Beirut (Fig. 16), time-based data visualization could be displayed and customized to enhance the user experience through fly-to features allowing to smoothly navigate between one view or scale and the other, as well as the progressive deployment of data points, in this case based on the chronology of events. The computation of the movement of the pins on the map relies on complementary Javascript libraries that enable advanced navigation features such as Turf.js described in paragraph 2.3.

Geospatial representation can also take a three-dimensional global shape. Mapbox offers the possibility to zoom out to reach visualize the entire globe, yet other libraries are specifically catered for this type of three-dimensional features and interactions. The library Globe GL, for instance, which was used in the *Global Refuge* project (Fig. 4), is based on the three-dimensional web-development library Three.js, which also relies on WebGL, a Javascript API allowing GPU-accelerated usage of physics and image processing and effects as part of the web page canvas. As seen in the project, the library also allows the animation of the data visualization and the customization of its interactivity through complementary Javascript functions that respond to the scroll and mouse inputs of the user in real-time.

When it comes to other types of data such as sound, animated time-based visualization is also instrumental. In the case of *Urban Soundscapes*, which featured both the Mapbox and Three.js libraries (Fig. 17 and Fig. 18), P5.js, a Javascript library for creative coding based on the core principles of Processing, was utilized to code the

animated visualization of sound recordings in real-time. In some parts of the app, this was overlaid on top of the map view, which allowed to immerse the user in the perception of sound in space (Fig. 17).

2.3 Algorithmic data analysis and rule-based design

One of the advantages of approaching data visualization design through programming is that it allows to algorithmically analyze the data and extract patterns that inform the visualization through rule-based design. This is particularly instrumental when dealing with dynamic data which changes based on real-time input. In such cases, the design of the visualization needs to take into account a potentially varying set of information with a bounding range that will grow and vary with time.

For instance, the Shape your City real-time data visualization was designed to adapt progressively to the number of data points shared by the visitors of the installation in real-time (Fig. 13). The size and legend of the diagram would adapt progressively based on the range of data inputs collected. The code-based approach to data visualization design enabled this real-time customization and flexibility. Similarly, the computation of mobility paths was enabled through the use of navigation algorithms, which are useful to analyze proximity and compute mobility time, which was needed for the mapping of the mobility and community living layers.

Furthermore, in some cases like the The Immuno-Responsive City mappings, the data was collected simultaneously with the visualization. The short timeframe of the project required the prototyping of the visualization throughout the data collection phase. One was informing the other and thus the rule-based design of the maps, generated through the use of Mapbox and Turf.js, was instrumental. Moreover, the use of algorithmic tools such as the Javascript library Turf.js allowed to shift from micro data points to macro comparative analysis. As the zoning maps illustrate (Fig. 9), the use of geospatial computation allowed to measure the density of certain data points within geographic boundaries.

3. Conclusions

As seen in the above-mentioned case studies, making use of web-development tools for the design of data visualization opens up possibilities such as interactivity, real-time response, micro-to-macro analysis, as well as customizable cross-sector depiction. From the step of data collection, to the phase of translation of the datasets to visual narratives, the use of the fundamentals of programming along with open-source languages and libraries offers the potential to create animated, multi-dimensional depictions of complex information. This reinforces the need to create an intrinsic link between design and development; and more particularly in this case, between data visualization design and computational programming literacy. Promoting this connection in educational and professional frameworks is essential to

foster effective analysis and communication of complex data. The promotion of digital makerspaces that would bridge the design thinking methodology with the agile software development framework is needed in order to accelerate this integration.



Fig 1. Views of Emerge Beirut webapp on mobile and desktop, Interactive mapping of Beirut following the 4th of August 2020 blast, Emerge Beirut, 2020 (own source).

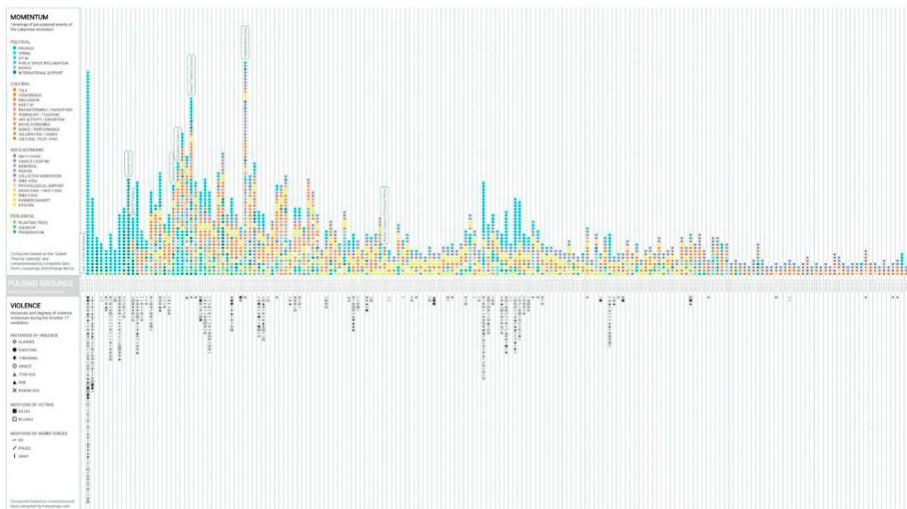


Fig. 2. Extract of Pulsing Grounds, Timeline of events of the October 2019 revolution of Beirut, presented as part of Beirut Shifting Grounds, 17th Venice Biennale of Architecture, Co-habitat Exhibition, 2021 (own source).

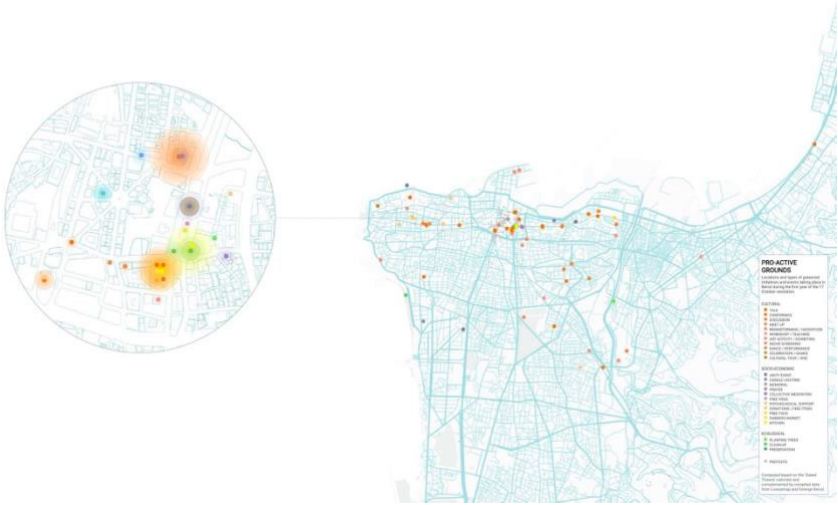


Fig 3. Extract of Pulsing Grounds, Map of pro-active events of the October 2019 revolution of Beirut, presented as part of Beirut Shifting Grounds, 17th Venice Biennale of Architecture, Co-habitat Exhibition, 2021 (own source).



Fig. 4. Shahzaadee Valli, Global Refuge, Screenshots of interactive dynamic storytelling of the phenomenon known as refugees, created as part of the Digital Makers course taught by Joanne Hayek at the Dubai Institute of Design and Innovation, 2022 (own source).

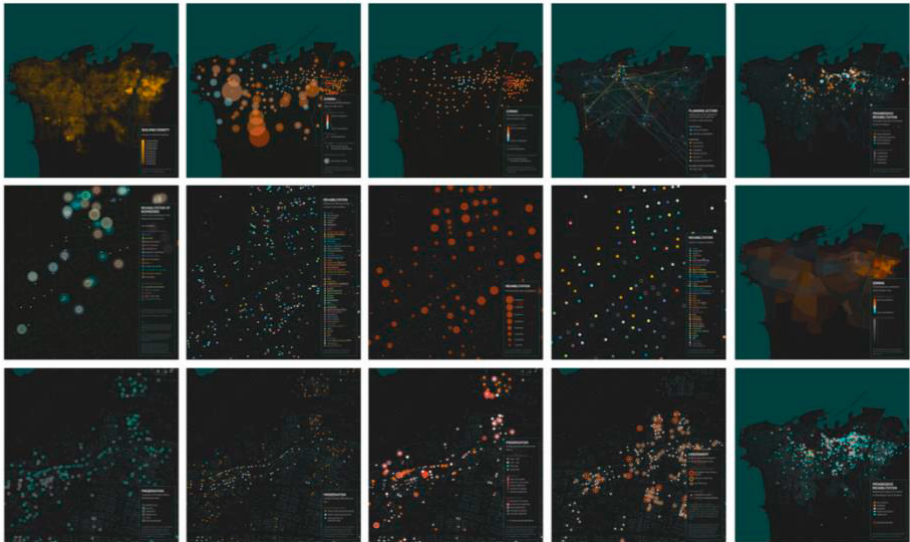


Fig. 5. Extract of maps of Beirut post-blast 'The Immuno-Responsive City', documenting the grassroots deployments that followed the August 4th 2020 blast in Beirut, presented as part of Beirut Shifting Grounds, 17th Venice Biennale of Architecture, Co-habitat Exhibition, 2021 (own source).

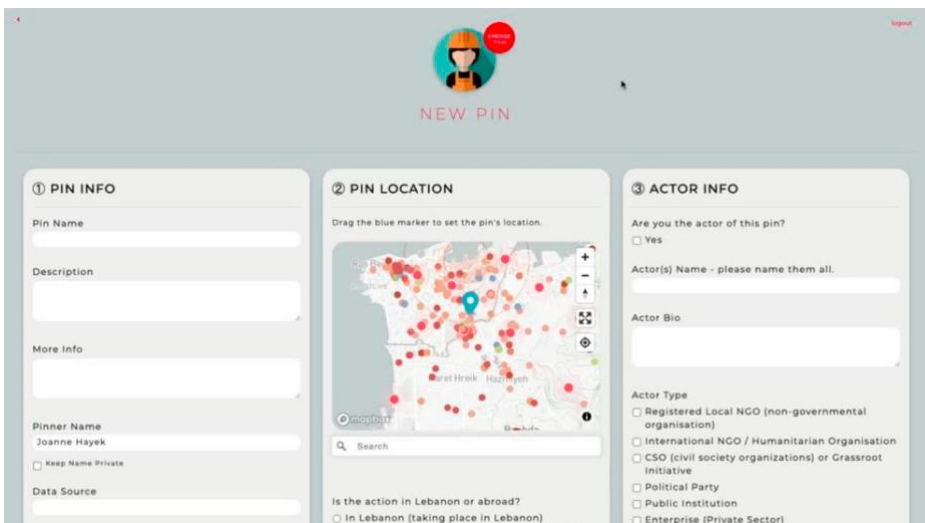


Fig. 6. Screenshot of Emerge Beirut webapp, New pin feature seen here on Desktop, Emerge Beirut, 2020 (own source).



Fig. 7. Views of EmERGE Beirut webapp, New pin feature seen here on Desktop showing the customizable tag-based data collection system, EmERGE Beirut, 2020 (own source).

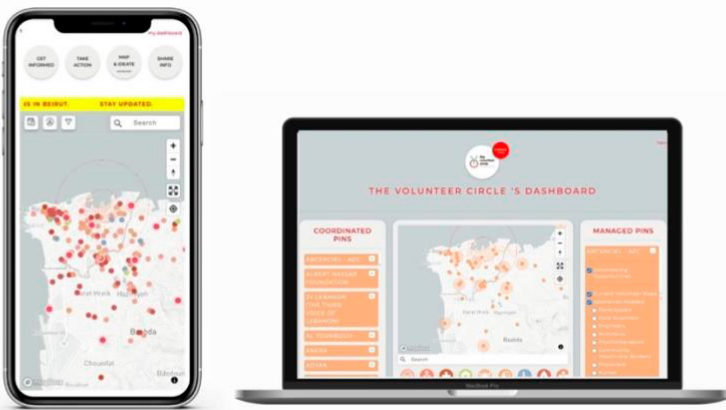


Fig. 8. Views of EmERGE Beirut webapp, Interactive Map on mobile and Coordinator Dashboard on Desktop, EmERGE Beirut, 2020 (own source).

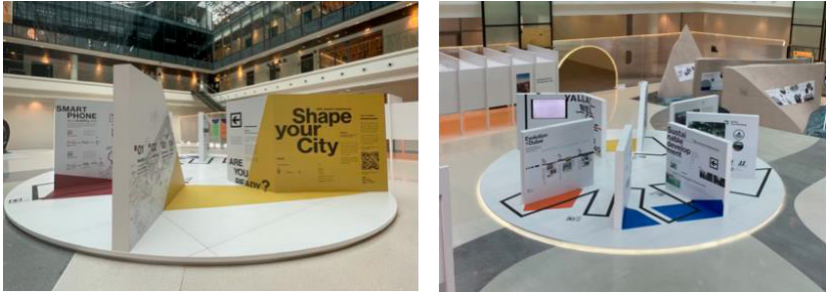


Fig. 9. Shape your City, Views of the physical installation. Presented at Dubai Design Week, Architecture Exhibition, 2021. Project by RMJM, DIDI, Desert Ink, AESG, Invicta Studio and An Open Studio (own source).



Fig. 10. Shape your City, Screenshots of webapp as accessed on phone by individual users and on screen for real-time visualization of the collective inputs. Presented at Dubai Design Week, Architecture Exhibition, 2021. Project by RMJM, DIDI, Desert Ink, AESG, Invicta Studio and An Open Studio (own source).

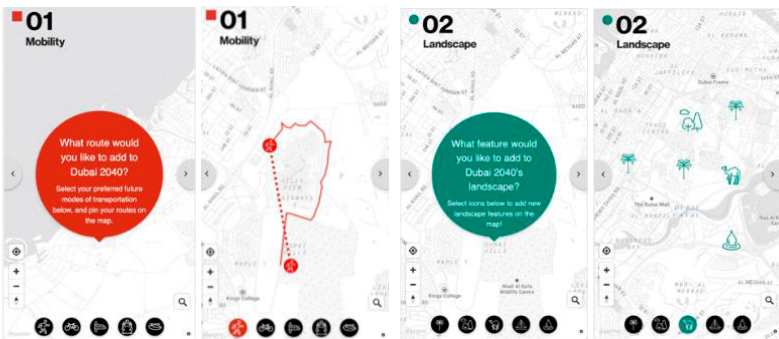


Fig. 11. Shape your City, Screenshots of webapp as accessed on phone by individual users: mobility and landscape layers. Project presented at Dubai Design Week, Architecture Exhibition, 2021. Project by RMJM, DIDI, Desert Ink, AESG, Invicta Studio and An Open Studio (own source).

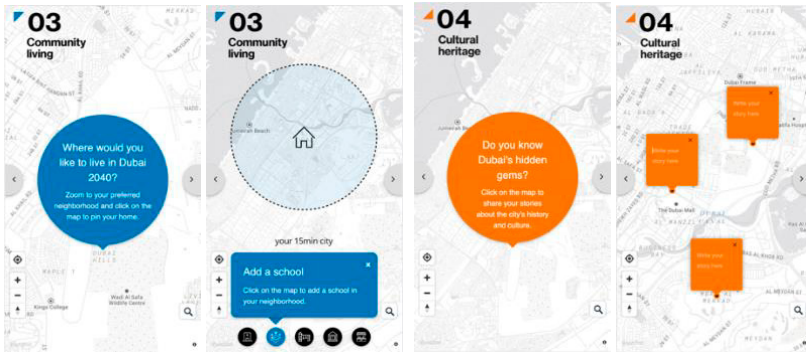


Fig. 12. Shape your City, Screenshots of webapp as accessed on phone by individual users: community living and cultural heritage layers. Project presented at Dubai Design Week, Architecture Exhibition, 2021. Project by RMJM, DIDI, Desert Ink, AESG, Invicta Studio and An Open Studio (own source).

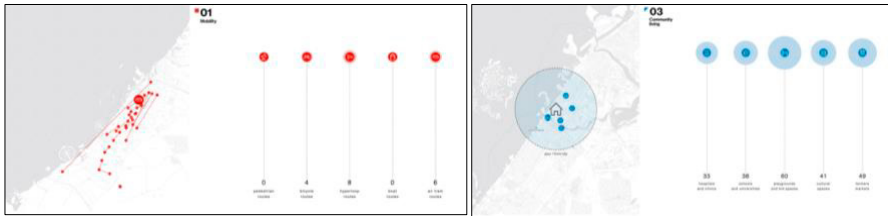


Fig. 13. Shape your City, Screenshots of dynamic data visualization webapp of the collective inputs: mobility and community living layers. Project presented at Dubai Design Week, Architecture Exhibition, 2021. Project by RMJM, DIDI, Desert Ink, AESG, Invicta Studio and An Open Studio (own source).



Fig 14. Extract of Pulsing Grounds, The five scales of mapping of the October 2019 revolution of Beirut. Presented as part of Beirut Shifting Grounds, 17th Venice Biennale of Architecture, Co-habitat Exhibition, 2021 (own source).



Fig. 15. Extract of maps of Beirut post-blast 'The Immuno-Responsive City', documenting the grassroots deployments that followed the August 4th 2020 blast in Beirut, presented as part of Beirut Shifting Grounds, 17th Venice Biennale of Architecture, Co-habitat Exhibition, 2021 (own source).

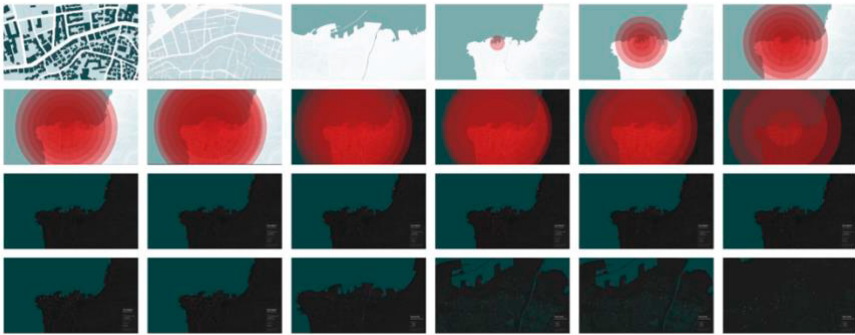


Fig. 16. Screenshots from animated map video, documenting the deployments that followed the August 4th 2020 blast in Beirut, presented as part of Beirut Shifting Grounds, 17th Venice Biennale of Architecture, Co-habitat Exhibition, 2021 (own source).



Fig. 17. Aaliyah Mohammed, Areeba Shahid, Ahmad Saleh and Rand Kashlan, Screenviews of Urban Soundscapes web-app on desktop and mobile, created as part of the Digital Makers course taught by Joanne Hayek at the Dubai Institute of Design and Innovation, 2022 (own source).



Fig. 18. Aaliyah Mohammed, Areeba Shahid, Ahmad Saleh and Rand Kashlan, Screenviews of Urban Soundscapes web-app, created as part of the Digital Makers course taught by Joanne Hayek at the Dubai Institute of Design and Innovation, 2022 (own source).



Fig. 19. Extract of maps of Beirut post-blast 'The Immuno-Responsive City', documenting the grassroots deployments that followed the August 4th 2020 blast in Beirut, presented as part of Beirut Shifting Grounds, 17th Venice Biennale of Architecture, Co-habitat Exhibition, 2021 (own source).

References

- Amiri, F. (2011). Programming as design: The role of programming in interactive media curriculum in art and Design. *International Journal of Art & Design Education*, 30(2), 200-210. Retrieved from 10.1111/j.1476-8070.2011.01680.x.
- Corral, L., & Fronza, I. (2018). *Design thinking and agile practices for software engineering*. Proceedings of the 19th Annual SIG Conference on Information Technology Education. Retrieved from 10.1145/3241815.3241864.
- Gropius, W. (1919). *Manifesto of the Staatliches Bauhaus*. Retrieved October 10, 2022, from <https://bauhausmanifesto.com/>.

- Gurusamy, K., Srinivasaraghavan, N., & Adikari, S. (2016). An integrated framework for design thinking and agile methods for digital transformation. *Design, User Experience, and Usability: Design Thinking and Methods*, 34-42. Retrieved from 10.1007/978-3-319-40409-7_4.
- Jones, A., Thoma, V., & Newell, G. (2016). *Collaboration constraints for designers and developers in an agile environment*. *Electronic Workshops in Computing*. Retrieved from 10.14236/ewic/hci2016.37.
- Maudet, N., Leiva, G., Beaudouin-Lafon, M., & Mackay, W. (2017). Design breakdowns. *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing*, 630-641. Retrieved from 10.1145/2998181.2998190
- Noble, J., & Biddle, R. (2004). *Notes on notes on Postmodern Programming. Companion to the 19th Annual ACM SIGPLAN Conference on Object-Oriented Programming Systems, Languages, and Applications - OOPSLA '04*, 47-71. Retrieved from 10.1145/1028664.1028710

Designing complexity: organising uncertainty through the visualization of non-linear processes

Miriam Mariani¹ (0000-0002-9302-2174)

¹PhD, La Sapienza University of Rome, miriam.mariani@uniroma1.it

Abstract. The awareness of the complex nature of society and its processes (social, cultural, educational, economic), and the inevitable reflection on the mutation that invests every scientific field, also involves the discipline of Design, which by its very nature is transversal in the issues it deals with, embracing a plurality of objectives, as well as processes and tools, sometimes specifically its own, sometimes sharing those of other disciplines. Starting from the themes proposed by the Conference, such as the production and consumption of information, its complexity and the need for its correct dissemination, this contribution proposes a reflection on the role of Information Design as a tool for organizing complexity. If, in fact, "Information Design" literally means "designing information", and information is in itself a complex concept and reality, then the question guiding this research topic is "*can we therefore design complexity?*" and the even more insidious question "*how to do it?*". In the subtitle of this contribution there is a partial answer as well as the proposal of a possible key to interpretation, that is the proposal of designing complexity by organizing uncertainty, its key value, through the visualization of non-linear processes and phenomena.

Keywords. Information Design / Complex Modelling / Visual Language / Dynamic Systems / GigaMapping

1. Design and complexity: a systemic approach

Today, the discipline of Design finds itself having to face new interpretative and design challenges, and more profoundly to read again and update its methods and tools to adapt them to the contexts in which it operates. Gianfranco Minati argues that:

In the post-industrial society or knowledge society, examples of sources of complexity are knowledge-intensive product and service systems [...] and properties [...] such as highly interconnected general interconnections, technological innovations and solutions that rapidly create new problems [...], large amounts of data. (Minati, 2021, p. 32)

As emerges from this statement, by "complexity", we do not mean a dimension of complication, but rather a way of thinking and acting in a systemic way, an

interweaving of threads in which unity in multiplicity occurs. The interweaving (the so-called *cum-plexum*) and multiplicity can generate a condition of uncertainty, to be understood as a state of limited knowledge in which it is impossible to describe a given phenomenon exactly. As stated and agreed upon by several authors, information, data and their visualisation are strongly affected by this condition of inaccuracy, or rather by their nature are affected by it. Just think of the number of sources from which data comes, or the variety of graphic languages with which to represent it, it is necessary to consider the multiple variables that come into play in a process of data collection, interpretation, and design of a data-based communication system (Fig. 1).

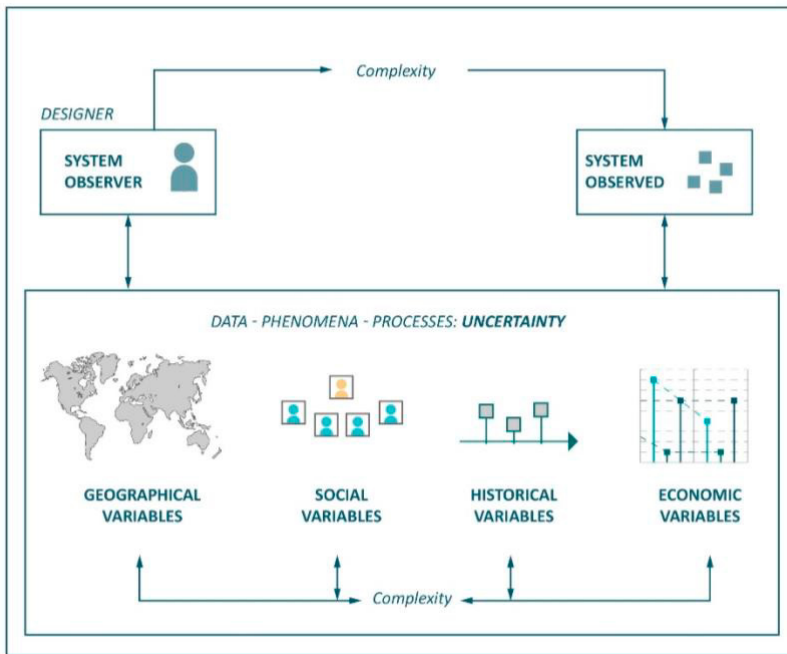


Fig. 1. Miriam Mariani, Data Design: a complex system (Property of the author).

Many similarities can therefore be found between the theme of organisation and that of design, particularly in the aforementioned branch of Information Design.

Can we design complexity? Is complexity not, literally, undesignable? Would a complexity that we could design - and thus describe, design, form, represent, invent, understand - really be complex? Would it not rather be, very trivially, complicated, at best hyper-complicated? To be understood, must it not be designable? Paradox, then, or play on words? (Le Moigne, 2007, p. 60).

Jean Louis Le Moigne's (seemingly paradoxical) question poses the main issue that links Design to the Science of Complexity. We find, therefore, similar variables of multiplicity, uncertainty and disorder found in the definition of "complexity" set out above, which allow for a parallel reflection between the concepts of "organisation" and "design". From a theoretical point of view, the considerations coming from the so-called Second-Order Cybernetics are fundamental, in particular from Heinz Von Foerster's work "Observing Systems" (1981), which emphasises that cognitive processes are recursive processes of computation and that the phenomena we observe are, in reality, representations of relations. This concept brings with it the consideration that the observer is, therefore, part of the observing system, introducing the shift from linear causality to circular causality. The link between Second-Order Cybernetics and Design is also supported by contributions from Hugh Dubberly and Paul Pangaro, who, quoting Ranulph Glanville, argue that: "Cybernetics and Design are two sides of the same coin" (Dubberly & Pangaro, 2015, p. 73). Indeed, the two authors argue that in order to study design, one must consider the reality of systems, for the understanding of which specific literacy is required. If systems are to be studied, the science that deals with the interaction between goals, feedback and learning, namely Second Order Cybernetics, cannot be overlooked. Finally, if design is based on the observer-observed system relationship and interaction, then it is possible to think of design as "conversation".

Second-Order Cybernetics provides a fundamental epistemological framework (circular causality and designer-observer) that is found in the later Systems Dynamics (Sterman, 2000), that is useful for thinking about complex systems in terms of language. However, Glanville emphasises that we need to consider the difference between dynamical systems in terms of energy and dynamical systems in terms of information, which are the ones of interest to design (Glanville, 2014). Subscribing to such reflections, Dubberly and Pangaro identify the relationship between Second-Order Cybernetics and Design as fundamental, placing systemic literacy at the basis of design, as a necessary skill for any designer to take responsibility for their point of view, to exercise collaborative processes through conversations and to articulate logic as an integral part of the process (Dubberly & Pangaro, 2015, p. 80). Without these considerations, one cannot speak of Design, but of mere problem-solving (Glanville, 2014, p.8).

From this systemic perspective, Le Moigne's answer to the previous question "*can we design for complexity?*" is affirmative, with one reassurance:

The observation is familiar: many phenomena initially perceived as complex (almost unintelligible or not properly representable) seem to suddenly become understandable as soon as modelers change code to describe them [...]. As soon as we describe or describe by means of that new, purely conceptual code (or language), it seems possible to consider intelligible, even simple, that phenomenon which yesterday was inextricably complex [...]. If

constructed, the most inextricable complexity becomes literally designable (Le Moigne, 2007, p. 65-67).

The last statement in this aside is key: the encoding of a language makes apparently unintelligible phenomena and concepts intelligible. Similarly, in information mapping (Information Design), the person who collects, interprets and re-processes data becomes part of the communication system itself through the encoding of a language (thus encoding a communication model). A so-called *complex model* would be declined in two complementary directions: one theoretical (based on the conceptual and organizational aspect of the process) and the other visual (based on the instrumental and computational aspect).

2. Designing complexity through the visual language

In support of what has been stated so far, theories of second-order cybernetics explain the shift from considering complexity as a property of the observed system to considering it as a property of the system that includes both the observer and the observed system. If complexity is not in the nature of things (observed system), it would reside in the model that the observer constructs for himself of the phenomenon he considers complex.

Complexity science is based on interdisciplinary representation models (Minati, 2009) that express interaction. Over the years, as contributions on the subject have evolved, various models describing complexity have developed, including cluster models and network models. In fact, the topic of networked connection is peculiar to complexity science, and in particular to the thought summarised by Albert-László Barabási in "Link. The New Science of Networks" (2002). According to Barabási, everything around us is interconnected through networks that characterise every structure (natural and artificial) in existence. One of the key points of Barabási's theory is the reference to Mark Granovetter's study ("The Strength of Weak Ties", 1973), according to which by accessing our "weak ties" we gain access to new information and opportunities, rather than by accessing our "strong ties" from which we would only get the information we already have access to (Barabási, 2002, p. 42), inferring the dynamic, flexible and evolutionary nature of these systems.

In order to elaborate a complex visual model, it is necessary that structures and relationships are explicitly and operationally defined; that it is valid and intuitive for all project actors; that the general applicability of the model in the project takes into account the complexity and dynamics of the project processes; that there is a situation-driven process management and not a sequence of steps and events (Forsberg et al., 2005). According to Forsberg, Mooz and Cotterman, in fact, a "visual model differentiates practices that are always present (perpetual) from those that are sequential to those that are situational" (Forsberg et al., 2005, p. 22). The construction of the visual model, therefore, must respect the multiplicity, complexity and dynamism of the systems involved: "It is not a matter of considering the phenomenon

from different points of view, in a relative way, but of considering that the phenomenon is actually made up of different, irreducible and simultaneous but coherent aspects" (Minati, 2021, p. 32).

Through complex modelling, it is possible to move from a *systems perspective* to a *structural perspective*, and finally from a *structural perspective* to a *dynamic perspective*. For each step, Systems Dynamics proposes a visual and organisational tool, respectively a *causal map*, a *structural map* and a *simulation model*: the organising dimension of relationship mapping again emerges, this time in terms of visual models (Fig. 2).

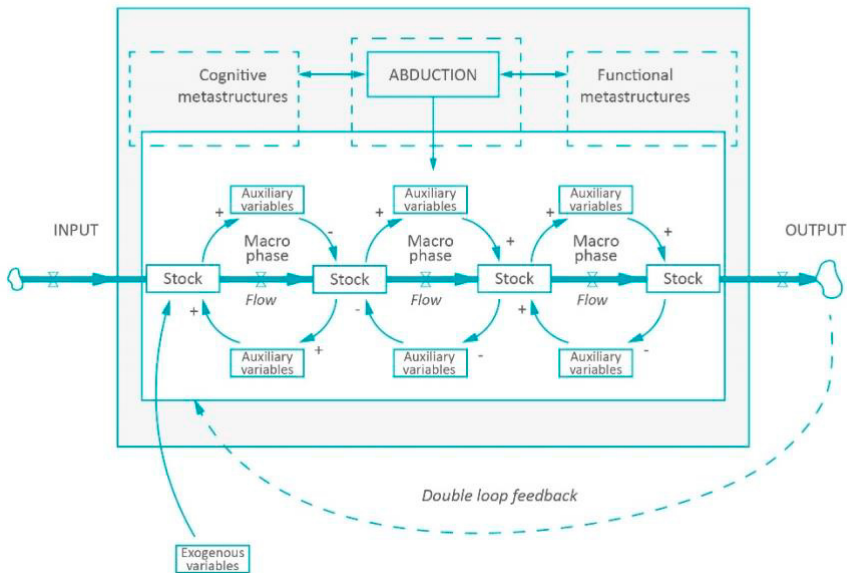


Fig. 2. Miriam Mariani, Structural Map (Property of the author).

The elaboration of each of these conceptual models corresponds to an abstraction operation through the rhetorical metaphor of the causal-loop diagram (Cioni, 2009), which is useful for describing and analysing the structure of a system. Therefore, modelling corresponds to a reduction of the system into a limited and manageable number of variables useful to describe the system effectively. According to Dubberly and Pangaro: "Systems theory – systems dynamics, cybernetics, etc. – offers [...] a language for the analysis of systems, [...] a language that designers can learn and use to create boundary objects, which can facilitate [design] conversations" (Dubberly & Pangaro, 2015, p. 78), meaning by "language" a true "systems vocabulary",

Linked to a set of structural and functional configurations, common patterns that recur in specific systems, a shared language [...] particularly useful for

analysing, designing and managing complex and adaptive systems that are intertwined with many of today's wicked problems [...]. Knowledge of cybernetics and other aspects of systems thinking, such as systems dynamics and complexity theory, are prerequisites for practicing design in the future. (Dubberly, 2018, p. 1-2)

3. Visualizing Complexity: a dynamic point of view

A possible direction of experimentation on complex visualisation comes from Systems Oriented Design (SOD), an emerging approach in Design research in the area of complex problem management. SOD is, in fact, an approach developed by Birger Sevaldson and other researchers at the Oslo School of Architecture and Design (AHO), defined as a “designerly way to work with systems”, which was created with the aim of providing implementation tools for systemic thinking for designers. According to Sevaldson and the SOD:

The imported perspectives tend to explain design through something other than itself, e.g. as cybernetic feedback circles or "circularities" (Glanville, 2014) or design as conversation (Pangaro, 2016). These images of design are valuable not as fulfilling explanations but as contributions to the many descriptions of design, a field that is too diverse and varied to be captured in simple definitions. While such descriptions are useful, they fail to talk about the inner nature of design as a specific activity based on visual thinking. (Sevaldson, 2018, p. 247)

From this statement emerges the criticism of modelling suggested by cybernetics and systems dynamics, which is considered useful for theoretical representation but not effectively as a visualisation tool in the operational phase. In response, a tool called GIGAMap was developed within SOD research, a mapping and visual tool with the aim of augmenting and aiding designers' ability to work with *supercomplexity* (Sevaldson, 2011). The GIGAMapping concept stems from the desire to overcome the limitations of diagrammatic visualisations in the design field, which are considered useful for communicating information but not for visualising processes in the design phase. The limitations of diagrams derive, in fact, from the lack of management of complexity and the difficulty of representing the dynamic nature of systems. The substantial difference between GIGAMaps and diagrams is therefore to be found in their use by designers, considering GIGAMaps as devices for research *by design* (or *through design*) based on the representational and abstract capabilities in the operative and design phase, which are proper to designers. Thus, Sevaldson argues:

The potential of true visual thinking emerges not only from documenting thoughts but by visualising and dynamically forming the analyses and

developing the thinking from the visualisation. Generative visualisation is one of the central advantages of the designer. (Sevaldson, 2011).

Building on the constructivist learning theories of Piaget, Dewey and Vygotsky, GIGAMaps support and promote the application of representation and visualisation skills not only in the final outputs of projects, but also (and especially) in the more abstract phases of processes. In operational terms, the GIGAMapping tool is defined as a “bridging device” (Sevaldson, 2018) whose responsibility is to bridge the gap not only between the “objective” components of the system (the project elements), but also between the “subjective” components, i.e. those who participate in the project: teams, groups, designers, companies. However, GIGAMaps are born as “intentionally vague and unresolvable” (by definition, over-simplification would lead to an unacceptable and conceptually erroneous reductionism of complexity itself), so they need to be broken down into smaller maps (*minimaps*) or lists of strategic actions. A tool for analysing and subsequently constructing the aforementioned *minimaps* (also developed within the SOD framework) is the ZIP (Zoom, Innovation, Potential): through the *Zoom*, the key points of intervention are identified; through the *Ideas* (and their related Innovations) it is possible to trace new relationships that modify the system, leading to new points of view; and *Potential* (or *Problems*) that constitute the leverage points of the interventions and the design challenges. The use of the ZIP technique has, therefore, operational and tactical reasons, the purpose of which is to elaborate larger and more complex maps, which can be of various types (hierarchical, non-hierarchical, temporal, spatial, image, mixed maps, etc.). The complex mapping of systems in terms of visual modelling is still an open issue that needs to be further investigated. Sevaldson himself emphasises (as previously Dubberly, 2018) the need to embed the teaching and practice of complex systems management in the design field especially within Design schools, therefore to conduct more research in the pedagogical field for a more concrete and established *supercomplexity* training, both individual and group (Fig. 3).

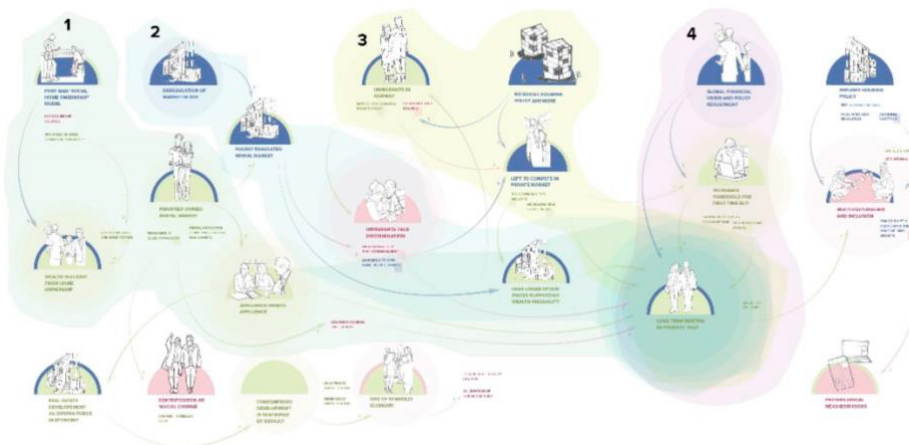


Fig. 3. Palak Dudani, Gentrification 2.0. Bridging the homeownership gap between citizens, 2018. A case study about the use of GIGAMapping (System Oriented Design Repository;

Property of the author; Fair use for research).

In particular, Sevaldson's approach proposes a level of enquiry that adds to the language decomposition (Morphology - Syntax - Semantics) the fourth, in the beginning more marginal level, that of Pragmatics, or more specifically Praxiology, understood as "systematized accumulation of practice-generated skills, experiences, and knowledge" (Sevaldson, 2018, p. 250), which shifts the point of view from a descriptive and epistemological dimension of the process to a simulative and applicative dimension, based on the concept of "adaptive expertise". What is relevant about the mapping models based on system dynamics is what emerges from the synoptic observation of the relational dynamics between the elements of the problem: it is in fact a useful tool for identifying areas of intervention and so-called "leverage points" that within a complex system can bring about major changes from small, targeted interventions.

References

- Barabasi, A.L. (2002). *Linked: The new science of networks*. Perseus Publishing.
- Cioni, L. (2009). *Introduzione alla System Dynamics, Technical Report*. Retrieved from <http://groups.di.unipi.it/~lcioni/papers/2009/introsysdyn.pdf>.
- Dubberly, H. & Pangaro, P. (2015). *Design Cybernetics: Conversation for Action*, T. Fisher & C.M. Herr (Eds). Springer.
- Dubberly, H. (2018). The Relevance of Cybernetics to Design and AI Systems, *ACM Interactions*, Vol. XXV.6, November + December 2018.
- Forsberg, K., Mooz, H. & Cotterman, H. (2005). *Visualizing Project Management: Models and frameworks for mastering complex systems*. John Wiley & Sons.
- Glanville, R. (2014). How design and cybernetics reflect each other, Keynote presentation given at relating systems thinking and design RSD3 2014. *RSD3 Proceedings*. Retrieved from <http://systemic-design.net/wp-content/uploads/2014/08/RanulphGlanville.pdf>
- Le Moigne, J. L. (2007), Progettazione della complessità e complessità della progettazione. In Bocchi, G. & Ceruti, M. (Eds.), *La sfida della complessità*, 60-78. Bruno Mondadori.
- Minati, G. (2009). The Meta-Structures Project, in *arXiv: Adaptation and Self-Organizing Systems*. Retrieved from <https://arxiv.org/ftp/arxiv/papers/0903/0903.0592.pdf>.
- Minati, G. (2021). *Parole di Sistemica* in Quaderni dell'AIEMS, n.1.
- Sevaldson, B. (2011). GIGA-mapping: Visualizzazione per la complessità e il pensiero sistemico nel design. In *Nordic Design Research Conferences, Making Design Matter*. NORDES. Retrieved from <https://archive.nordes.org/index.php/n13/article/view/104>
- Sevaldson, B. (2018). Visualizing Complex Design: the Evolution of Gigamaps. In Jones, P. & Kijima, K. (Eds.). *Systemic Design. Theory, Methods and Practice, Translational Systems Sciences*, 8, Springer Japan, 243-270.
- Sterman, J. (2000). *Business dynamics*. McGraw-Hill.
- Von Foerster, H. (1981). *Observing Systems. Seaside: Intersystems Publications*.

Rationalism and cartoonism in post-war Chilean infographics

Gonzalo Morales¹ (0000-0002-3764-2635)

¹Pontifical Catholic University of Chile, ggmorale@uc.cl

Abstract. This monograph exhibits part of the results of a research initiated in 2013 on the history of infographics in Chile. Its corpus is composed of images extracted from printed graphic supports, such as brochures, books and newspapers, among others. These publications were analyzed qualitatively and complemented with the study of bibliographic sources and expert interviews. The main objectives of this research are to help think about the influence of the political and social context on the graphic development of a territory, as well as to initiate a dialogue with other local histories, many of which have not yet been documented. In the same way, this work offers a cadastre of visual references that are part of the material culture of a historical moment about which there is not enough systematized information. More specifically, this part of the research focuses on the period between 1945 and 1960, known as the early postwar period. Although Chile did not actively participate in the armed conflict, it was equally affected by it in multiple dimensions, including the graphic industry. More specifically, both the rationalist language, characteristic of European modernism, and the sophisticated expressiveness of American cartoons, left their mark in the country and configured a formal style detached from the political charges that gave them meaning in their original contexts.

Keywords. Infographics / Post-war / Chile / Rationalism / Cartoonism

1. Introduction

Although there is no record of the term "infographics" being used in Chile until the 1990s, it is logical to consider that the production of this type of image precedes its theorization. Nowadays, the daily use of the word confirms the existence of certain attributes that make it possible to identify when an image does or does not fall into this category, however, these limits are not entirely clear, not even in the specialized bibliography. Defining what an infographic is is fundamental if we want to study its evolution in historical terms.

When reviewing some of the main bibliographic sources that have attempted to define the term, the main characteristic that usually stands out is the intention to facilitate communication to a certain audience. For example, in the book *The Power of Infographics*, Mark Smiciklas (2012) defines infographics as: "visualization of data or ideas that tries to convey complex information to an audience in a manner that can

be quickly consumed and easily understood" (p. 3). For the purposes of a historical research built from the collection of primary sources, this type of definitions are too ambiguous, as they depend exclusively on the interpretation made on objectives that are usually unknown. Therefore, it is necessary to identify certain formal characteristics that serve as evidence of such intentions. Some keys to this can be found in *The Language of Graphics: A Framework for the Analysis of Syntax and Meaning in Maps, Charts and Diagrams*, a work in which Jörg von Engelhardt (2002) compiles some of the most relevant taxonomic proposals oriented to the categorization of diverse visual resources. His analysis leads to the idea that there are several primary forms of representation, including maps, pictures, statistical and temporal graphs, diagrams of links and groups, tables, symbols and written text. By combining their forms, more complex images are obtained, such as statistical linkage maps or symbol charts, among others (pp. 137-145).

For the purposes of this research, such hybrid representations will be considered infographics, since they involve more sophisticated communication strategies. In other words, the infographic character of an image will be determined by its capacity to associate two or more kinds of visual resources to transmit more easily information that may be of different kinds. Such images may stand out both for the magnitude of the variables incorporated and for the novelty with which they strategically combine their tools. With this definition, it is possible to choose specific case studies and analyze them comparatively in order to establish relationships with their cultural and socio-political context.

2. Rationalism and cartoonism

On this matter, one period of particular interest is the early post-war period between 1945 and 1960. In this regard, it should be noted that Chile was far from playing a leading role during World War II, but it was not exempt from suffering, albeit tangentially, some of its consequences.

During those years, the teaching of design was not part of the curricula of any local university. For this reason, the graphic panorama was mainly defined by two aesthetic currents that had begun to develop in the previous decades and that, in a certain sense, would represent diametrically opposed values.

The first of these styles was developed under the principles of the incipient modernist architecture, which, in Chile, had begun to revolutionize the discipline since the 1930s thanks to the influence of a generation of professionals who, by separate paths, had had the opportunity to train in Europe, in the heart of the movement. In this regard, Max Aguirre (2008) reports¹:

Fue el caso de Sergio Larraín García-Moreno, Juan Martínez Gutiérrez, Roberto Dávila Carson y Rodulfo Oyarzún Philippi. Larraín García-Moreno viaja y recorre Europa;

¹ All quotations retain their original language and are accompanied by a translation by the author immediately afterward.

Martínez Gutiérrez, sin titularse aún, gana el concurso nacional del Pabellón de Chile en la Exposición Iberoamericana de Sevilla en 1929, permaneciendo en Europa hasta 1931; Dávila Carson estudia con Behrens, Van Tongerloo y Van Doesburg, y trabaja con Le Corbusier, regresando a Chile en 1933; Oyarzún Philippi estudia en Viena y conoce al urbanista Karl Brunner, quien a instancias suyas es contratado por el gobierno de Chile, introduciendo la enseñanza del urbanismo en el país y proponiendo una reforma urbana para Santiago. Todos ellos tuvieron una destacada participación en la docencia universitaria y en los procesos de reforma de la enseñanza de la arquitectura que desde 1933 se pusieron en marcha en las escuelas del país. [This was the case of Sergio Larraín García-Moreno, Juan Martínez Gutiérrez, Roberto Dávila Carson and Rodulfo Oyarzún Philippi. Larraín García-Moreno traveled and toured Europe; Martínez Gutiérrez, not yet graduated, won the national competition for the Chilean Pavilion at the Ibero-American Exposition in Seville in 1929, remaining in Europe until 1931; Dávila Carson studied with Behrens, Van Tongerloo and Van Doesburg, and worked with Le Corbusier, returning to Chile in 1933; Oyarzún Philippi studied in Vienna and met the urban planner Karl Brunner, who at his request was hired by the Chilean government, introducing the teaching of urban planning in the country and proposing an urban reform for Santiago. All of them had an outstanding participation in university teaching and in the processes of reform in the teaching of architecture that began in 1933 in the country's schools.] (p. 14)

In this way, the pioneering generation of the local Modern Movement succeeded in installing its revolutionary principles in the same academic spaces where they were initially scorned for their eminent rupturism. In this context of pioneering access to the modernity of the West, Sergio Larraín served as Dean of the Faculty of Architecture and Fine Arts of the Pontificia Universidad Católica de Chile from 1953, while the rest of his contemporaries had been working as academics since the mid-1930s, both in his own university and at the Universidad de Chile. It was precisely during this period that a second wave of Chilean modern architects emerged, with the figure of Fernando Castillo Velasco standing out, an emblematic character of a new rationalism of a more political and militant nature. It was during these two decades that the architectural magazine industry reached its apogee:

En el período que se publicaron (1913-1941) convergió el debate de mayor intensidad y la batalla más dura para hacer prevalecer los criterios y las nuevas ideas de la modernidad arquitectónica en el ámbito político, universitario y propiamente profesional, como también ante la opinión pública. Fue una batalla cultural ligada a fenómenos de cambio de la cultura y de la sociedad, que afectaron de una u otra manera a todo el país. [The period in which they were published (1913-1941) saw the most intense debate and the toughest battle to make the criteria and new ideas of architectural modernity prevail in the political, university and professional spheres, as well as in public opinion. It was a cultural battle linked to phenomena of change in culture and society that affected the whole country in one way or another.] (Aguirre, 2008, p. 16)

Thus, after a short time, the mechanistic aesthetic, inherited from the Bauhaus and the more reductionist artistic avant-gardes, crossed the frontiers of architecture and

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found its place in publications on a wide variety of subjects, present above all in the use of statistical graphics. This new form of representation, which gradually detached itself from the historicist influence that at that time still predominated in the printed media, became an obligatory reference for the construction of functional images of a pedagogical and informative nature. Its transcendence can be explained to a great extent by the scarce offer of careers that provided training in drawing in a modern sense. However, the architectural profession was not the only one in which the craft of illustration was skillfully developed, nor was rationalism the only trend that influenced the national scene.

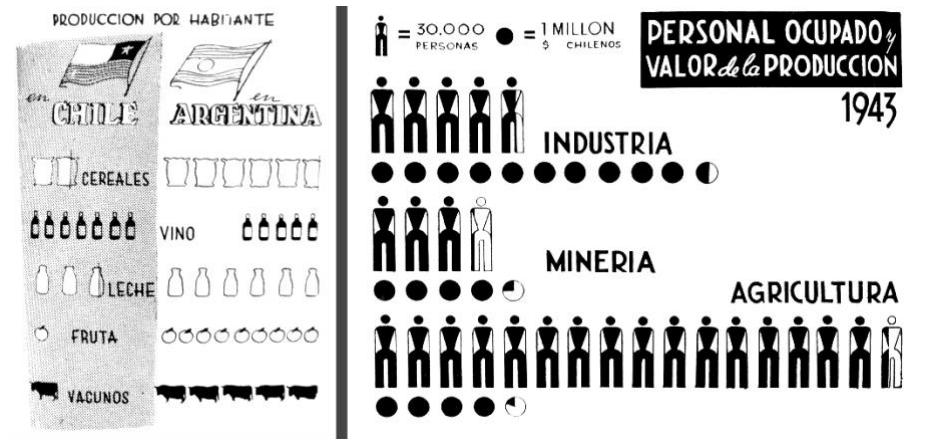


Fig. 1. Arquitectura y Construcción, Num. 4, 1946.



Fig. 2. Plan de fomento y urbanización, 1951.

From the United States, a diametrically opposite communicational strategy began to be introduced into the country. Its beginnings date back to 1933, with a government project known as the Good Neighbor policy, which cemented cultural imperialism as a State purpose, particularly with regard to Latin American nations. Indeed, the

political and military class of the northern country emphasized the importance of mass entertainment artistic media for the dissemination of their ideas at the international level. This is demonstrated by some quotes compiled in research such as the book *El Terrorismo de Estado: La Doctrina de la Seguridad Nacional en el Cono Sur*, by Jorge Tapia (1980), or the essay by Fernando Purcell (2010), *Cine, Propaganda y el Mundo de Disney en Chile durante la Segunda Guerra Mundial*, texts where the testimonies of authorities linked to the US government are exposed, openly expressing the propagandistic effectiveness of comics and cinema (Purcell, pp. 488-495; Tapia, p. 92). In line with this thinking, various commercial initiatives were undertaken with the intention of strengthening inter-American ties. However, none other matched the magnitude and impact of Walt Disney and his company through a new commercial language that was extended to the South America continent.

According to Jorge Montealegre (2008) in the book *Historia del Humor Gráfico en Chile*, in 1937 it was already possible to acquire in the country printed material starring the internationally known characters of Disney's films (p. 159). However, the real media stir did not arrive until the end of 1941, when the very author of those animations visited Chile for propaganda purposes. Marcelo Morales (2015) argues in relation to his visit to the country:

[...] en esta visita de sólo cinco días, Disney dibujó fuera del Palacio de La Moneda, se encontró con dibujantes chilenos en las oficinas de la revista Topaze y, vestido de huaso, bailó cueca en el fundo Santa Ana de Quilicura de propiedad de José Ureta. [in this visit of only five days, Disney drew outside the Palacio de La Moneda, met with Chilean cartoonists in the offices of Topaze magazine and, dressed as a huaso, danced cueca in the Santa Ana de Quilicura farm owned by José Ureta.] (p. 110)

Such was the importance that the media attributed to the celebrity's tour, that his drawing style became an unavoidable reference for a sector of the national graphic arts. Soon, several of his most recognizable visual codes began to be seen in graphic supports of various kinds, mainly in advertising, magazines and newspapers.



Fig. 3. Conozca usted su lavadora Bendix, circa 1960.

Thus, during the period between 1945 and 1960, the European Modern Movement and Walt Disney's imagery made their influence evident in the field of national infographics. The first one was particularly present in intellectual and professional magazines. The second one, in contents of a more miscellaneous and popular nature. On many occasions, the authors of the images intuitively discerned which of the formulas worked best for their purposes, whether to deliver information with pretensions of objectivity or to use a more understandable language that appealed to the media features of popular culture with an international bias and to the emotional factor.

In spite of this, local productions emerged that achieved an encounter between both styles, generating a particular and original form of expression. A good example of this is the leaflet entitled "¿Qué es la industria chilena?", published by the Sociedad de Fomento Fabril (SOFOFA) in 1957 (Fig. 4). In it, it is possible to identify the presence of characters and objects represented in the characteristic key of the American cartoons, visible only through silhouettes that allow the recognition of those forms more linked to the comics. Thus, Storandt Publicidad, credited in the brochure as authors, generated a unique system of American-influenced pictograms that were replicated in the form of statistical graphics in the same way as it was done in European rationalist publications. In this way, it is possible to establish that this print summarizes the fusion of styles that defined the character of national infographics during the early postwar period, appreciable in different nuances according to the problem of representation and its format.



Fig. 4. ¿Qué es la industria chilena?, 1957.



Fig. 5. Eva, Num. 311, 1951.

3. Contents of the infographics

In terms of content, three main themes can be recognized in the infographics of the 1950s. The first referred to the nation's economic and industrial progress, a matter of singular importance for the Corporación de Fomento de la Producción (CORFO) and other government institutions, which spared no resources in boasting the progress they had achieved shortly after their foundation in an adverse context of world instability. According to Sofía Correa, Consuelo Figueroa, Alfredo Jocelyn-Holt, Claudio Rolle and Manuel Vicuña (2001) in *La Historia del Siglo XX Chileno*:

En un primer momento, el desarrollo alcanzado por el área fabril fue en verdad notable. Considérense las cifras correspondientes al período. Entre 1940 y 1953, el sector industrial creció a un ritmo anual de 7.5%, aumentando su contribución al ingreso nacional de un 13.8% entre 1925 y 1929, a un 21.7% entre 1948 y 1952. [At first, the development achieved by the manufacturing area was truly remarkable. Consider the figures for the period. Between 1940 and 1953, the industrial sector grew at an annual rate of 7.5%, increasing its contribution to national income from 13.8% between 1925 and 1929 to 21.7% between 1948 and 1952.] (p. 147).

Thus, the image of a Chile abundant in raw materials and manufactured products began to become popular, defining the economic profile of each region throughout the territory. Likewise, cartographies and travel maps emerged that represented the

Rationalism and cartoonism in post-war Chilean infographics

country as an overflowing source of tourist attractions, where the *Guía del Veraneante*, published annually from 1940 to 1962 by Ferrocarriles del Estado (Cortés, 2014, p. 22), and the 1955 illustrated catalog with Lan Chile's air routes, stand out.



Fig. 6. Mensajeros de progreso, 1950.

A second recurring theme in mid-century infographics was the instructions for the use of household appliances, particularly those that to date had no cultural precedents in Chile. Their introduction into local commerce, stimulated mainly by United States tactics to promote programmed obsolescence for products derived from technologies developed during World War II, generated the need to explain to the population the correct use of countless modern appliances imported for the first time into the country during the post-war period. Such consumption dynamics had, like the Walt Disney phenomenon, a premeditated political background, as Pedro Álvarez (2011) explains in his book *Mecánica Doméstica*:

El desafío de vender los productos y difundir los hábitos de consumo de los norteamericanos en el exterior era básicamente un problema de carácter tecnológico y cultural. La visión apologética de Estados Unidos proponía un modelo de organización económico, político y social que buscaba proyectar al país como nación-faro de la humanidad. Autores como Jeremy Tunstall reprodujeron idealmente esta corriente ideológica con una visión casi fundamentalista. En su libro *The media are American*, Tunstall afirmaba que la cultura se constituía sobre las variables del comercio y la tecnología, lo que evidenciaba su carácter “esencialmente norteamericano”. [The challenge of selling products and disseminating the consumption habits of Americans abroad was basically a technological and cultural problem. The apologetic vision of the United States proposed a model of economic, political and social organization that sought to project the country as a beacon nation of humanity. Authors such as Jeremy Tunstall ideologically reproduced this ideological current with an almost fundamentalist vision. In his book *The Media are American*,

Tunstall asserted that culture was constituted on the variables of commerce and technology, which evidenced its "essentially American" character.] (p. 35)
 Faced with this situation, the national industry began to compete with foreign companies thanks to the production of technical objects as well as durable and fungible goods, supported by the publication of manuals and advertising in printed and radio media for their respective assimilation and use. Fensa, Fracmo, Hoover and Marmicoc were some of the brands that introduced instructional design locally, through brochures with schematic views of washing machines, blenders, pressure cookers and vacuum cleaners, among other household products.



Fig. 7. Máquina eléctrica Hoover de lavar, circa 1955.

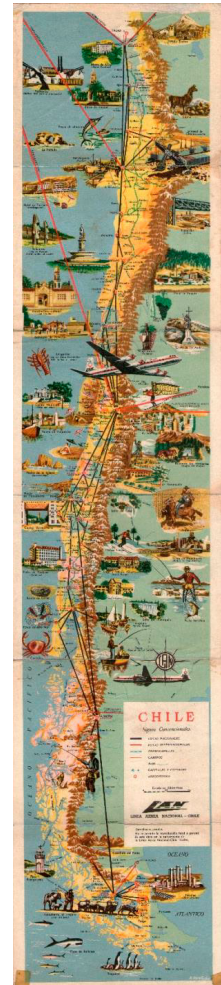


Fig. 8. Chile: Lan, 1955.

Finally, a topic that acquired particular importance in the publications of the 1950s was military culture and historical military exploits. The main reason for its resurgence at the national level was the return to power of Carlos Ibáñez del Campo, president of Chile between 1952 and 1958 and exponent of a political trend known as Latin American populism. As a military man and founder of the Carabineros de Chile, his program promoted a value pattern that exalted law enforcement agencies and professed the pursuit of good civic behavior. In this way, printed material such as the 1955 *Anuario de la Nación* and later the magazine *Carabineros de Chile*, exposed, through images, knowledge related to the internal organization of these institutions, evidencing his nationalist zeal.

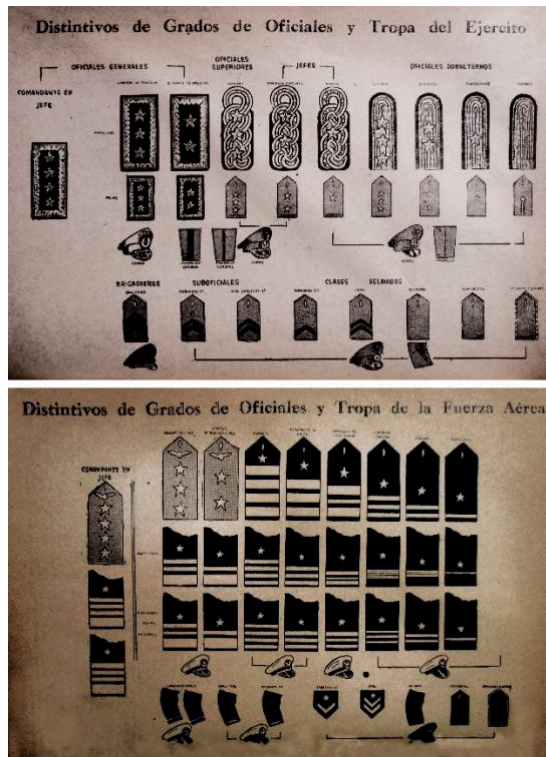


Fig. 9. *Anuario de la nación*, 1955.

In parallel, educational texts such as the famous *Resumen de la Historia de Chile*, edited by Leopoldo Castedo based on the work of Francisco Encina, explored the evolution of various war conflicts through diagrams of geographical links that described the development of important war campaigns for their teaching and pedagogical approach to the readers. However, like any governmental experience founded almost exclusively on the charisma of a caudillo, the Ibáñez regime ended up

unleashing a political crisis that initiated a new process of social structuring as a prelude to a particularly convulsive next decade.

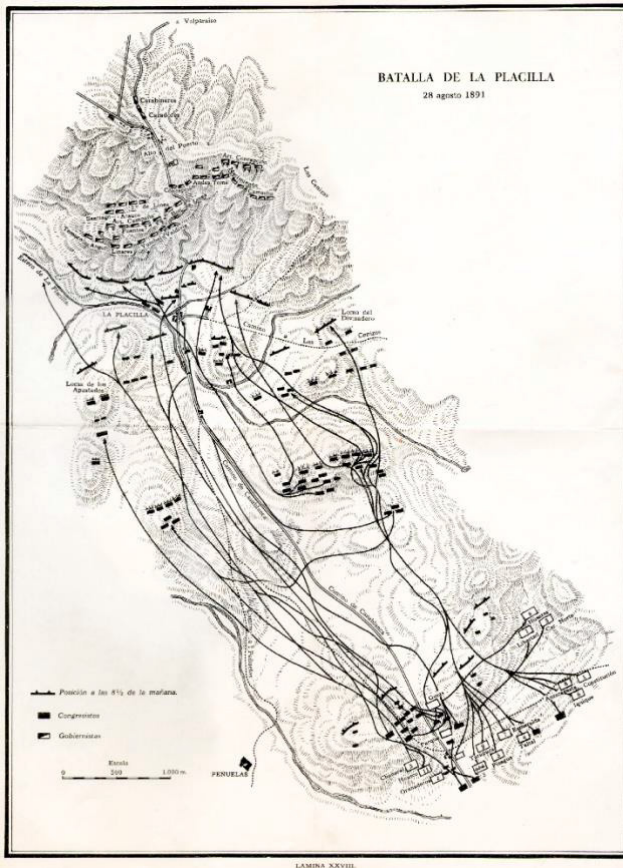


Fig. 10. *Resumen de la historia de Chile*, Leopoldo Castedo, 1954.

4. Conclusions

In short, after World War II, Chile and the rest of the countries in the region were dealing with their own political conflicts, far from the epicenter of the conflict, but not completely alien to it. This, added to the lack of spaces for academic discussion on visual representation, allowed workers in the graphic industry to experiment with mixing languages of opposing value origins, without fear of betraying any of the political dogmas of the period. In this way, they ended up creating a sometimes eclectic graphic style that, in some very particular cases, managed to shape an original form of representation that was very much in keeping with its context.

References

- Aguirre G., M. (2008). Para una historia de la difusa arquitectura moderna en Chile. *Revista De Arquitectura*, 14 (17), 12-17. Retrieved from 10.5354/0719-5427.2008.28174
- Álvarez Caselli, P. (2011). *Mecánica doméstica: publicidad, modernización de la mujer y tecnologías para el hogar 1945-1970* (Eds.). UC.
- Correa S., S., Jocelyn-Holt, A., & Rolle, C. (2001). Historia del siglo XX chileno. Sudamericana.
- Cortés, M. (2014). *Turismo y arquitectura moderna en Chile: guías y revistas en la construcción de destinos turísticos (1933-1962)*. ARQ Eds.
- Engelhardt, J. von. (2002). *Language of graphics: a framework for the analysis of syntax and meaning in maps, charts and diagrams*. Institute for Logic, Language and Computation.
- Montealegre, J. (2008). *Historia del Humor Gráfico en Chile*. Editorial Milenio.
- Morales, M. (2015). 15.000 DIBUJOS. *Solomonos*, (5), 102-113.
- Purcell, F. (2010). Cine, propaganda y el mundo de Disney en Chile durante la Segunda Guerra Mundial. *Historia (Santiago)*, 43 (2), 487-522. Retrieved from 10.4067/S0717-71942010000200005.
- Smicklas, M. (2012). *The Power of Infographics*. Que Publishing.
- Tapia, J. (1980). *El terrorismo de Estado: la doctrina de la seguridad nacional en el Cono Sur*. Editorial Nueva Imagen.

Third-person Second: a narratological explanation of an infographic

Stuart Medley¹ (0000-0001-7324-8494)

¹Edith Cowan University, s.medley@ecu.edu.au

Abstract. This paper explains an infographic which depicts a service design for homeless people. The infographic is discussed in narratological terms, with a focus on third and second-person characters, audience identification with characters, and the temporal, story-telling aspects of visual timelines. While the infographic was created with a reliance on the tacit knowledge of the service designer and illustrator, a means was sought to retro-actively explain how the visual narratives contained within it were intended and how they should be received. The need for making the tacit explicit was to communicate the strategy to the client funding the service. That explanation is recapitulated in this article. In the SECI model (Nonaka & Lewin, 1994); de Castro Peixoto et al., 2022) tacit knowledge is made explicit through an “externalisation” process. The most appropriate way of externalising the design process here, given that the infographic has a temporal dimension as well as clearly depicted persons (or characters), was to see the work through the theoretical lens of narratology. Furthermore, narratology is appropriate in explaining how the infographic embodies a complex blurring between third and second-person. While the text in the infographic may initially support the view that the characters are third-persons (an extra-diegetic narrator in the text is describing the emotional states of two of the characters), information is supplied for the reader to identify with a specific character (Tal-Or & Cohen, 2010; Chen & Bell, 2022) and to begin to understand that this service is offered to them: an implied ‘you’ in the infographic. I explain how the approach is a point along a continuum, at the extreme of which lies the comics contract. In the case of the comics contracts, the third-person object must be inferred as a second-person subject; subject to the terms of the agreement. This understanding will ultimately be legally binding. Understanding the narratological aspects of an infographic may be of use to other designers and design academics, especially where an implied second-person is necessary to the understanding of infographics which have a call to action or a legally binding implication.

Keywords. Infographic / Narratology / Second-person / Visual narrative / Comics contracts

1. Introduction

This paper focuses on an *infographic* which depicts a service design for people experiencing homelessness. The infographic is discussed here in narratological terms, with a focus on third-person and second-person characters. Of particular interest is how readers of the infographic are encouraged to assume that the third-persons depicted are references to themselves, in the second-person. Better understanding this phenomenon is significant while there is a growing trend to develop visual terms and conditions for products and services and, more importantly, visual contracts where the signatories are legally bound by the agreement. Visual narrative infographics are a reflection of the pictorial turn and narrative turn evident throughout the social sphere over recent years and likely to grow in popularity: “Data storytelling is an emerging visualization paradigm that aims to “tell a story” with data in order to elicit deeper reflections in an effective manner” (p.67, Zdanovic et al., 2022).

The infographic in focus, called *No Wrong Door*, (Fig 1) is emblematic of an approach taken by the service designer and illustrator to communicate clearly and as simply as possible a complex service system aimed at multiple audiences. The illustrator of the infographic in question is the author of this article.

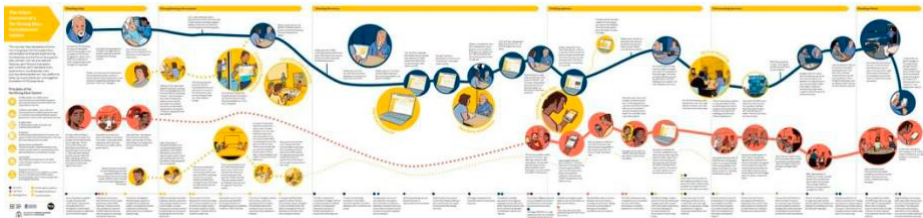


Fig. 1. Stuart Medley, *No Wrong Door*, infographic for consortium of Western Australian social service providers, 2020. (Government of Western Australia).

The client commissioning the design, a consortium of Western Australian government agencies and social enterprises, required that the information about the service be highly accessible to and clearly understood by its intended audiences. A timeline as a hybrid set of visual narratives was developed as the infographic. While the infographic was created with a reliance on the tacit knowledge of the service designer and illustrator, a means was sought to retro-actively explain how the visual narratives contained within it were intended. The need for making the tacit explicit was to communicate the strategy to the client funding the service. That explanation is recapitulated in this paper describing how *No Wrong Door* reveals the complexity of the service design.

2. What is the infographic for?

The function of this infographic comes from the brief given to the designers by the consortium: “The design must represent a visible system: A *No Wrong Door* system is able to be seen and understood by everyone.” The design describes a service for people experiencing homelessness. Specifically, a service where there is no prescribed entry point, nor a right way to avail oneself of the service. Hence “No Wrong Door”. According to the consortium brief, “the design is meant for everyone who has a stake in this proposed system. Importantly it allows people experiencing homelessness to see what goes on behind the scenes at the service providers. Ian and Jase are semi-fictional characters, and while they don’t represent every experience in homelessness, their journeys demonstrate how new platforms, behaviours and incentives work together to enable a *no wrong door* experience.”

The infographic shows two individual characters’ (*Ian* and *Jase*) experiences of the proposed service system and the front line supports (service provider staff) they connect with. These characters are based on research data given to the designers by the consortium. In this sense the characters are what design discourse would call *personas*. Their hypothetical experiences of the system are what design discourse would call *scenarios*.

The infographic is laid out in vertical bands of information (Fig 2), which can be read chronologically from left to right. At some bands in the timeline, the reader can see that the step in the service applies to several depicted characters at once, while at others, the service step applies only to one specific character. Along the bottom of the timeline runs a set of principles which inform each step of the service.

2.1 SECI Model: Externalization

In order to explain this infographic to the consortium, the SECI model (de Castro Peixoto et al., 2022) was adopted because of its focus on making tacit knowledge explicit. This is achieved through the model via a process called *externalization*: “the process of giving words and meaning to the tacit knowledge (externalisation). These concepts can then be crystallised into a concrete form (combination), such as an intervention, which can be evaluated (justification) and shared with other stakeholders (networking knowledge)” (van Buijsen, 2021)

The most appropriate way of externalising the design process here, given that the infographic has a temporal dimension as well as clearly depicted personas (or characters) placed into visual narratives, was to see the work through the theoretical lens of *narratology*. Through this lens, the *No Wrong Door* infographic is a mix of telling (the text) and showing (the pictures)(Weber, 2020) of the multiple timeline tracks.

Furthermore, narratology is appropriate in explaining how, for the reader, the infographic embodies a complex blurring between third-person and second-person. Particular audiences need to identify with particular characters, to understand that “this is a service for you”.

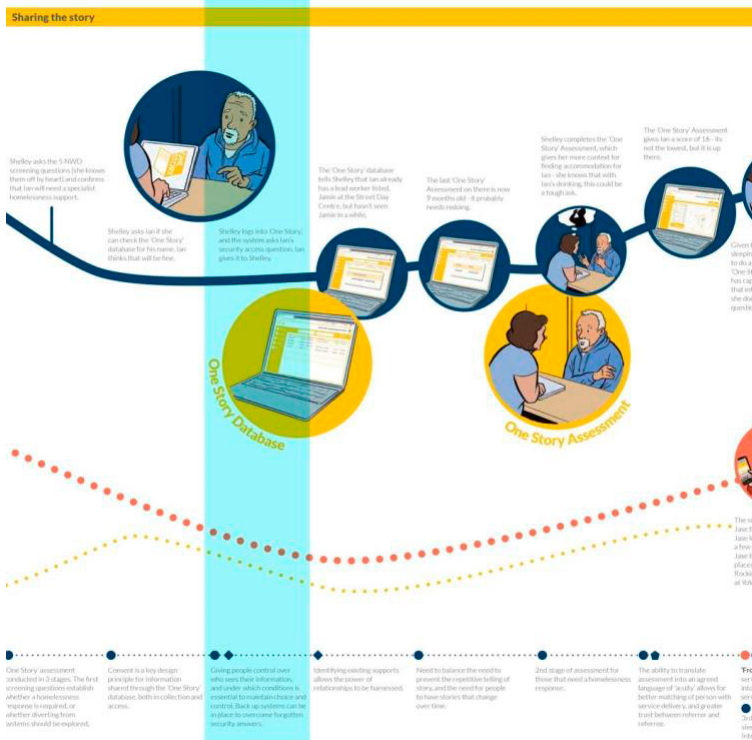


Fig. 2. Stuart Medley, *No Wrong Door* (detail and highlight), infographic for consortium of Western Australian social service providers, 2020. (Government of Western Australia).

3. Narratology

It is not unknown in the field of narratology for a character to begin as a first-person or second-person and evolve or change into a third-person through the reading. Narratologist, Monika Fludernik, uses Italo Calvino’s “If on a winter’s night a traveller” as an example of a second-person narrative that evolves into a third-person form (p.31, Monika Fludernik, 2009). In the infographic explained in this paper, the design logic leads in the other direction: At first glance, the beholder of the timelines may assume these are third-persons, objectified on the page through depiction. Upon closer inspection, as the beholder becomes also a reader, it becomes clear that at least one of these characters is more closely aligned with the reader’s position and subjective view of the world. While the text may initially support the view that the

characters are third-persons (an extra-diegetic narrator in the text is describing the emotional states of two of the characters), enough information has been offered in the infographic for the reader to identify with a specific character (Chen & Bell, 2021; Tal-Or & Cohen, 2010) and to begin to understand that this service is offered to them: an implied ‘you’ in the graphic narrative.

The theories of narratology are currently being expanded to encompass some peculiarities of *graphic* narratives such as comics and storyboards: “graphic narration subjects to doubt some of the theoretical presuppositions, prevalent in much narrative theory that is based on literary narrative fiction, and requires us to critically examine various key distinctions, such as those between first- and third-person narration” (p.27, Kai Mikkonen, 2017).

Rolf Reitan explains the function of second-person narratives as if these “reach out to the reader roles projected by the text and invite active participation and even identification by real readers” (p.170, Rolf Reitan, 2011) Readers may feel addressed by an initially ambiguous you and may “enter a game of being the protagonist”, accepting the fiction of being the protagonist: “After a while, we probably will forget it; getting absorbed in the protagonist and his or her vicissitudes, we slip back to a “witness” position, like when reading a standard third person novel. But the latent deictic significance of “you”, having been activated once at the beginning, lies ready to be reactivated at any instant” (p.170, Rolf Reitan, 2011).

3.1 Textual/verbal track

Second-person narratives are described as ‘unnatural’ outside of song or poetry where they are common. They are further complicated in graphic narratives such as comics and film where it is unusual to see anything other than a third-person subject. For example, most comics have separate visual and verbal tracks: respectively, the drawings in the panels and the accompanying speech (and sometimes thought) bubbles. Of course, the verbal track of a comic (or any graphic containing word and image) has the potential to carry first-person, or second-person text, as per a novel told in first-person, or a song lyric sung to a second-person. That is, the graphic track may show the character in third-person, but we may see a thought bubble above that character’s head written from first-person perspective. In the *No Wrong Door* infographic, the text and the pictures both support an understanding of the characters as third-persons. However, since the three timelines in the graphic feature different third-person characters, and these are each based on researched evidence, different readers can, and do, appreciate the narrative as referring to themselves in the second-person sense. Schuler describes it as trying-on the identities of different characters and checking for the best fit (Schuler, 2021). For instance, during prototyping of the infographic, one of the service design staff said she understood from the graphic “where I fit in the system as a service provider” and “it alerted me to the importance of matching the person to the accommodation”.

3.2 Drawn narratives and characters

For the illustrator on this project, drawn personas were a way to de-identify the real people reflected in the consortium's research. This was important in a sensitive context such as homelessness. However, this implicit abstraction away from the photographically-real needed to be balanced against the importance of allowing different readers to "see oneself" in the story; a balancing act between abstraction and specificity.

In terms of particular strengths of turning data visualisations into visual stories or narratives, there is still a lot to be studied. Currently, in the literature, no special advantages of the approach have been identified in terms of making the information more memorable: "we find no significant differences in recall between traditional visualizations and data storytelling visualization. However, we find indications that the cognitive load induced by different chart types and self-assessed prior knowledge on the chart topics could possibly have a moderating effect on information recall." (p.67, Zdanovic et al., 2022). Also, there may be advantages in terms of *appealing* to the reader and in making the information accessible, even relatable. Narrative theory around comics speaks of particular advantages to the drawn character. Kendall says that cartoon faces are easier to process in terms of understanding emotional expression and direction of gaze (Kendall, 2019). Furthermore, Harrison (1981) wrote of the accessibility and appeal of the comics form:

breaking it down into the three steps of leveling, sharpening, and assimilating (p. 57). Leveling means simplifying the reality at the syntactic level, for instance, reducing the 3-dimensional reality to a 2-dimensional drawing, representing in black-and-white what is in color, or retaining only the outline of a figure and a suggestion of an object's shape. When excessive details are eliminated from the image, the remaining elements are sharpened to stand out from the background; for instance, when the human face is simplified to an icon, its eye dots and mouth line will stand out to attract viewer attention (Han Yu, 2016)

3.3 Relatability/appeal

In narratology, *identification* with particular characters is examined in relationship to other factors such as readers' *immersion* into and *engagement* with the narrative, and their *empathy* with particular characters. Authors of fiction may try to deliberately create characters such that the reader will identify strongly with them. In non-fiction comics, other factors may be accentuated to encourage immersion:

"A common technique used in instructional comics is constructing surrogate users who perform the same tasks that are being instructed to readers. Comics' tradition in portraying human characters and their actions makes the construction of surrogate users a rather natural move, a move that has a

number of benefits for conveying instructions. First, through the portrayal of surrogate users who are engaged in a given task, readers can see, from the vantage point of an observer, what they are being asked to do (Han Yu, 2016)

Then again, according to Felnhofer *et al*, *identification* requires more exploration: “The question of what contributes to users’ identification with media characters remains an open issue in research. Apart from media interactivity, user characteristics like gender, age, immersive tendencies, and factual transportation into the narrative are promising factors” (Felnhofer *et al.*, 2022). Accordingly, there are interesting research approaches to the question, with theorists homing in on specific factors. “*Emotional contagion*” is a term used by Cummins & Cui to describe this kind of identification with media characters (Cummins & Cui, 2014). Their approach is to look at the importance of direct *bodily address* from the character to the reader in visual narrative forms. They contend that bodily address, where the onscreen performer could be seen speaking to the viewer, fostered a stronger sense of interaction relative to verbal or no address. Coincidentally, I had chosen to ‘introduce’ visually each character in the infographic via individual portraits in which each character appeared to look directly at the reader (Fig 3)

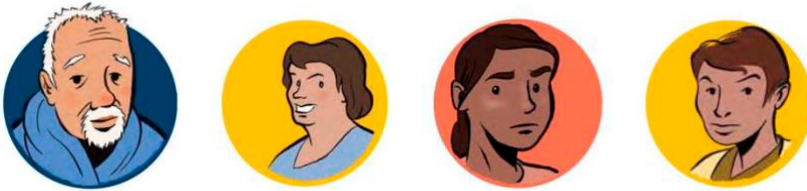


Fig 3. Stuart Medley, *No Wrong Door* (character details), infographic for consortium of Western Australian social service providers, 2020. (Government of Western Australia).

The design approach taken in the *No Wrong Door* infographic is a point along a continuum, at the extreme of which lies the comics contract. Lawyer, Robert de Rooy, summarizes comics contracts as ‘contracts written in pictures’: legally binding contracts where parties are represented by drawn characters; terms of the agreement are shown in sequential pictures; and parties to the agreement sign the comic. In the case of the comics contracts, the third-person object (seen in the comics panel) must be inferred as a second-person subject; subject to the terms of the agreement. This understanding will ultimately be legally binding. Understanding the narratological aspects of a particular design may be of use to other designers and design academics, especially where an implied second person is necessary to the understanding of infographics which have a call to action or a legally binding implication.

4. The second-person and the law in comics

Comics contracts are yet to be disputed in a court of law. Their makers might want to say because the comics form brings clarity through the combination of pictures and words. The absence of disputes to date may be a function of the low number of these contracts so far made, and that they are, so far, well-made. Looking forward to a time where their popularity grows, it will be important to map out some characteristics of effective comics contracts. The strong identification by the reader with a particular character described above, for example, has a legally binding dimension in comics contracts. It's therefore important that designers get representation right, and that we can explain it to others.

In the law literature, the Second-person standpoint already receives special acknowledgment:

What is distinctive about second-personal reasons is that they are analytically related to claims and demands that an addresser has the authority to make of, and address to, the agent second-personally. Reasons of this kind always involve an accountability relation between addresser and addressee—that is, that the addressee is answerable to the addresser in some way, if not for compliance, then at least to give consideration or something similar.” (Darwall, 2006).

Darwall says the only way such authority can be established is within the second-person perspective, and uses this to conclude that the concept of law is a second-personal concept: laws derive from legal authority and create legal obligations, responsibilities, and reasons to comply: “that is, ‘legal obligations’ and ‘legal reasons’ for acting in a sense analogous to that in which even a moral skeptic can accept that there are ‘moral obligations’ and ‘moral reasons.’ Second-personal legal reasons exist in this sense” (p.900-901).

Furthermore, “when someone takes a second-person standpoint toward someone else and makes claims and demands [...] he and his addressee share a common second-personal authority to make claims and demands of one another by virtue of their capacity to enter into relations of mutual accountability (that is, their second-personal competence)” (p.902).

In the comics contracts, as in our storyboards, no ‘you’ appears in the text. However, the infographic works in the same way as this second-personal competence of which Darwall writes. Ultimately, this affect must prevail in documents which depict visually terms and conditions and, even more crucially, legal agreements upon which employment depends. One is effectively signing that you understand this third person to be the second-person “you”.

5. Findings

5.1 User feedback

The infographic was shown to a focus group of potential service users and staff who would provide the service if and when implemented. Qualitative responses appear to confirm that focus group participants understood the appeal to them (as second-persons) via the depicted characters (third-persons). One participant, a young adult who had experienced homelessness in the previous year said “it was good to see someone who looked like me in the story”. Another participant who had also recently experienced homelessness said, “it will support us to get everyone on board. It shows what the issues facing me actually are”. With regard to the service provision visual narrative in the infographic, one of the service design staff said they understood from the graphic “where I fit in the system as a service provider”.

5.2 What could be improved

What could have worked better according to the literature, now that the tacit knowledge is informed by theory and made explicit here: According to Cummins & Cui, the advocates for face-to-face communications, or *bodily address*, between characters and readers, if the narrative ends with bodily address to the reader, as well as beginning that way, an even stronger sense of interaction is fostered (Cummins & Cui, 2014). In the *No Wrong Door* infographic, the characters were introduced via bodily address to the reader, but the narratives were not book-ended this way. This may be a more effective way in *No Wrong Door* to state what changes have happened for each stakeholder, and suggest the journey has ended for now and to recapitulate that appeal direct to the reader.

6. Conclusions

Visual narrative infographics are a reflection of the pictorial turn and narrative turn evident throughout the social sphere over recent years. They are likely to continue to grow in popularity for all kinds of serious applications. Where they make an appeal to the reader through the visual rhetoric of characters in a graphic narrative, these designs need to be carefully constructed with a view to their effect on an audience. Understanding the narratological aspects of the designs, in particular how readers and beholders identify with particular depicted characters, will be of growing importance in effective visual communication of complex systems.

Narratology is a productive field of theory to help explore and explain identification with personas in infographics, particularly the understanding by the reader of a third-person depiction as a second-person call to action. Further empirical research into identification with depictions of personas is required, especially in legal contexts

where identification has a legally binding dimension. Identification and appeal require more work in this context because they are underworked concepts even in their original field of narratology.

References

- Belinda, B. (2021). *Science*, 5(1), 14-37.
- Chen, M., & Bell, R. A. (2021). A meta-analysis of the impact of point of view on narrative processing and persuasion in health messaging. *Psychology & Health*, 1-18. Retrieved from 10.1080/08870446.2021.1894331.
- Cummins, R. G., & Cui, B. (2014). Reconceptualizing Address in Television Programming: The Effect of Address and Affective Empathy on Viewer Experience of Parasocial Interaction. *Journal of Communication*, 64(4), 723-742. Retrieved from 10.1111/jcom.12076.
- Darwall, S. (2006). *Law and the second-person standpoint*. LAL Rev., 891.
- de Castro Peixoto, L., Barbosa, R. R., & de Faria, A. F. (2022). Management of Regional Knowledge: Knowledge Flows Among University, Industry, and Government. *Journal of the Knowledge Economy*, 13 (1), 92-110. Retrieved from 10.1007/s13132-020-00702-9.
- Felnhöfer, A., Wittmann, L., Reichmann, A., König-Teshnizi, D., & Kothgassner, O. D. (2022). *Character identification is predicted by narrative transportation, immersive tendencies, and interactivity*. *Current Psychology*. Retrieved from 10.1007/s12144-022-03048-4.
- Fludernik, M. (2009). *An introduction to narratology*. Routledge.
- Yu, H. (2016). *Appeal of Comics-Style Technical Communication*. In *The Other Kind of Funnies*, 49-70. Routledge.
- Kendall, L. (2019). *The processing of cartoony and photorealistic faces* [PhD]. University of British Columbia.
- Mikkonen, K. (2017). *The narratology of comic art*. Routledge.
- Nonaka, I., & Lewin, A.Y. (1994). *Dynamic theory knowledge of organizational creation*. Organization
- Reitan, R. (2011). Theorizing Second-Person Narratives: A Backwater Project? In F. Jannidis, M. Martínez, & J. Pier (Eds.), *Strange voices in narrative fiction*, 147-174. De Gruyter.
- Schuler, B. (2021). *An exploration of how teachers are integrating LGBTQ+ young adult literature into the secondary english language arts classroom*. Purdue University Graduate School.
- Tal-Or, N., & Cohen, J. (2010). Understanding audience involvement: Conceptualizing and manipulating identification and transportation. *Poetics*, 38(4), 402-418. Retrieved from 10.1016/j.poetic.2010.05.004
- van Buijsen, M. (2021). *Improving care and treatment for adults with a visual impairment and serious mental illness From tacit knowledge to a logic model of current practice*.
- Weber, W. (2020). Exploring narrativity in data visualization in journalism. In *Data Visualization in Society*. Amsterdam University Press. Retrieved from 10.5117/9789463722902_ch18
- Zdanovic, D., Lembcke, T. J., & Bogers, T. (2022). *The Influence of Data Storytelling on the Ability to Recall Information*. *ACM SIGIR Conference on Human Information Interaction and Retrieval*, 67-77. Retrieved from 10.1145/3498366.3505755

Strengthening the rule of law through information design

¹Kim Raad, ²Sarah van Hecke

¹Lead Information Designer at Stibbe, kim.raad@stibbe.com

²Communication scientist and legal design adviser at Deloitte, svanhecke@deloitte.nl

Abstract. Legal design has entered the legal field as an innovative and promising approach to the legal practice. This multidisciplinary and human-centred approach leads to a visual way of communicating legal information. Which contributes to rebuilding, or enhancing, the trust of citizens in the rule of law. In the field of legal design legal experts and design experts to work together to get to the best results in explaining complex legal information in an understandable and clear way. Exactly what information design intends to do. 1500 characters including spaces.

Keywords. Legal Design / Information design / Rule of law / Visual communication / Access to justice

1. Introduction

Legal design is the collective name for initiatives aimed to make the legal system more human-centred. As Margaret Hagan, executive director of the Legal Design Lab at Stanford Law School says: ‘The purpose of legal design is to develop a human-centred, participatory approach to reforming the legal system [...] It recognizes the value of having interdisciplinary, inclusive groups build and test new improvements to the system.’ In this paper we define legal design as the collaboration between legal professionals and information designers which brings forth a visual way of communicating legal content. All with the intention of clarifying complex legal information to procure better access for users and stakeholders partaking in legal processes. Although a young discipline, it has been greeted with enthusiasm in the legal field. Not only on educational level, such as the Stanford legal design Lab, but also within law firms and governmental organisations. The possibilities though, of how to use it, with whom to work and how to proceed, are still being explored. When using legal design, legal professionals, tech professionals, designers and plain language experts work together in extended legal projects. It brings a lawyerly focus on abstract complexities together with a designerly focus on the human-centred experience like the needs of clients or users. This multidisciplinary approach is new for most of the practitioners in the legal field, an environment known to be exclusive and inward focussed. Whereas, now information designers and communication experts are recognised as valuable allies in legal teams. This innovative approach which requires a collaboration between legal and non-legal disciplines needed some time to root in

this more conservative environment but results now are showing the approach puts forward very powerful results. Receiving a very positive response from legal professionals, legislators and clients. Not only law firms but also (semi-)governmental institutions operating within a specific legal framework, recognize the value of clear and understandable communication and how visualisation contributes to this. There is a need for information designers not only in the corporate legal field but also on public level within organisations majoring in communicating incomprehensible complex information and where proper understanding of this information by for example citizens is of social importance.

This paper focusses on the added value of information design brings in developing understandable and clear legal information for lay people in the legal practice and society in whole. Legal information tends to be complex, and information design(ers) is the key to make that information easier to understand and act upon. Information designers organise and provide visual ways to display information in a way that maximizes its clarity and understandability. As information design focuses on the need of user and the context in which they need to find and apply information (human-centred). The goal is accomplishing the writer's goals by meeting the reader's needs. Legal design contributes to society by, amongst others, ensuring that new or amended legislation is communicated in a clear and understandable way and the administration of justice transparent. Which leads to an improved access to justice for the society in whole.

Looking at legal procedures, providing information on a level which is accessible by all afflicted, can create the much-needed engagement and ensure that all parties involved understand the justice of the legal consequences following a decision. Clear visual communication can play a key role in this.

Applying information design to make legislation better understood is therefore of great importance to strengthen the access and engagement of citizens in the legal system and shape a more democratic and fair society. This may not be the starting point when working in legal corporate environments as the authors of this paper do, but we strongly believe in the importance of the use of information design with the legal domain and the value of collaboration with information designers in the legal design process stretches beyond the singular use of legal design as an innovative legal consultancy tool.

2. The importance of access to justice

The rule of law is the political philosophy that all citizens and institutions within a country, state, or community are accountable to the same laws. In Western Europe we like to believe we live in a democratic society. One that is run by an honest government which has the best interest of its people at heart and can be held accountable. A society strengthened by an independent judicial power, administrative power and legislative power. Where justice is delivered timely, ethically and impartially. Balanced by a legislative system that is transparent and accessible. Together these independent elements create what is referred to as 'the rule of law':

a durable system of laws, institutions, norms and community commitment (figure 1). The importance of this fourth element is often neglected while the rule of law is essential for the community commitment by the citizens is needed in a democratic society.

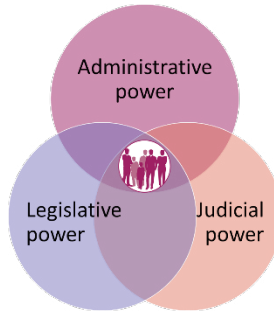


Fig. 1. Rule of law (Property of the author).

Community commitment by citizens is an essential ingredient of a durable democratic society. As it are the citizens that form the very foundation of that democratic society. For a democracy to function accordingly, citizens commitment is of great importance. This commitment goes beyond just having faith in the rule of law and the institutions that enforce it. Democracy is characterized by the fact that all citizens can participate in shaping the common good on an inclusive and accessible level. Every citizen should realise he or she is a member of the community and that he or she bears responsibility for its proper functioning. Therefore, only constant interaction between institutions and citizens within the community can make a democratic system work properly. However, over time the legal system as represented in administrative, legislative and judicial power, became more and more complex. Nowadays it's has become increasingly difficult for citizens to play their part in the rule of law. Most of them don't feel they have proper access to justice. Citizens often have no confidence they can utilize their rights or that the power of justice is within their reach or on their side. And they lack the knowledge how to exercise their rights. The complexity of the legal system has created a distance between the citizens and the rule of law, but needs to be bridged keep the democratic process functioning properly. This is an assignment to the institutions that together form the rule of law and its citizens:

1. the rule of law has the obligation to move from complex and confusing to clear and understandable; and
2. citizens have the obligation to not turn a blind eye on the rule of law. They are part of the legal system and therefor have a responsibility to not be ignorant of that same system. They need to educate themselves on how it works, how they can contribute and participate.

The rule of law is based on interaction between institutions, laws, norms and commitment of citizens. Where citizens participate through exercising their right and institutions provide clear and understandable possibilities to do so, both parties will provide guidance to that very system. So, by exercising your rights as an individual in society, you shape the very society you live in. An experience that positively enhances the level of trust you place in that very system.

This rhythm can, as we believe, benefit from legal information design. By utilizing the benefits of information design such as the ability to communicate complex legal information effectively, we can contribute to the confidence of citizens in the rule of law and institutions that enforce it.

3. Benefits of visual communication

The focus of legal design lays in applying information design in an information dense environment where experts interact with laymen about topics that often require a certain level of expertise. Information design makes use of visual language to communicate a message instead of communicating that message textually. Visual communication has several benefits to textual communication which makes the opportunities for successful understanding of the message raise when it comes to the exchange of complex legal information.

Communicating visually has advantages over word-based communication when it comes to encoding and retrieving information from the memory. The processing of words often requires more cognitive exertion. Research into ‘the picture superiority effect’ shows that if we only read a text, approximately 10% of the information is remembered three days later. If the same information is presented in a relevant combination of image and text, 65% of the information is remembered three days later. So, by making visual communication part of legal communication, which is often complex or multi-faceted, the message is not only better understood, but also more memorable. Which is not the only benefit we see.

A large part of the legal domain requires decision making; either new legislation, in court, or through providing insight in judicial decisions. Before reaching a verdict of finalizing legislation, large amounts of information need to be processed by parties involved. Obtaining and integrating information is called information-processing. It is defined as: “a set of related processes that occur when information is taken in, transformed, and then used to produce output”. However, information-processing for deciding is not that easy. Decision-makers are often faced with extra challenges as they communicate, interact and exchange information with each other. They are continuously faced with a so called ‘information explosion’. This occurs when individuals (whether as individual or as professional) are confronted with an amount of (textual) information that is greater than their capacity to process this information. This limited capacity to process information can be explained with the cognitive load

theory¹. Processing large amounts of textual information can take a high cognitive cost given it asks a lot from the working memory. This high cognitive cost of the working memory may lead to a cognitive overload causing the receiver of that information to use heuristics². This can lead to making decisions based on biases and imperfections. The information overload has thus an impact on the information-processing and the quality of the decision-making process. Offering the required information on a visual basis, instead of (pure) text, one can facilitate the information-processing process preventing information overload and the use of heuristics. In addition to this, visual communication augments cognition as it:

1. Creates an external representation

All visualizations are external representations. Therefore, they store information externally by which recourses in the working memory become available for other aspects of thinking. Whereas information that needs to be read or listened to, is in the working memory and is not stored externally. Which makes textual information more demanding on the working memory, and visual information less demanding.

2. Allows for a clear information structure

Visual information is structured in a different way in comparison to text. Visual information that is related to each other is stored together. With visual features, certain spatial relationships can emerge. Hierarchical differences, for example, can be clearly visible with visual features. With text, this 'distance' is harder to indicate, making it more cognitively demanding to process textual information, relative to visual information. In addition to spatial relationships with distance, relationships can also be easily indicated with, among other visual features, colours or lines.

3. Allows for cognitive offloading

Third, visualizations are a solution to cognitive overload. With visual information, cognitive load is reduced because one can additionally use one's vision to process information. This is also called 'vision to think'. It can be explained further, using so-called emergent features. These are visual features of a group of objects that are more obvious than features to the individual objects themselves. Meaning that patterns

¹The Cognitive load theory is based on a cognitive architecture which consists of a sensory, working and a long-term memory¹. Information is received through sensory memory and then processed in the working memory¹. After successful processing, the information is stored in long-term memory. Once stored in long-term memory, information is considered knowledge and can be easily retrieved. The amount of information that can be stored in long-term memory is unlimited. However, the amount of information that working memory can process is limited. When working memory has to process a lot of information, it becomes overloaded. This is called cognitive load.

²The use of heuristics when processing information is called heuristic processing². With this method of processing, readers focus on a limited part of the text. Namely the part of the text that allows them to use simple rules of thumb to determine whether they agree with the information or not. Rules of thumb are knowledge structures that are learned and then stored in memory. Heuristic processing through the application of rules of thumb requires relatively little cognitive effort.

often emerge when these features are grouped together. In this way, complex relations or calculations are replaced by simple pattern recognition processes. These are only observed by the visual system and would not have been seen when the information was textual.

These advantages of visual information make it clear that visual information is easier to process. By integrating legal design, making visual communication the default in the legal sector, legal communication becomes easier to process, more understandable and easier to remember. Or in other words, more human-centred.

4. Legal communication and the rule of law



Fig. 2.1 Dynamics of communication legal information (Property of the author).

Legal communication in our society is delivered to (groups of) individuals / (corporate) organisations, but also to the society in whole. The legal knowledge of these receivers varies from expert to ignorant. Looking at legal communication as practiced by legal, juridical and administrative powers (also see figure 1), the focus on the output of most legal communication or information seems to stay on the left side of the matrix (see figure 2.1). Legal services in OECD countries for example are often based on a high level of legal knowledge and tend to focus on the type of legal problems, not the need of the client or citizen involved. Direct results of this 'fail' of legal communication is reflected in the trust (or lack of trust) citizens place in the rule of law, as explained in this paper. Though, if we want to strengthen the rule of law, we do have to find a way to communicate in a clear and understandable manner which speaks to larger group of citizens and by so creates more involvement. This human-centred approach is an

important part of legal design. By connecting the human-centred legal design approach to the visual approach of information design the output moves to the right side of the matrix (see also figure 2.2).

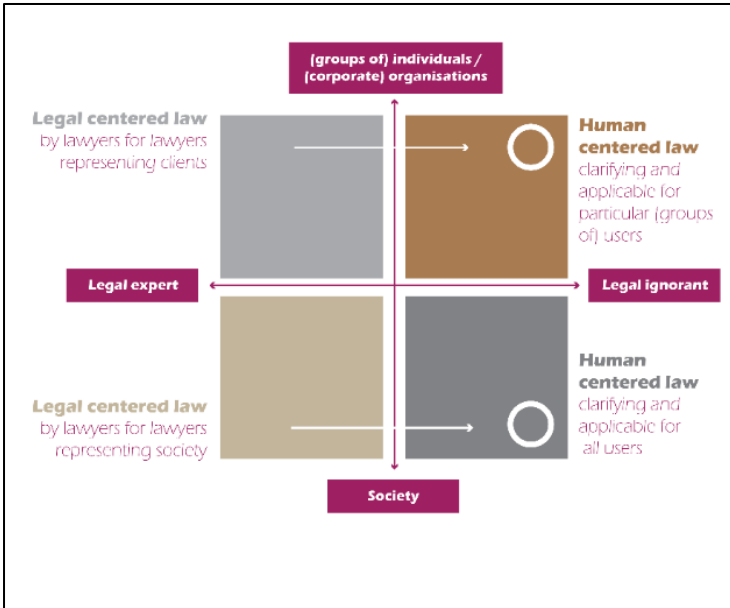
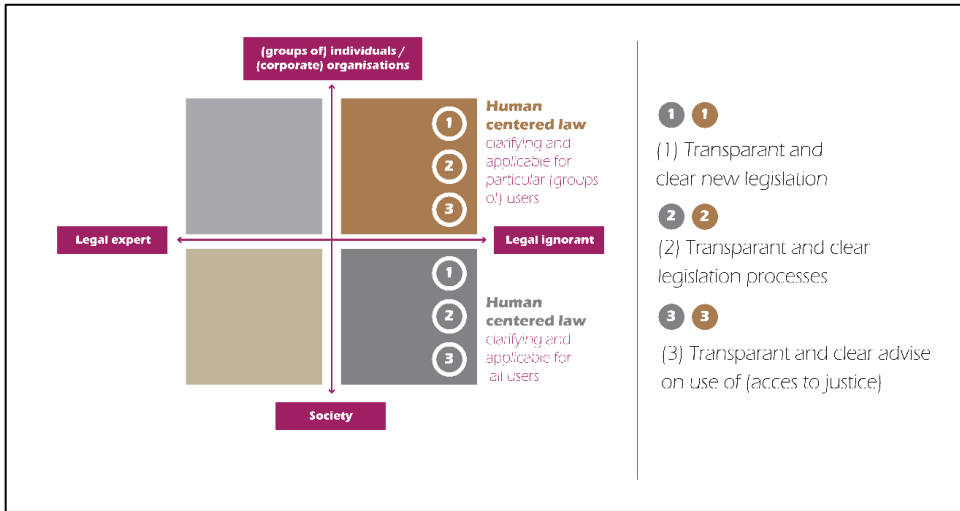


Fig. 2.2 Dynamics of communication legal information (Property of the author).

This will create an applicable and understandable legal message also for the more legally ignorant stakeholders. Strengthening of the need of involvement by the stakeholders can be expected as a result. As legal design aims to translate complex legal information into more human-centred, usable, and satisfying output, information design has proven the perfect tool.

This results in:

- New legislation that is transparent and clearly explained by legislative and administrative powers in society and applicable for all involved.
- Legislation processes become insightful and understandable and clearly explained by legislative, judicial and administrative powers in society and applicable for all involved.
- Access to justice explained in a transparent and clear way by judicial powers in society and applicable for all involved (see figure 2.3).



5. Conclusions

The added value of information design provides understandable and clear legal information for lay people in the legal practice and society in whole. The necessity of transparent and understandable legal information is more and more recognised in the legal field as does the value of legal design as a human-centred and multidisciplinary application to reach this goal. The complexity of the legal system is a serious treat for the democratic system as it causes citizens to feel less connected to the institutions that represent the rule of law. This can be untangled by the visual approach of information design when clarifying the legal information. As citizens need to gain confidence again to interact with their legal system and the rule of law, and therefore accepting the legal decisions following new legislation and legal actions, visual communication is an important asset to provide the much needed transparency of the provided information. Understanding and processing complex information benefits from a certain amount of visual language and makes the message for the often legally ignorant stakeholder applicable and understandable. Where legal design aims to translate complex legal information into more human-centred, usable, and satisfying output, information design is the perfect tool.

References

- Boivie, S., Bednar, M. K., Aguilera, R. V., & Andrus, J. L. (2016). Are boards designed to fail? The implausibility of effective board monitoring. *Academy of Management Annals*, 10 (1), 319-407.
- Centrale Raad van Beroep (2011). Vertrouwen in de democratische rechtstaat. Publieke bijdrage aan de viering van 200 jaar rechtelijke match in Nederland. Retrieved from Rechtspraak.nl.
- GlouDEMANS-VoogD, N. (2018). *Woord in beeld*, AB 2018.
- Keizer, E., Schut C. (2017). De meerwaarde van Legal design, *Houthoff Buruma Magazine*, 44-49.
- Haapio, H., Passera, S. (2013), Visual law: What lawyers need to learn from information designers. *Legal Information Institute*, VoxPopuLII.
- Hagan, M. (2017), *Law by Design*. Retrieved from <https://lawbydesign.co/>.
- Hagan, M. (2020), Legal Design as a Thing: A Theory of Change and a Set of Methods to Craft a Human-Centered Legal System. *Design Issues*, 36 (3), 3-15.
- Hegarty, M. (2011). The cognitive science of visual-spatial displays: Implications for design. *Topics in cognitive science*, 3 (3), 446-474.
- Hoeken, Hornikx, & Hustinx (2012), *Overtuigende teksten. Onderzoek en ontwerp*. Uitgeverij Coutinho.
- Huang, W., Eades, P., & Hong, S. H. (2009). Measuring effectiveness of graph visualizations: A cognitive load perspective. *Information Visualization*, 8 (3), 139-152.
- Louwerse, P. (2018), *Met legal design kun je zaken winnen*. Retrieved from mr-online.nl
- Meuwese, A.C.M. & van Weelden, L. (2022). Visuele wetscommunicatie, *RegelMaat 2022* (38), 116-133.
- Nelson, D. L., Reed, V.S., & Walling, J.R. (1976). Pictorial superiority effect. *Journal of Experimental Psychology Human Learning and Memory*, 2 (5), 523-528.
- OECD (2019). *Equal Access to Justice for Inclusive Growth: Putting People at the Centre*, OECD Publishing.
- Tan, K. H., & Platts, K. (2003). Linking objectives to actions: A decision support approach based on cause-effect linkages. *Decision sciences*, 34(3), 569-593.

The Water Cycle Project: visualising water balance. Designing a model for teaching data visualization

Enrico Bravi¹ (0000-0001-7826-4936)

¹New Design University, enrico.bravi@ndu.ac.at

Abstract. This paper presents the results of The Water Cycle Project (TWCP), an interdisciplinary project that took place during the summer semester of 2022, with the collaboration of undergraduate students from the Graphic and Information Design course at the New Design University in St. Pölten, all of which were attending the Data Visualization class (4th Semester).

Different tools and visual narratives were explored and adopted in order to communicate effectively the relevance of complex systems—such as water cycles—and visualize the results to stakeholders with different needs, in different locations. The visual display of quantitative information about water balance had the aim to best facilitate an understanding of our influence on the water cycle, so that the resulting awareness may support citizens and decision-makers in their progress towards sustainable solutions.

Furthermore, this paper attempts to offer a systematic look at the methodology used throughout the semester, an analysis which is warranted not only by the complexity of the subject matter and the correlated data, but also by the interdisciplinary aspects and the different actors involved in the project.

Keywords. Data visualisation / Water cycle / Mapping / Visualizing complexity

1. Introduction

The water cycle is a complex system that comprises several different processes: in brief, the system illustrates the continuous movement of water on, above (in the atmosphere), and below the surface of the Earth, relative to a certain region and period and including human influence on the system.

Nested within the global water cycle are the specific situations of any given region and time period. For instance, the water cycle moving-and being moved-through Central-Europe in a dry summer is different than the water cycle through Middle-East in a wet year, and different still than the water cycle through East Africa over the course of a decade. Humans are an intricate part, and a major driver, of how water cycle manifests itself: in many areas population growth, pollution, and human development determine the depletion of water supplies. Understanding this dynamics and our influence within it-both globally and regionally-empowers our capacity to address the challenges and opportunities presented to us on the path towards achieving sustainability and resilience.

Globally, agriculture represents the most significant area of human influence on the water cycle, accounting for 70% of global freshwater withdrawals (FAO, 2017). Along with household use and industrial water use, our lifestyles and consumption behaviours have the potential to compromise the quality and availability of water in those regions that are critical to food growth.

Climate change manifests itself in the water cycle. Water plays a central role in the planning for the mitigation of climate change and even our adaptation to it. Water security is also essential for all pathways of development and peace, and pivotal for achieving many of the *Sustainable Development Goals* (United Nations, 2022) developed by the United Nations—in particular Goal N. 6: *Ensure availability and sustainable management of water and sanitation for all*, but also supporting goals such as *Climate action* (N. 13), *Life on land* (N. 15), and *Responsible consumption and production* (N. 12).

2. Preamble

The remarkable spread of competences and skills across different disciplines makes information design an engaging area of research and teaching, but also a complex one. Pettersson et al. (2004) identifies three main areas of knowledge within information design: *Infology*, *Infography*, and *Infodidactics*. While the first two represent the theoretical and practical parts of the discipline, *Infodidactics* stands for “the methods used for teaching the various aspects of information design” (Pettersson, 2011).

It is, perhaps, in the very nature of information design to collaborate with other disciplines, which is why the adjective *interdisciplinary* is often considered as a *sine qua non*, a prerequisite for any information design project. On the other hand, the use of the term may appear far less obvious during the development of an educational activity, especially at the undergraduate level.

For this very reason, the type of methodology here employed should be one that can keep in mind at all times the issues connected with teaching and research, as well as the implications related to the involvement of an external (*third-party*) entity—be it a client, a content owner, or another kind of external partnership.

There are various facets in this type of collaboration that can be analyzed and multiple viewpoints that can be taken. From the onset of the project, one can identify three main actors: the students, the teaching staff, and an external partner institution. Each party has different needs and priorities: from the perspective of the outcome, for sure, but also from that of the process itself.

3. Didactical Approach

3.1 Semester Structure

During the summer semester of 2022, a group of bachelor students from the Graphic and Information Design course at the New Design University in St. Pölten attending the Data Visualisation class (4 th Semester) explored different visualization strategies in order to communicate data about the water cycle in different parts of the world, for various purposes and audiences.

With the scientific support of the IASA, the International Institute for Applied Systems Analysis—an independent international research institute located in Laxenburg—three different kind of basins and sub-basins around the world were selected: the Salzach Basin, part of the Danube Basin (Europe); the Lake Victoria Basin, part of the Nile Basin (Africa); the Bhima Basin, part of the Krishna Basin (Asia). The different sizes and conformations of the basins, as well as the variety of socioeconomic and climatic conditions, made a first level of understanding possible through a comparison—but they also offered a variety of topics and issues for discussion, specific to each area.

The selected basins were investigated throughout the semester at four different levels of analysis, in order to frame the complex subject matter properly and to offer different approaches depending on the type of data: Meta and Macro levels, mainly introduced the larger context of the main basins (Danube, Krishna and Nile)—first on a global/continental scale (Africa, Asia, Europe) and then on an international one; the Meso level, focused on the sub-basins (Salzach, Bhima and Lake Victoria) on a national and regional level; and finally the Micro level put the focus on smaller local areas within the respective sub-basins.



Fig. 1. Project Documentation (Tabloid Format), Covers, 2011 (Property of the author).

Students were divided in three groups, and each group of seven students was put in charge of analyzing one basin. All team members were asked to collaborate and communicate within each group, but also to share their progress, questions, reflections and achievements with the class. Different kinds of maps and visualizations were developed for each level of analysis by each group and student, making the process – and the entire learning experience – a personal and a collaborative one at the same time.

The choice of the newspaper format for the project documentation made it possible for the students to work from the very beginning of the project on the many design decisions connected to cartography, especially regarding scale. A basic layout template was made available for the students so that they could immediately focus on the visualizations.

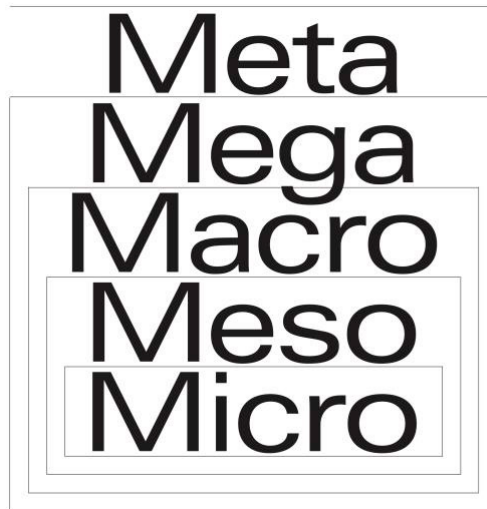


Fig. 2. The number of cycles in the model can potentially be either reduced or increased, in accordance with the level of complexity of the project, the available time, etc.

3.2 Level of Analysis

The different levels of analysis were examined one after the other, beginning from the largest (Meta) level, then moving on to the intermediate ones (Macro and Meso), and finally to the most detailed one (Micro). This idea of zooming in is a reference to the short documentary film *Power of Ten* directed by Charles and Ray Eames in 1977, based on the book *Cosmic View* by Kees Boeke, published in 1957. Zooming in on these areas made it possible for us to break down the different topics and the complexity of

the data to the four levels. Unlike the mentioned references, the scale used for TWCP is not fixed: it depends on the choice of each student in relation to the assigned basin. Each level of analysis was developed through an open, iterative process, with each new design decision entailing changes and updates to the previous levels. The complexity of the data was distributed throughout the four levels of the process—beginning with a low complexity dataset, then increasing the challenge— and it was also compensated by the degree of definition and the restrictions of the individual assignments. A glossary with selected scientific terms was collected to further support communications between students and scientists and ease the transfer of knowledge. While the first two levels of the analysis (Meta and Macro) allow for a comparison between the three watersheds and a gradual approach to their specific issues, from the students' perspective these also allowed them to gradually deal with a whole set of design-related decisions. These decisions were, in a sense, scaffolded: they would later become relevant once again for the more complex levels of analysis (Meso, Micro). Here, the necessary quantitative data was kindly provided by the open-source hydrological model *Community Water Model* (CWatM) developed by IIASA, which can simulate hydrology both globally and regionally at different levels of resolution, in order to explore how water demand will evolve in the future in response to socioeconomic development, and how water availability will change in relation to climate (Burek et al., 2020).

All team members were required to test and understand the transformation process turning data into its visual representation, which included varying degrees of ideation and understanding, as well as the application of knowledge about visual variables (Bertin, 2010; Roth, 2017) in the context of qualitative and quantitative data visualization and mapping.

The teaching method, based on a hybrid teaching model, included group activities and personal work, regular interactions and reviews with scientists, and guests lectures. A crucial role was played by a mid-semester workshop and excursion to IIASA in Laxenburg. Technical skills (QGIS, RawGraphs) and analytical skills (exploring quantitative data in spreadsheets) were key factors in the design development and brought the students out of the comfort zone of the traditional (standard) software used in the field.

Students were also asked to document the process leading to the final visualization. Short explanatory texts and captions have been included to sketch out the context, to underpin and explain the visual elements, and to prompt self-reflection on the personal design process.

4. Methodical approach

4.1 Methodical examples

Describing his proposal for a teaching model appropriate to information design, Pettersson (2011) defines four levels of production, each involving a review activity: analysis and synopsis, production of draft, production of script, production of original and master. This model generates a clear iterative structure of the process, which is then divided into *subprocesses*. Within these subprocesses, however, the specific key roles are not evident—or even taken into account.

The idea of a *concentric-cyclic process* as proposed by Nijhuis and Boersema (1999) reflects with a good degree of approximation the level of analysis (Meta, Macro, Meso, Micro) and the iterative structure designed specifically for TWCP. The authors identify five steps: *Analysis, Synthesis, Simulation, Evaluation, Decision*.

In their *Model Workflow of an Information Design Project*, Koponen and Hildén (2018) structure their work and divide the different phases of a project around the concept of *key role: content owner, information designer, implementer*. Although just part of the suggested model seemed to fit in the peculiarities of a didactic context, the notion of *key roles* was essential in order to define the final proposed model.

One last relevant example taken into account while designing the course was the ‘Data Visualisation Literacy Framework Process Model’ (Börner et al., 2019). The authors structure the workflow as a succession of six main steps: Stakeholders, Acquire, Analyse, Visualize, Deploy, Interpret. In the specific case of the TWCP, it was not possible to involve Stakeholders directly due to geographical and time constraints. Instead, IIASA researchers directly involved in the various projects took on this role, becoming at times intermediaries and, to all intents and purposes, a hybrid figure integrating the roles of content owner and Stakeholders. This ambivalence was not clear from the onset, and it certainly had an influence on the process.

4.2 Model description

Compared to the model offered by Koponen and Hildén (2018), in the instance here discussed the *key roles* have been updated due to the didactic and research context. Specifically, the figure of the *lecturer* has been introduced to act as a mediator between Information Design *students* and the *content owner*. As also stated by Pettersson (2011), the traditional role of the lecturer towards the class constantly changes, depending on the phase of the project: the lecturer acts as a supervisor and, sometimes, even as a co-worker of the students.

Building on the previously analyzed models, by extending and adapting some of the core concepts therein, four phases (*Acquire, Analyse, Visualise, Evaluate*) and six key steps were finally identified (Fig. 3):

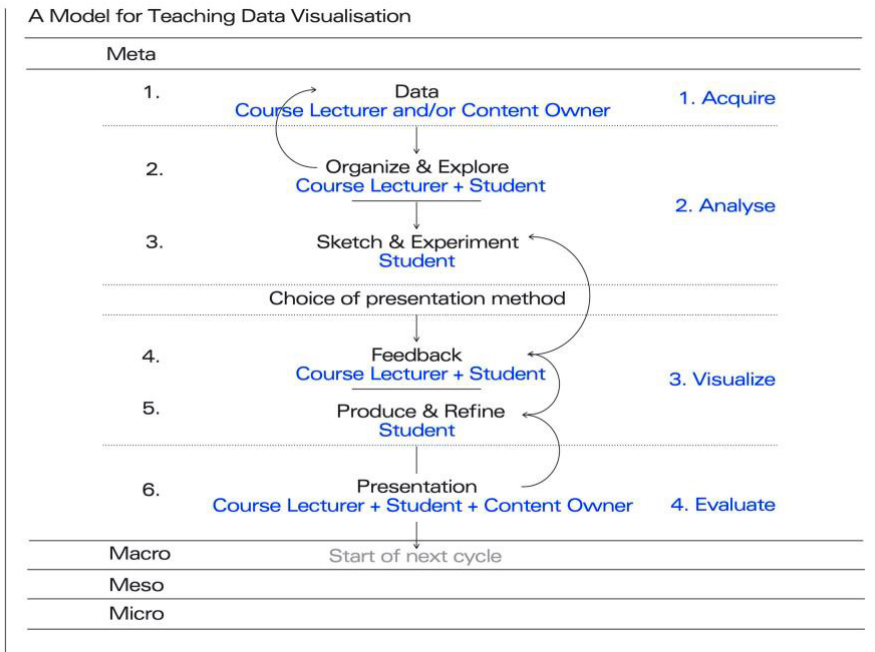


Fig. 3. Model for Teaching Data Visualisation, 2022 (Property of the author).

Acquire

The course *lecturer* and/or the *content owner* are in charge, on the one hand, of preparing the material for the different assignments, but even more importantly to structure and select the necessary knowledge the students require to engage with the data and the subject matter at large. Depending on the level of analysis, different strategies and degrees of preparation might be preferred. This also includes the students assuming an active role.

Analyze

One of the many challenges faced by the undergraduate students was dealing with vast amount of data (especially regarding the Meso and Micro Levels). Data cleaning and data aggregation were in part covered in phase 1 (*Acquire*), but just to the extent of facilitating the access to the data. Some of these tasks were shared within the individual groups and the class. (*Organize & Explore*) If necessary, the data at this stage can be sent back to the *content owner* for an update or correction, otherwise the *student* can move on to the next phase (*Sketch & Experiment*).

Visualize

After having tested several options trough analog sketches, the *student* chooses a presentation method, which is discussed as part of a revision phase (*Feedback*) with the *lecturer*. In the best case scenario, the student can now proceed to the next step

(Produce & Refine). If further adjustments are needed, the student returns to the previous step and reconsiders his or her choice of a presentation method.

Evaluate

As a final step, in order to validate the choices made and review the scientific validity of the visualization, the final result is presented to the content owner, to the lecturer and to the entire class. Depending on the outcome and complexity of the task, one or more iteration of step 5 (Produce & Refine) may be necessary before the student can move on to the next level of analysis and start a new cycle.

5. Conclusions

The Water Cycle Project is meant to facilitate communication and conversations between diverse groups, visualize the different water flows in different regions of the world, and provide a visual understanding of complex systems. The project also aims to grant citizens the tools they need to explore their local water cycle, specifically those areas where our influence can be seen as having a significant impact. A selection of the most compelling results of the course have been collected in a publication to document this collaboration and to share with a wider audience the effects and the challenges of research-led teaching practices in undergraduate courses—and, generally, the role of information designers when it comes to supporting the communication of complex topics.

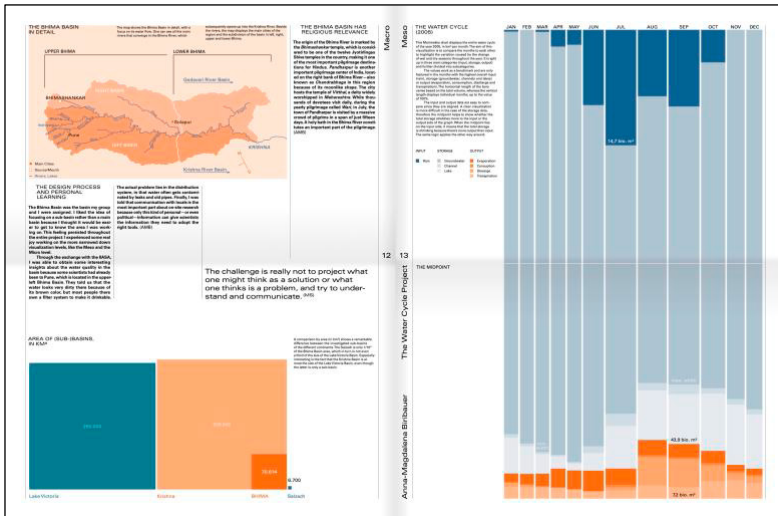


Fig. 4. Anna-Magdalena Biribauer, Bhima Basin Documentation (pp. 12-13), 2022.

The students, with no prior knowledge of the topic and just a basic information design background, were able to benefit a great deal from the teaching format and the

challenges and visual possibilities hidden in complex datasets. TWCP aims to encourage open dialogue and learning across disciplines, and between students and researchers, in order to successfully understand, visualize and communicate complex information.

Nevertheless, because of the nature of this collaboration, and the time and resources available to us, the outcome of the semester should be considered as an exploration of strategies more than an explanation of different processes; and the visualizations themselves should be seen as proposals for potential future visualizations rather than final and closed results.

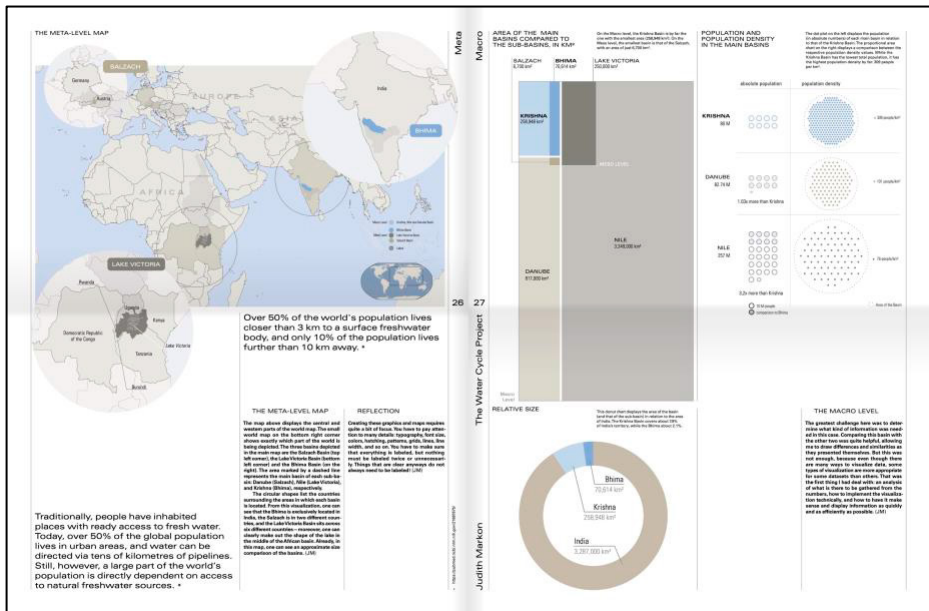


Fig 5. Judith Markon, Bhima Basin Documentation (pp. 26-27), 2022.

As revealed in a series of interviews, the exchange and dialogue between the students and IIASA researchers, was – together with a highly relevant topic – the best source of intrinsic motivation for the whole group and a key factor in the project's success. Future developments should be oriented towards the formulation of a pedagogical model, with a focus on linking teaching and research. In this sense, a comprehensive analysis of interpersonal and group-dynamics, based on a grounded theory model, could also make an important contribution for future multidisciplinary collaborations.

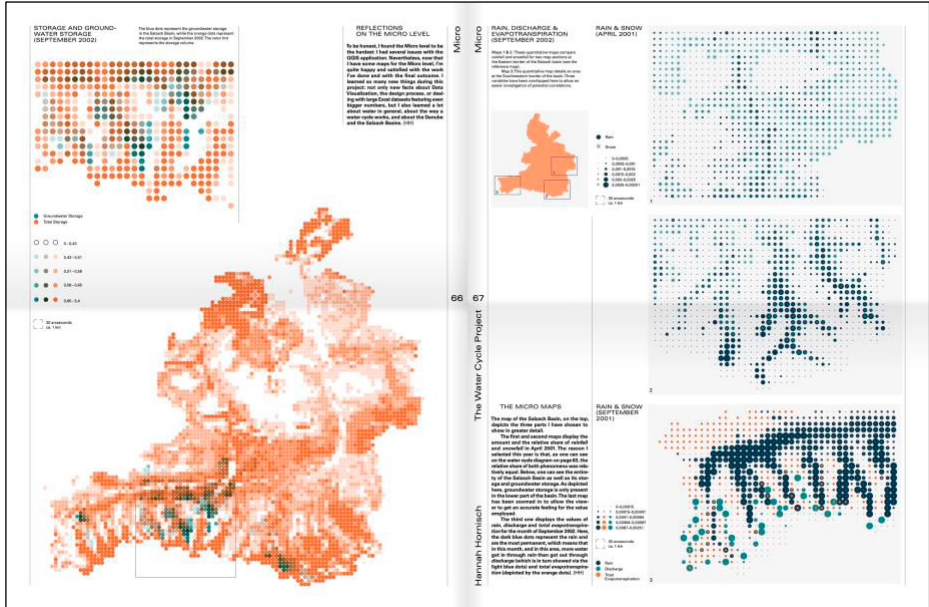


Fig. 6. Hannah Hornisch, Salzach Documentation (pp. 66-67), 2022.

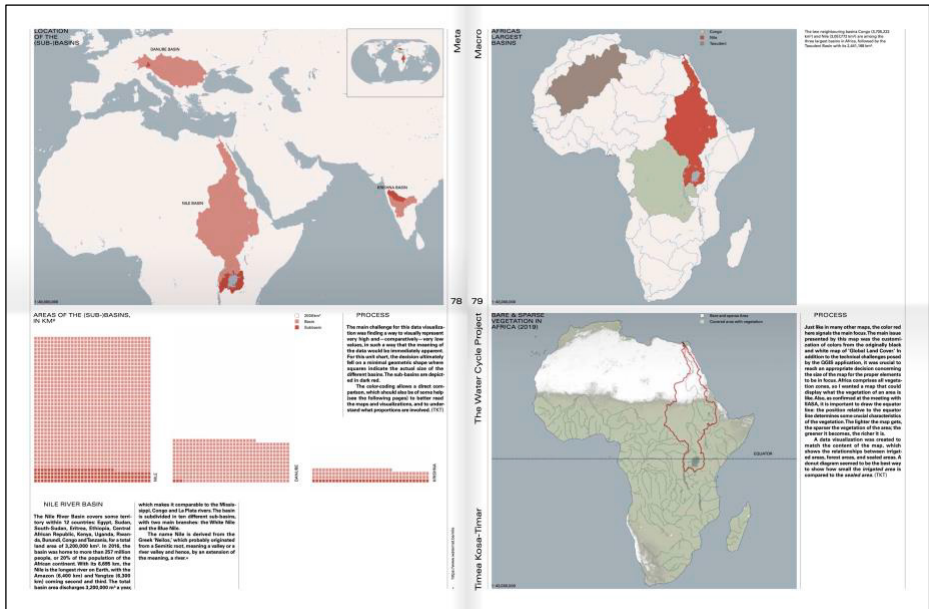


Fig. 7. Timea Kosa-Timar, Lake Victoria Documentation (pp. 78-79), 2022.

References

- Bertin, J. (2010). *Semiology of Graphics: Diagrams, Networks, Maps*. Esri Press.
- Börner, K., Bueckle, A., & Ginda, M. (2019). *Data visualization literacy: Definitions, conceptual frameworks, exercises, and assessments. Proceedings of the National Academy of Sciences*. 116 (6), 1857-1864. Retrieved from 10.1073/pnas.1807180116.
- Burek, P. , Satoh, Y., Kahil, T. , Tang, T. , Greve, P., Smilovic, M. , Guillaumot, L. , Zhao, F., & Wada, Y. (2020). Development of the Community Water Model (CWatM v1.04) – a high-resolution hydrological model for global and regional assessment of integrated water resources management. *Geoscientific Model Development*, 13 (7), 3267-3298. Retrieved from 10.5194/gmd-13-3267-2020.
- FAO (2017). *Water for Sustainable Food and Agriculture*. Retrieved from <https://www.fao.org/3/i7959e/i7959e.pdf>.
- Koponen, J. & Hildén, J. (2018). *Data Visualization Handbook*. Aalto University.
- Nijhuis, W. & Boersema, T. (1999). *Visual Information For Everyday Use. Cooperation between graphic designers and applied behavioural researchers*. CRC Press.
- Pettersson, R. (2011). A Model for Teaching Information Design. *Educational Technology*, 51 (4), 12-19.
- Pettersson, R., Andersson, C. & Köping Olsson, B. (2004). *Philosophy of Information Design Research Methods*.
- Roth, R. (2017). Visual variables. In Richardson, D., Castree, N., Goodchild, M.F., Kobayashki, A., Liu, W. & Marston, R.A. (Eds.), *The International Encyclopedia of Geography*, 1-11. John Wiley & Sons, Ltd. Retrieved from 10.1002/9781118786352.wbieg0761.
- United Nations (2022, March). Retrieved from <https://sdgs.un.org/goals/>.

Resisting the Algorithm or Chart-junk? Field mapping cultural history using visual metaphor

Ian Mitchell¹ (0000-0001-6184-0271)

¹Liverpool School of Art and Design, Liverpool John Moores University,
i.mitchell@ljmu.ac.uk

Abstract. UK designers Dorothy have been mapping the history of music culture through their Blueprint series for 10 years. These prints all use a visual metaphor as a structural framework, an approach which can be critiqued as placing artistic preference over informative design. Yet recently their blueprint model has been appropriated by Google Culture and Arts as the interface to an immersive online exhibition *Music, Makers & Machines*, suggesting a subjective and authorial approach to mapping cultural history which is not only valid but may warrant critical examination. Bourdieu's Field Theory provides one such critical lens through which to examine visual maps and conceptual diagrams of this type, having been adapted by academics to present interesting ways to visualise in two dimensions the (often) complex mapping of people, artefacts, spaces and organisations across space, time, and concepts. This paper presents a reflexive exegesis of the design of Dorothy's Blueprints, placing their work in the context of a history of visual mapping and conceptual diagrams, whilst exploring and repurposing ideas related to Bourdieu's field theory as tools to further the visual analysis of their work, and is supported by interviews with Dorothy's designer-in-chief.

Keywords. Info-graphics / Field Theory / Mapping Culture / Conceptual Diagrams

1. Introduction

UK designers Dorothy have been mapping the history of music culture through their Blueprint series for 10 years. Their prints have grown from the relatively simple presentation of loosely grouped genres charting a few hundred electronic music artists to the more complex visual mapping of the history of dance music culture – drawing the dots between scenes, sub genres, clubs, record labels, artists and moments spanning 50 years and many continents. Although their posters are primarily commercial artworks, designed and sold for their aesthetic quality, they employ a model for mapping cultural history which can be examined from an academic perspective.

Since 2017 I have collaborated with Dorothy's designer-in-chief, Jim Quail, on the research and design of their *Acid House Blueprint*, its new editions, and associated projects. Up until this point, Jim had worked alone, as researcher, author, and designer. The posters were his babies, and his process was his own. The collaboration uncovered several concerns, which from the role as an academic required further critical examination and explanation, specifically:

1. The strengths and weaknesses of using visual metaphor as a creative framework.
2. The issues of narrating the entangled history of a cultural scene which is hybrid in its very nature where most things are linked in some way to everything else.
3. The significance of the authorial role of the designer of these maps in comparison to more objective data-driven visualisation?

2. Methodology

The approach to presenting an exegesis of Dorothy's blueprints is two-fold:

1. The blueprints can be situated within the context of a rich history of visual mapping and conceptual diagrams, and it is important to acknowledge this to draw comparisons and provide a historic underpinning for further analysis.
2. There are several ideas and tools that can be borrowed from cultural and social studies to analyse the design of the blueprints, such as field theory from sociology, entangled history from historiography and the rhizome model from cultural theory.

It is important to stress the reflexive and retrospective nature of this approach. I have a professional interest in the success of the work which does question my position as an objective researcher, and there is a risk of post rationalising the work to an extent that may present false narratives. However, collaborating closely with Dorothy has given me an insider's perspective, and privileged access to sources (Dorothy's process, opinions, and original artwork) which otherwise would have been difficult to uncover or use.

3. Exegesis

3.1 Visual metaphor

Formally Dorothy's blueprints all use a circuit diagram associated with the music or culture as a visual metaphor and a structural framework for the mapping to follow. A diagram of a theremin is used for electronic music; an early transistor radio for alternative music; a guitar amplifier for rock and roll and a turntable for hip-hop. And in the case of the Acid House Blueprint (Fig. 1) the circuit diagram of the Roland TB-303 synthesiser (Fig. 2) that was responsible for the squelchy bass sounds that characterise the music. The visual metaphor also acts as a reinforcing signifier of the conditions required for a culture to establish and reproduce: "The circuit is dependent on all the components coming together at just the right time - in the right order." (Quail, 2018)

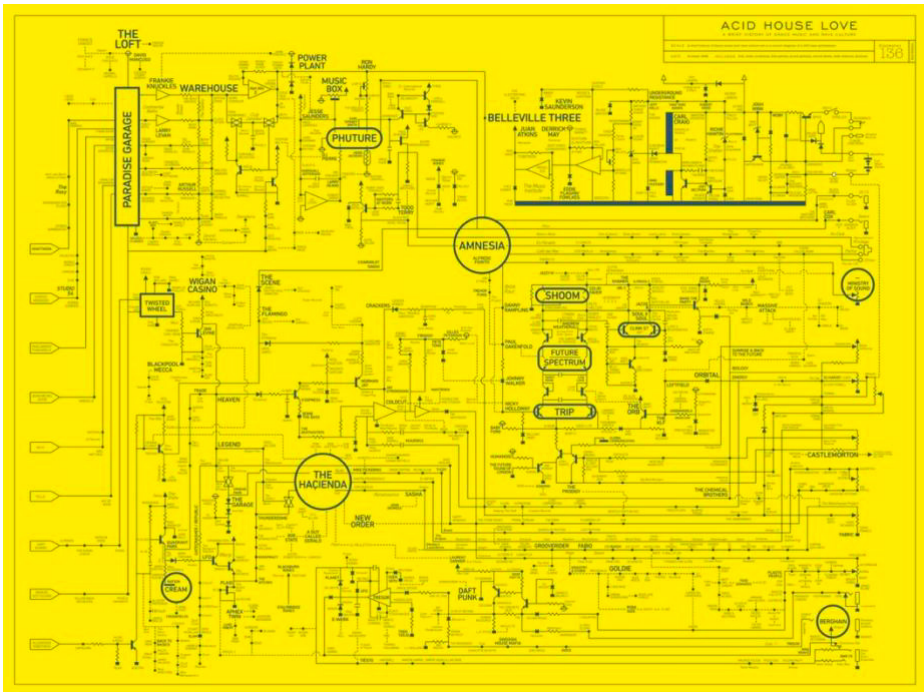


Fig. 1. Quail, J & Mitchell, I, Acid House Love Blueprint, Dorothy, 2018.
(<https://www.wearedorothy.com/collections/blueprints/products/acid-house-love-blueprint-a-history-of-dance-music-and-rave-culture-special-edition>).

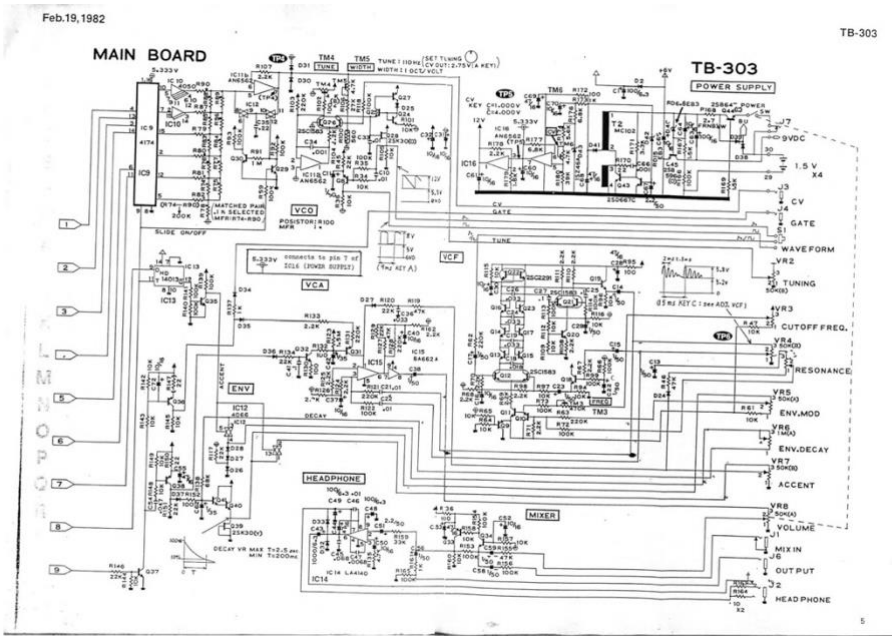


Fig. 2. Roland, Roland TB-303 Circuit Board Diagram, Roland TB-303 Service Notes, 1982. (<https://archive.org/details/synthmanual-roland-tb-303-service-notes/page/n3/mode/2up>).

However, the use of visual metaphor to present information and data can be considered problematic by some. The approach has been critiqued as contrived and restrictive, placing artistic preference over informative design by information design critics such as Tufte (2001), who disparagingly calls the outcomes of this practice “chart-junk”. In defence of Dorothy’s approach their prints are presenting qualitative information rather than quantitative data. The organisation of this information into diagrammatic form is highly subjective. No two people would map a subject the same way. In fact, this subjective nature is central to the use of other mapping practices such as the perceptual diagrams used in marketing and advertising.

3.2 Historic context

In the art world the interconnected flow of art movements is often visualised in diagrammatic form, from Barr’s much referenced chart of modernist art history for MoMA’s *Cubism and Abstract Art* exhibition catalogue, to the same museum’s more recent interactive diagram for their show *Inventing Abstraction: 1910-1925*. These two examples (Barr, 1936 and MoMA, 2013) present a contrasting approach to the visualisation of similar information. Barr’s original visualises the history in the form of an evolutionary tree diagram, whilst the contemporary visualisation renders the data as an interactive network.

Evolutionary tree diagrams have been used for centuries in western culture to characterise knowledge as linear, centralised and hierarchical. An approach codified in the 'Figurative system of human knowledge' in Diderot's *Encyclopédie* (1752) which shows knowledge organised into three main branches: memory, reason, and imagination. This approach has been repeatedly used through-out the 20th Century to chart the historic development of creativity; for instance, Jencks (1986, p.23 and p.37) and Maciunas (1966).

Similar approaches have been taken to chart the field of music, from Pete Frame's *Rock Family Trees* to Jeremy Deller's art piece *The History of the World* (1997). Frame's *Rock Family Trees* focus on the lineage of the traditional rock music unit of band line-ups. They are hierarchical and linear and restricted to representing musicians as players within a narrow field. Deller's diagram at first looks the simpler, appropriating the visual language of a scribbled mind map rather than a virtuoso piece of art. However, the text that accompanies the artwork reveals there is much more going on.

"I drew this diagram about the social, political and musical connections between house music and brass bands – it shows a thought process in action. It was also about Britain and British history in the twentieth century and how the country had changed from being industrial to post-industrial. It was the visual justification for Acid Brass. Without this diagram, the musical project Acid Brass would not have a conceptual backbone." (Deller, 1997)

The metaphor of the mind map gives Deller the opportunity to produce a non-linear, decentralised, and non-hierarchical network diagram, which makes connections between artefacts and players across fields of power and culture.

3.3 Entangled history

Deller's art piece can be viewed as an expression of entangled history (Bauck, Sönke, & Maier, 2015) – where cultural works are understood as resulting from entanglements between socio-political and artistic discourse – in this case acid house and brass bands and everything in between. The term describes an approach to history where everything is considered connected, culture is hybrid and reciprocal, and where everything is influenced by everything else. In historiography entanglement is the rejection of a European and Imperialist point of view in favour of "a trans-cultural perspective". (ibid.)

Although there are significant differences in the motivations and objectives of Dorothy's and Deller's work, similarities can be found. Dorothy's network approach has the potential to chart society and social difference, which is one of the main concerns of field theory – and a lens through which visual maps and conceptual diagrams can be further examined.

3.4 Field Theory

Proposed by French sociologist Pierre Bourdieu, field theory is a way of graphically mapping social fields to explain how members of different social classes may relate to culture. In *Distinction: A Social Critique of the Judgement of Taste*, Bourdieu sets the scene for the broader practice of mapping culture visually in diagrammatic form:

“The mere fact that the social space described here can be presented as a diagram, indicates that it is an abstract representation, deliberately constructed, like a map, to give a bird's-eye view, a point of view on the whole set of points from which ordinary agents (including the sociologist and his reader) see the whole world. Bringing together in simultaneity, in the scope of a single glance – this is its heuristic value – positions which the agents can never apprehend in their totality and their multiple relationships” (Bourdieu, 1984, p.93)

His basic methodology has been adapted by academics as tools to understand and chart a variety of other cultural or artistic production within the fields of media and journalism (English, 2016), the alternative press (Baines, 2016), visual art (Grenfell & Hardy, 2003) and the music industry (Cooke, 2020).

Although these field mappings prioritise sociological or ethnographic concerns and rarely consider the visual maps as the outcome or conclusion to their research, they do present interesting ways to visualise in two dimensions the often-complex mapping of people, artefacts, spaces and organisations across space, time, and concepts. For instance, Grenfell & Hardy (2013) in their mapping of the Young British Artists (YBAs) use an approach derived from Bourdieu's *The Rules of Art* (1996) to present both multiple timeframes and contexts in the same diagram – also a key feature of Dorothy's blueprints.

Grenfell and Hardy (2003) outline a three-step methodology to map cultural fields, which has informed the analysis of the blueprints and the deconstruction of the design process:

- The Logic of the Field;
- Mapping the Field;
- Insider accounts as data.

To understand the logic of the field, one must define its underlying structure – often using a two-axes scatter chart, like the perceptual maps already mentioned. At first glance, the *Acid House Blueprint* doesn't use 2-axes, instead using the circuit diagram structure. However, there is a loose timeline that can be overlaid along the diagonal axis, with a further axis exploring points in time that does show some similarity in form to Bourdieu's and Grenfell & Hardy's structure (Fig. 3). This timeline also reflects a generalised history of the culture that in isolation can be critiqued as reductive and linear when the reality is messier and more nuanced – or perhaps “entangled” to use

historiography's term. However, this dominant narrative needs to be acknowledged as it exerts such influence on the logic of the field at the macro level.

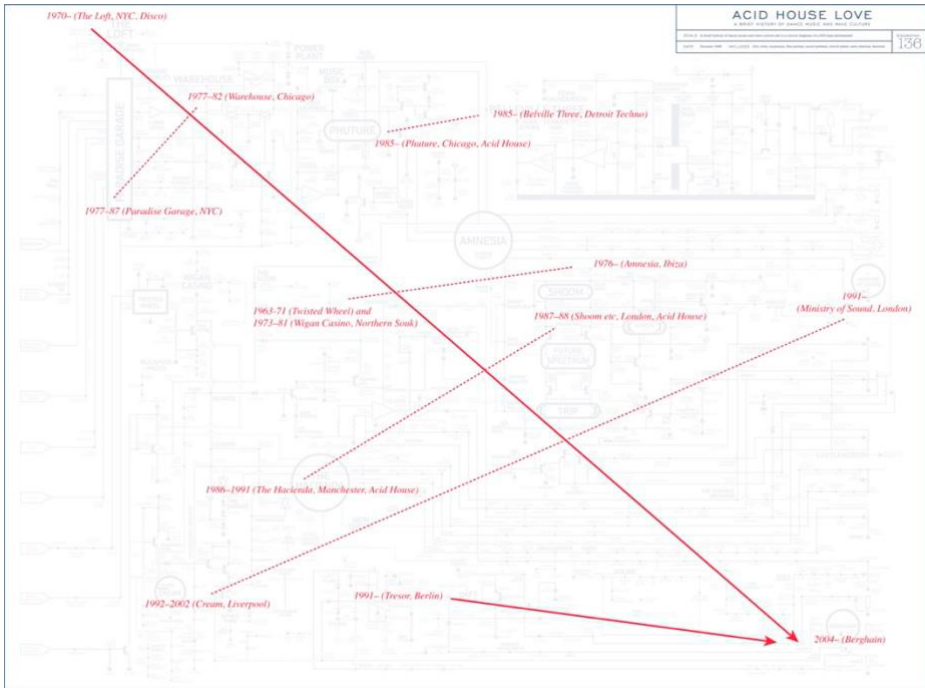


Fig. 3. Mitchell, I, Acid House Blueprint, temporal (diachronic and synchronic) structure, 2022.

Mapping the field is in fact done at three levels: the macro, the mezzo, and the micro. The first macro level is concerned with mapping the field of power. In Grenfell & Hardy's example this level maps the fields of culture, commerce and politics related to the YBAs. Analysing the *Acid House Blueprint*, the fields of power are an extension of the logic of the field, such as genres and geographic locations, rather than the politics, economics, and external social forces. However, there is some power at play. These genres and geographic fields are anchored mainly by clubs – the sites where the culture is played out – rather than artists. On the blueprints these anchors tend to be placed in circles or rectangles – the form for electronic transistors in circuit diagram language. This was an intentional break in approach from Dorothy's other blueprints where the macro level is defined exclusively by artists. This allowed the mezzo and micro levels to be defined by the people that participated at the grass roots – the clubbers and the network of local DJs and club nights. Layering this visual analysis into one diagram (Fig. 4) shows some complex stuff going on at this macro level in the *Acid House Blueprint*, despite Dorothy's limited awareness of it at the time of creation.

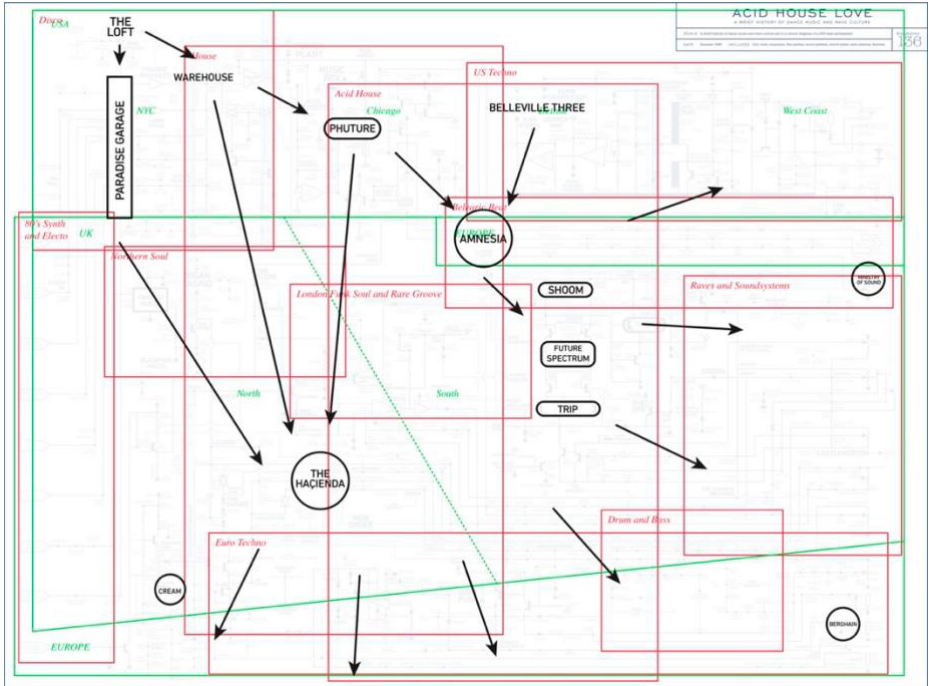


Fig. 4. Mitchell, I, Acid House Blueprint, macro level fields, 2022.

Mezzo level mapping is more obviously aligned with Dorothy’s conscious approach. This process was primarily intuitive and reflexive and done by trial and error. What might be called heuristic in academic speak. The process was underpinned by my prior knowledge and lived experience – the clubs, events, and venues I experienced first-hand, and the records I bought at the time, with the gaps filled in by extensive reading and research. Each item was researched further by Jim to inform the translation of the research onto the circuit board framework. Fig. 5 illustrates the process of mapping the history of Northern Soul, from the macro anchor of the club (Twisted Wheel) through the mezzo level of key DJ’s and artists and the other clubs and people who were influenced by or surrounded them to the small details or insider stories. In the case of Northern Soul, it’s the three songs that were always played at the end of the night at Wigan Casino, known as the “3 before 8”. These micro narratives are important features of the blueprints. They are the things that only mean something to you if you were there. Only a few people might pick up on them, but they show that Dorothy has done its research. They also help flatten out the hierarchy of the mapping, placing things at the periphery in the same field of vision as key players.

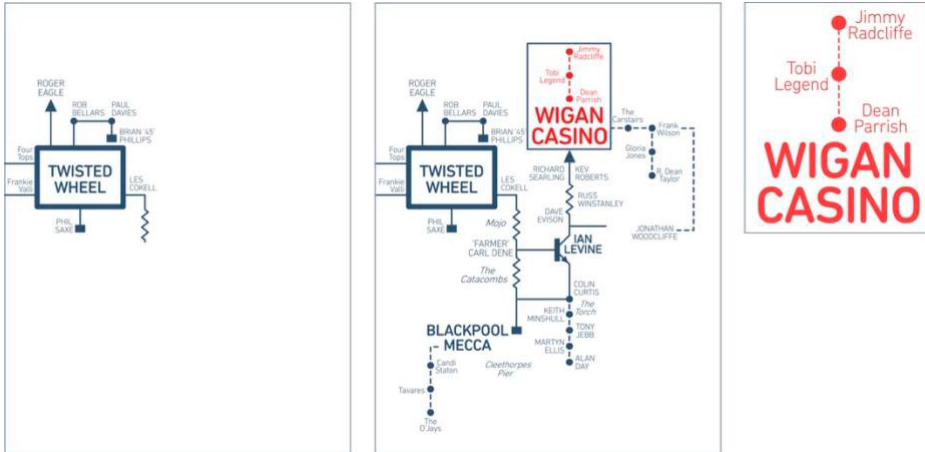


Fig. 5. Mitchell, I, Acid House Blueprint, from macro to mezzo to micro level details, 2022.

3.5 Habitus

The micro level introduces one of field theories key concepts – the habitus of the agents and players. An individual’s habitus depends on various factors such as social class, education and past choices that influence their ways of thinking and behaving (Bourdieu, 1984, 1992 & 1996). This reveals the sociological origins and concerns of field theory. These factors have not been considered whilst producing the blueprints. However, there are factors that can signify habitus for this culture that could be used to inform the mapping, such as longevity, impact at the time, influence, scope, and commercial success. Crucially these can all be measured – some objectively (by units sold, chart position etc.), or a subjective value can be assigned to them. These metrics could then determine the scale of items in relation to each other, which is a feature of the blueprints that often lead to questions from the audience – e.g., why is Orbital set in a larger point size than The Chemical Brothers?

When questioned about this Dorothy are very clear – the simple choice of what point size to set an artist in is a key curatorial decision based on a range of subjective value judgements. Importantly the authors of the Acid House Blueprint (Jim and I) are the unseen agents in this map, who have our own dispositions and relationship with the field – our own habitus.

There are other features that could be used as a signifier of the habitus of artists. For instance, the distribution of artists whose practice places significance on a specific production value such as a bass sound; or artists who used the acid house sound of the 303 synthesiser (Fig. 6). Both show how entangled the culture can be.



Fig. 6. Mitchell, I, Acid House Blueprint, production factors influencing the habitus of artists within the fields, 2022.

3.6 Rhizomes

The field is not the only model for mapping culture that is so entangled and potentially dynamic depending on viewpoint. The rhizome, as defined by French theorists Deleuze and Guattari (1987), is one such model.

“As a model for culture, the rhizome resists the organizational structure of the root-tree system which charts causality along chronological lines and looks for the original source of ‘things’ and looks towards the pinnacle or conclusion of those ‘things.’ A rhizome, on the other hand, ‘ceaselessly established connections between semiotic chains, organizations of power, and circumstances relative to the arts, sciences, and social struggles.’ Rather than narrativize history and culture, the rhizome presents history and culture as a map or wide array of attractions and influences with no specific origin or genesis, for a ‘rhizome has no beginning or end; it is always in the middle, between things, interbeing, *intermezzo*.’ The planar movement of the rhizome resists chronology and organization, instead favouring a nomadic system of growth and propagation.” (Deleuze and Guattari, cited in Heckman, D, 2002)

The idea of any map of culture being just a snapshot, one layer of a greater body, which could be re-configured in different contexts, resonates with our emerging understanding of the model of the blueprints.

A traditional reading of the map would suggest that clubs and artists that are positioned a great distance from one another would have little in common. Yet there are connections, which a rhizomatic form can resolve, with the connections folding the map in on itself (Fig. 7). Any one of the points can be moved into the centre. In this case the Berlin club Berghain which is very much at the centre of the current club culture. The map can then be rebuilt around it, somewhat like the alternative versions of maps of the world which place China and East Asia at the centre. Both uncover the

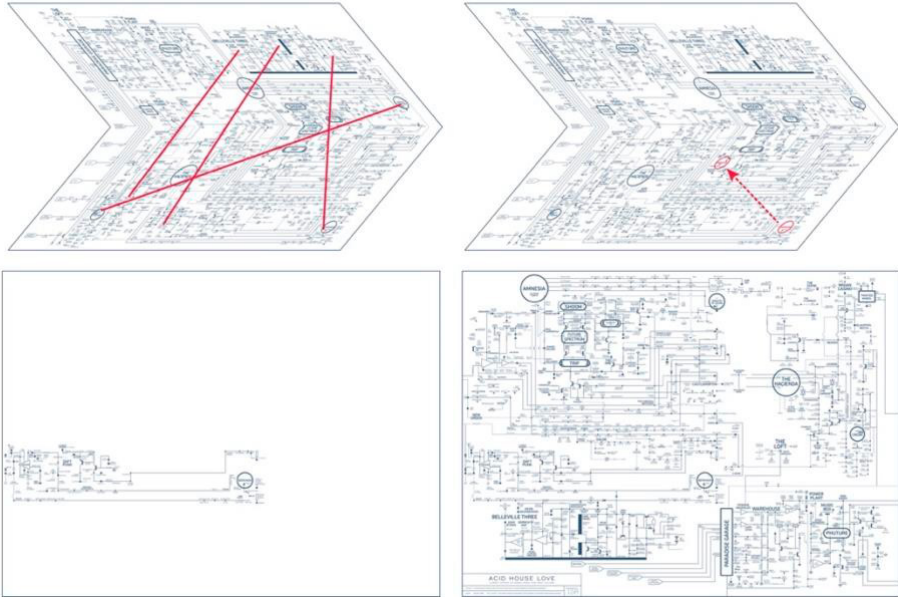


Fig. 7. Mitchell, I, Acid House Blueprint, rhizomatic re-centering of the field, 2022.

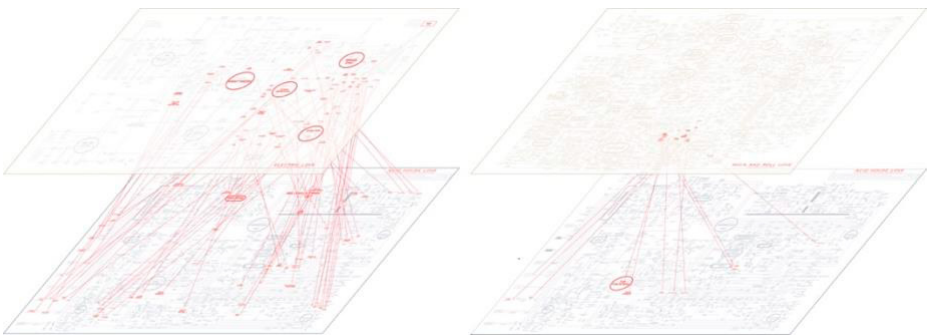


Fig. 8. Mitchell, I, Acid House Blueprint, rhizomatic traversing of the field, 2022.

myth that maps provide an objective and scientific depiction of our world, whether physical or conceptual.

Fields can also be traversed in rhizomatic form. Fig. 8 visualises all the items on the acid house print that are also on the other blueprints. Viewing the blueprints in this way can draw out some of the deeper issues the maps may present for different readers – for instance a musicologist may be able to take insight from these visualisations.

4. Conclusions

The retrospective and reflexive nature of much of this analysis can feel self-indulgent, but there are conclusions to be shared.

Circuit diagrams are a known visual language that has symbolic value in popular music culture and the broader context of network mapping. Its framework of simplified possibilities helps us make sense of the complexity of connections. By forcing us to abstract the information in this way hierarchies are flattened, and micro narratives are brought together in the same field of vision as the dominant players – a modest contribution to the practice of entangled histories.

A data driven approach does have potential. This was explored by Dorothy in their *ClubTogether* (2019) installation that used an interactive map to crowdsource other people’s memories of club culture. The information that was gathered has informed subsequent editions of the Acid House Blueprint and a spin-off Liverpool version. When asked to develop a print about a very local scene in and around Blackburn in 1989 objective metrics were used to assign value to individual tracks that were heard at these events, which could then inform positions on a timeline. But ultimately, Dorothy never wants to relinquish its control on making curatorial decisions on what and how things go on the maps. That is their value. Despite their informative surface qualities, they are deeply personal works.

Tellingly Dorothy’s blueprint model was appropriated in 2020 by Google Culture and Arts as the interface to a brief history of dance music for an online exhibition *Music, Makers & Machines* (Fig. 9). Its use by one of the world’s biggest exponents of automated data harvesting felt something of a validation of Dorothy’s analogue approach.

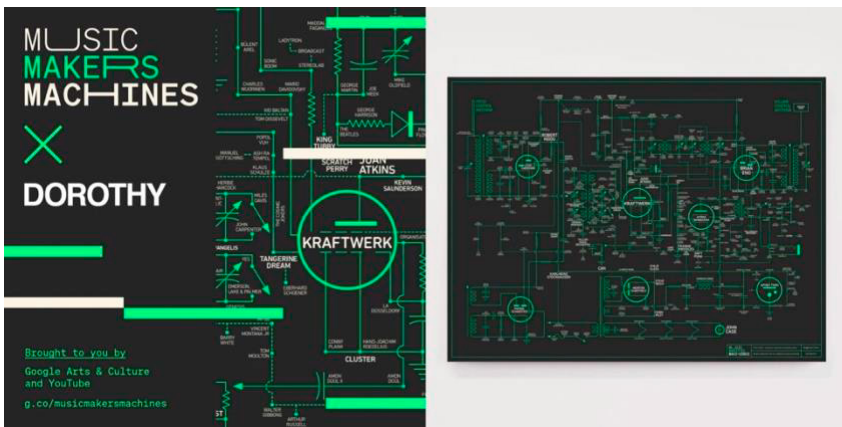


Fig 9. Dorothy and Google, Music Makers Machines, website interface, Google Arts & Culture. (<https://artsandculture.google.com/project/music-makers-and-machines>).



Fig. 10. Acid House Blueprint, representation of women and men, 2022 (Property of the author).

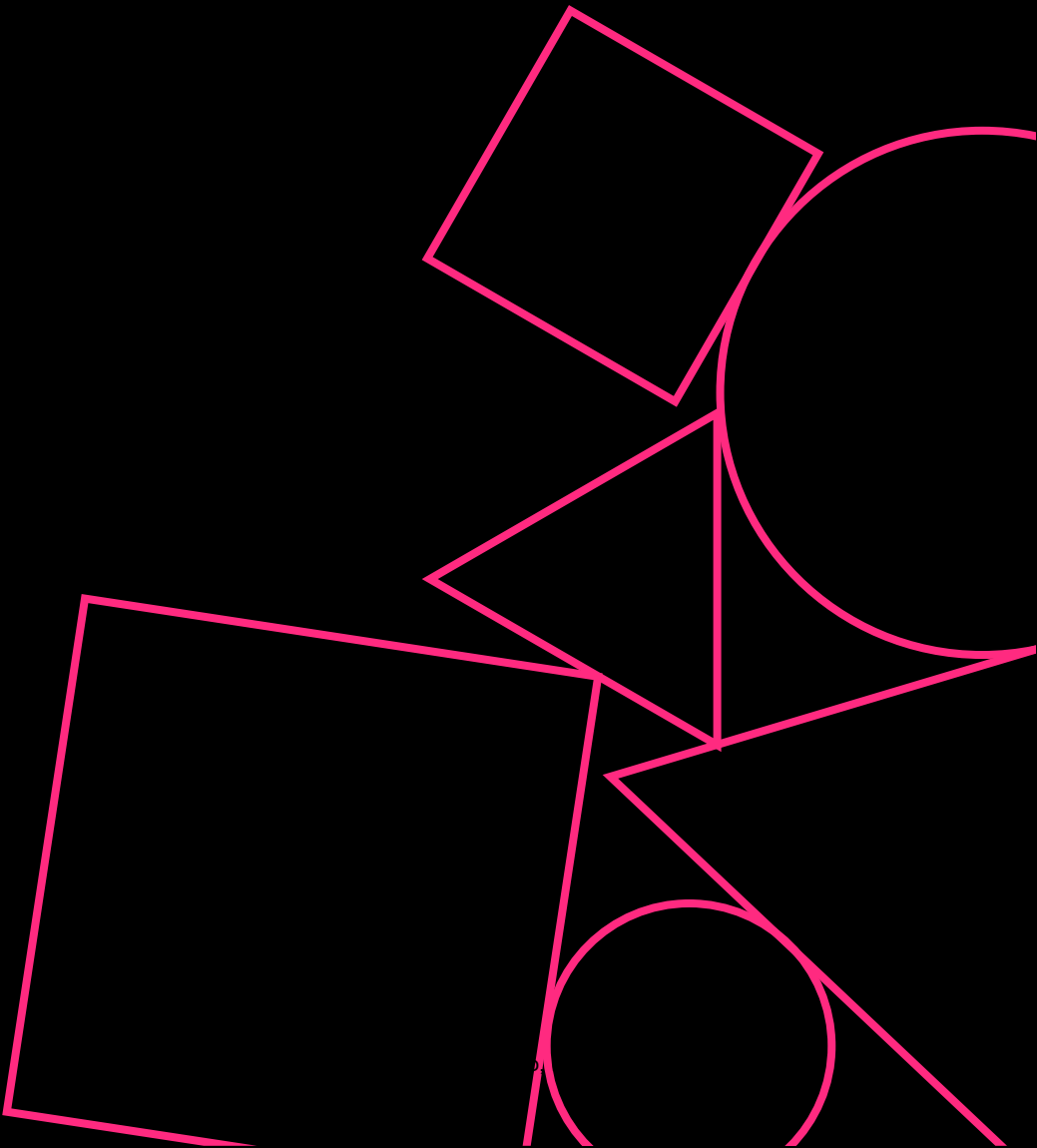
The interpretations of the cultural theories used to analyse the maps are just that – interpretations – and may not stand up to scrutiny by a sociologist or cultural theorist, however, from a personal and reflexive perspective, they have been useful in helping to understand certain features. First it revealed what Dorothy (James and I) did intuitively. Secondly it suggested ways to read the maps and their potential as learning tool. For instance, Fig 10. maps the representation of women and men across the cultural field. A similar analysis of the representation of people of colour, or more nuanced gender representation and inclusion could be explored – but would need far greater research. Finally, it has challenged us to explore more methodological approaches, whilst offering lots of justification to remain loyal to our subjective and intuitive process.

References

- Baines, J. (2016). *Democratising Print? The Field and Practices of Radical and Community Printshops in Britain 1968-98* (Publication No. 10613037) [Doctoral dissertation, London School of Economics]. ProQuest Dissertations & Theses Global.
- Bauck, S., Maier, T. (2015). Entangled History. *InterAmerican Wiki: Terms - Concepts - Critical Perspectives*. Retrieved from <https://uni-bielefeld.de/einrichtungen/cias/wiki/e/entangled-history.xml>

- Barr, A. (1936). *Cubism and Abstract Art. [Exhibition catalogue] MoMA*. Retrieved from <https://www.moma.org/calendar/exhibitions/2748>
- Bourdieu, P. (1984). *Distinction: A Social Critique of the Judgement of Taste. Translated by R. Nice*. Harvard University Press.
- Bourdieu, P. (with L. Wacquant). (1992). *Réponses*. Seuil.
- Bourdieu, P. (1996). *The Rules of Art: Genesis and Structure of the Literary Field*. Polity Press.
- Cooke, N. (2020). *Mapping the Field of Electronic Music* [Unpublished doctoral dissertation]. School of Arts and Cultures Newcastle University.
- Deleuze, G., Guattari, F. (1987). *A Thousand Plateaus. Translated by B. Massumi*. University of Minnesota Press.
- Deller, J. (1997). *The History of the World. [Artwork]*. Retrieved from <https://www.jeremydeller.org/TheHistoryOfTheWorld/TheHistoryOfTheWorld.php>
- Dorothy (2019). *Club Together. [Artwork]* Retrieved from <https://clubtogether.me>
- Dorothy (2022). *Blueprint. [Artworks]* Retrieved from <https://www.wearedorothy.com/collections/blueprints>.
- Dorothy and Google (2020). *Music Makers Machines. [Website]* Google Arts & Culture. Retrieved from <https://artsandculture.google.com/project/music-makers-and-machines>.
- Frame, P. (2022). *Rock Family Tree [Artworks]* Retrieved from <https://rockfamilytrees.co.uk/>.
- Grenfell, M. and Hardy, C. (2003). Bourdieu and the Young British Artists. *Space & Culture*, 6(1), 19-34.
- Heckman, D. (2002) "Gotta Catch 'em All: Capitalism, the War Machine, and the Pokémon Trainer" *Glossary, Rhizomes, Issue 5, Fall 2002*. Retrieved from <http://www.rhizomes.net/issue5/poke/glossary.html>.
- Jencks, C. (1986) *What is Postmodernism?*. Academy Editions.
- Quail, J. (2018, June 8th). *Love Maps. [Conference presentation] 2CO Everyday*. Liverpool School of Art & Design.
- Maciunas, G. (1966). *Fluxus. (Its historical development and relationship to avant-garde movements). Diagram No. 1-2. [Artwork]*. Retrieved from <https://artpool.hu/Fluxus/Maciunas/fluxdiagram.html>.
- MOMA (2013) *Inventing Abstraction: 1910-1925*. Retrieved from <https://www.moma.org/interactives/exhibitions/2012/inventingabstraction/?page=connections>
- Tufte, E. (2001). *The Visual Display of Quantitative Information*. Graphics Press.

1.2 Informative animation



Anthropophagic design: memes and Brazilian pop culture

João Paulo Amaral Schlittler¹ (0000-0001-9097-9440)

¹Faculty of Architecture and Urbanism/School of Communications and Arts, University of São Paulo, joapaulos@usp.br

Abstract. Brazilian culture consists of a myriad of influences: indigenous, colonialists, imperialists, slaves and immigrants have blended for centuries into what Oswald de Andrade, a Brazilian modernist author, defined as “Cultural Anthropophagy”. A term that, even having been coined one hundred years ago, continues to permeate Brazil's contemporary techno-cultural habitat. Brazilian pop culture is undoubtedly shaped by the media business, however it continues to draw from cannibalistic re-appropriations, evidenced by the global viral repercussion of Brazilian memes. This research aims to explore how motion graphics and animation can reappropriate foreign culture while maintaining local identity in a global digital network and therefore visually convey complex information through vernacular forms of visual language.

Keywords: Memes / Vernacular Design / Pop Culture / Animated GIFs

1. Introduction

In a certain sense, this article connects a mismatch of ideas that have surfaced from research that I have been conducting in recent years. What may seem as a patchwork of interests, can be strung together in order to establish a framework situating animation and motion design practices in the context of digitally connected contemporary pop culture. Today it has become commonplace for Information to be virally mediated in a contemporary societal condition defined by Kazys Varnelis as a *networked culture* (Varnelis, 2008). More specifically, I feel challenged to comprehend how local Brazilian cultural identity is represented in animated imagery that has become a ubiquitous form of representation.

Ultimately, I would like to address socially responsible design practices in contemporary society: a scenario immersed in artificial intelligence agents, synthetic pleasures and radical political and economic shifts that affect us on a global scale. As we begin to comprehend these changes in a world that emerges from a global pandemic, facing uncertainties caused by nationalistic wars, climate change and emerging biological and digital viruses, some questions arise: Are we only apparently removing our masks? Are we still attached to our previous faces? Are we facing a completely different reality regarding how we communicate? Hence my interest in the role of contemporary pop culture in audiovisual design, as I believe that moving

images are a very effective form of communication, carrying the power of elucidating complex concepts and information.

Brazil, and I would risk saying, that pretty much everywhere in the world is dealing with political and economic agents that adopt misinformation tactics as a method of obtaining and remaining in power, with dire consequences to society. In my training as an architect I came to value immensely the importance of designing public spaces that welcome interaction and promote democratic coexistence. Service designers can be understood as architects of networked spaces housing our digital existence, therefore the social aspects of design applied to media environments have become paramount and have the power to promote change in a positive way. While global economic powers overcast nation states, local economies and cultural legacies gain more and more importance as an alternative to dead end unsustainable environmental and social policies. Educational strategies that can empower individuals and communities must incorporate collaborative methods and represent diversity. For this reason I suggest that information and motion designers can create very rich experiences by drawing from contemporary pop culture and its communication methods.

With this in mind, I have been researching themes that can construct a landscape of building blocks of audiovisual design practices in a *networked culture*, so far I have canvassed: digital memes, viral videos, animated GIFs, digital graffiti (projection mapping). While these forms of media have global reach in our networked world, the object of my research has focused on identifying elements of local Brazilian culture. However, seeking to be unconstrained by the divide of high and low art, steering away from an elitist preservation of imported culture, and rather looking into remediation of local traditions either on social media or by the cultural industry. In this sense, Brazilian pop music may well host examples that reflect a range of elements that are representative of the remediation of local culture and the collective imagination.

2. Cultural Anthropophagy

Brazilian culture consists of a myriad of influences: indigenous, colonialists, imperialists, slaves and immigrants have blended for centuries into what the Brazilian modernist author Oswald de Andrade, defined as *Cultural Anthropophagy* (Andrade, 1928). A term that, even having been coined one hundred years ago, continues to permeate Brazil's contemporary techno-cultural habitat. A landscape composed of displaced Miami Beach apartment buildings rising next to cinder block makeshift homes, topped by blue fiberglass water tanks, entangled in a mesh of network cables and antennas that connect 200 million smartphone users that chat and post incessantly on social networks. Brazilian pop music: *techno brega*, *funk*, *sertanejo*, is undoubtedly shaped by the media business, however it continues to draw from cannibalistic re-appropriations, evidenced by the global viral repercussion of Brazilian memes.

Oswald de Andrade's *Cannibalist Manifesto* (Andrade, 1928) maxim *Tupi or not Tupi, that is the question*, is very illustrative of the ideas behind *Cultural Anthropophagy*. *Tupi* represents a subdivision of the language family *Tupi-Guarani* spoken by South American indigenous people living mainly in Brazil south of the Amazon River and Paraguai. In the manifesto, there is a word play with *To be, or not to be* from William Shakespeare's play *Hamlet*. Tarsila do Amaral is probably one of the most exponential visual representations of the ideas behind the Manifesto, her painting *Abaporu* is considered the inspiration behind her husband Oswald's manifesto. *Abaporu* depicts an indigenous figure next to a Mandacaru cactus typical of northeastern Brazil, the painting however draws from clear aesthetic influences of European modernist vanguard movements.



Fig. 1. *Abaporu*, oil painting on canvas, Tarsila do Amaral, 1928. (Colección Costantini - Buenos Aires, Argentina).

While these artistic expressions are representative of an elite with western European background and education, traditional popular culture in Brazil draws from native Brazilian, African influences, North-America and more recent immigrant cultures, from the Middle-east, Asia and Eastern Europe. This mix of influences can be identified in cultural manifestations such as *Cordel* folk literature, narrating local stories while drawing from Portuguese wood print tradition or *Bumba meu Boi*, a traditional ritual involving music and performances mediated by the figure of an ox, the practice is considered as Intangible Cultural Heritage of Humanity by Unesco. Even though

Bumba meu Boi is typical of Maranhão state, different manifestations are encountered in other regions. Candomblé is an African diasporic syncretic religion, where in order to avoid persecution African deities were represented as Catholic saints. Syncretism can be found as well in a number of typical culinary traditions: *Feijoada*, which is considered a national dish and has origins in European stews, is made of beans domesticated by native Brazilians and accompaniments with African origins.

Brazilian popular music is probably the most well known expression of local syncretic culture. *Bossa Nova*, a fusion of *Samba* and Jazz is listened by people all across the globe since the 1950's, the *Tropicalia* movement from 1960's is internationally known for artists such as Caetano Veloso, Gilberto Gil and Gal Costa, incorporating Brazilian rhythms and psychedelic pop rock among other influences. Visual artists such as Helio Oiticica and Ligia Clark are representative of the neo-concrete art contemporary of *Tropicalia*. While less known internationally, there are numerous forms of fusion in Brazilian music from *Mangue Beat*, to *Funk* and even *Brega*, which may include genres like sertanejo drawing from American Country Western. Some of these styles may be considered a fabrication of the cultural industry. However, artists such as Anitta and Pablo Vittar who have gained international recognition in the past decade, even though they may be despised by a cultural elite, are truly representative of Brazilian Culture and are a synthesis of a multitude of local and global influences.

3. Animated memes and Brazilian pop culture

The syncretic appropriation of global icons can be perceived in Brazilian memes. In general, they are haphazard reinterpretations of messages and images that circulate in mass media and the resulting imagery is very roughly finished. This typical characteristic of memes created in Brazil is paradoxically an aspect that can be assumed to be an essential factor in their global popularity. The perception of these singularities can be supported by a reflection of how local cultures are seen from a foreign point of view. While Brazil is known for its cultural diversity, on the other hand we struggle to comprehend our identity. A century has passed since the Brazilian Modern Art Week of 1922 and it is plausible that the answer can still be found in Oswald de Andrade's proposition of Cultural Cannibalism. A concept that can be transposed to Brazil's Pop Culture, while undoubtedly being shaped by the cultural industry, it is not immune to a cannibalistic re-appropriation.

Images have always had an important role in Brazilian political propaganda, and the messages conveyed have quickly adapted to technical innovation. Pictures of candidates broadcast on television campaigns are frequently enriched by graphic artifacts with the intention of calling the attention of the viewer. More recently this kind of imagery has been revisited in digital graphic formats such as GIF's, an essential; visual element in the dissemination of political misinformation, encountering a fertile field for viralization on social networks.

For this reason it is crucial to understand why something becomes a meme, some characteristics of GIFs, how they began to circulate on a larger scale and what is relevant on the internet today. Digital Memes originate in Biology from a term coined in 1976 by Richard Dawkins in his book *The Selfish Gene* (Dawkins, 2007), it is related to copying and mimetism, having its roots in the word minema. The internet meme is this "situation", an object that repeats and replicates incessantly in specific circles of the internet. We should emphasize the specifics, since the internet experience has similarities to a diagram of bubbles within bubbles. These memes, as in their biological counterparts, adapt, evolve, construct layers and within an infinity of possibilities they can even trigger changes in the world around them, either on a private or public scale. Memes reach the public in a variety of forms, they can be presented as a video, an animated GIF or more commonly as a static image, they tend to describe everyday subjects that refer to a specific social circle, behaviors, or something being circulating in the media and recent news. Memes also don't have a singular form of representation, they may originate from an old photograph, a drawing that represents a memorable, a funny event shared within a group, or even political discourse (Tecmundo, 2015). The fact is that memes are intrinsically connected to a group of people, they're daily routines and opinions. It is a specific group that defines if something is a meme or not, and it will depend on their engagement if they will be reproduced or viralized. This aspect of memes are quite different from the logic of icons and symbols in visual communication systems and graphic user interfaces: even though the intention of these identity systems are to establish universal visual languages, they are defined from the top up and may be as incomprehensible as memes are to people external to the circles where a given meme circulate.

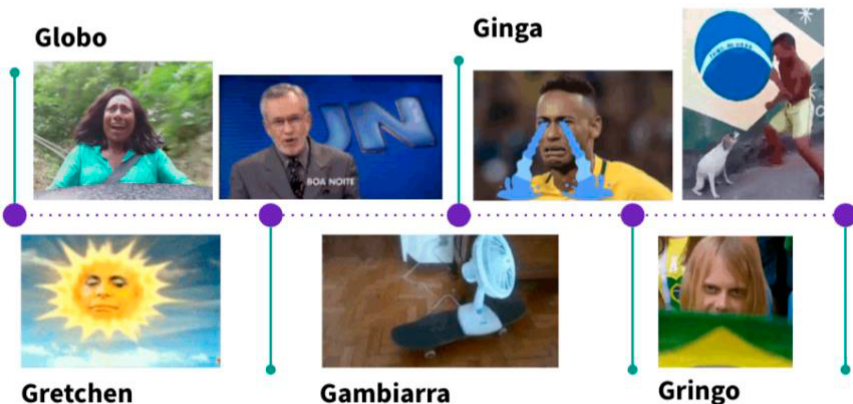


Fig. 2. 5Gs of Brazilian Pop Culture in GIFs, Anonymous, 2021. (Museu de Memes - Montage by the author).

We can perceive important visual characteristics of memes: the assembly of graphic elements in layers (AKA "photoshopped") and animated loops that have the intention to help focus on the elements of the montage. Even being rare, there are cases where

the animation has storytelling aspects, and when present, generally the narrative has the role of reinforcing meanings that associate the words to the images. On the other hand it is quite common that animated narratives are used in the appropriation of animation mediated in mass media, recontextualized through montage, generating new meaning and consequently a new meme. An example of this procedure is the GIF where Queiroz, a low rank assistant of a Brazilian politician accused of covering up corruption schemes, is inserted in a scene of the *Simpsons* TV series: In this animation he backs up into bushes in a yard, as if avoiding responsibility.

The relevance of this example where a segment of an existing animation is re-utilized evidently reflects the practice of remediation, intrinsic to cultural practices carried on digital networks (Bolter, Grusin, 2000). Another characteristic commonly encountered in animated memes is the synthesis of memorable actions in a couple of frames, therefore facilitating reproduction and recognition with the objective of amplifying memorability. In this process the animation is incorporated into the construct of elements of a discourse, contributing to a novel digital grammar. This process is analogous to Roland Barthes ideas regarding mythology in the post-industrial society of the second half of the 20th century. Barthes suggests that "Myth is a type of speech" (Barthes, 1992), in this sense we can think of memes as a type of discourse. With this in mind, memes can potentially be considered a key element of new literacies incorporating symbolic and visual elements (Knobel; Lankshear, 2007). This is a language where animation is extremely important, especially due to its power to cause impact in a synthetic manner.

Memes can also be highly effective in disseminating fake news. The meme *URSAL* (Museu de Memes, 2018) that originated during political debates for the 2018 Brazilian presidential campaign is an excellent example of the importance of specific ideological circles as catalysts in the creation of memes. The event, whose origins are unknown to a great part of the population, is in reality extremely complex. Summarizing nothing less than the process of how dissemination of fake news occurs. Masked under the revelation by Corporal Dacciolo (a candidate with insignificant representation) of a *great truth* to the Brazilian population, Dacciolo spread the news, that supposedly there was a plan of the extreme left to coordinate a dictatorial coup orchestrated by several Latin American countries with the objective of creating a socialist block in Latin America, thus the name: *URSAL: Union of Socialist Republics of Latin America*, the term which originated as an irony, was assumed as a serious menace by a significant number of voters, generating numerous memes which include infographic describing the plan.



Fig. 3. *URSAL Memes*, Anonymous, 2018. (Museu de Memes).

4. Towards a novel visual literacy

The ubiquity of portable digital devices has determined a radical shift in the form of how we communicate, not only due to the fact that we are connected in any place at any time, but mainly in the way we communicate, verbal language when expressed orally in face to face communication, has the support of gestures and facial expressions. When transposed to social networks, on one hand there are losses due to technological limitations inherent to the apps, on the other there can be gain associated with the creation and dissemination of visual representations that intend to compensate for the loss of person to person interactions.

As an example we can cite examples of animated GIFs used to reinforce reactions and gestures as well as Emoticons, icons that represent emotions. Both cases represent elements commonly utilized in text messaging and comments on social networks. However in many instances the meaning associated to the graphic elements cannot be simply comprehended by the transliteration of the imager being represented, since they are dependent on cultural aspects, quite commonly associated with memes.

These are clues towards putting together building blocks of an animated representation of Brazilian pop culture. Memes represent how young Brazilians talk, translated into poorly photoshopped GIFs synthesizing local pop symbols, slang and sarcasm in a couple of frames; gambiarras is a term that represent an improvised way of permanently fixing something or solving a problem; and are as chaotic as the exuberant and shiny colors on the live transmission of Carnaval festivities on TV Globo permeating a national collective imaginary.

Only twenty five percent of Brazil's 210 million inhabitants are fully alphabetized (Cieglinski, 2012), therefore the prevalence of the use of emojis, reaction GIFs, videos and voice messages while communicating on social networks and messaging apps. Thus my interest as a designer in understanding these new emerging digital literacies. They can be seen as reappropriating or remediating foreign mass culture as well as traditional forms of cultural expression. And while apparently they may seem very simplistic, there are very complex nuances and subtexts embedded in these messages. An analog counterpart to digital memes are Pichação, a type of urban graffiti in Brazil.

The omnipresent images are an important form of expression of young people from the periphery of Brazilian cities, using mainly black and white graphic symbols, the scriptures consist of an urban form of visual language. At first the strokes may seem abstract or indecipherable, however, they can be read fluently by their markers, as described by an artist in the documentary PIXO (Wainer; Oliveira, 2010), who reports his inability to read proper Portuguese though he has no trouble in decoding the messages on city walls.

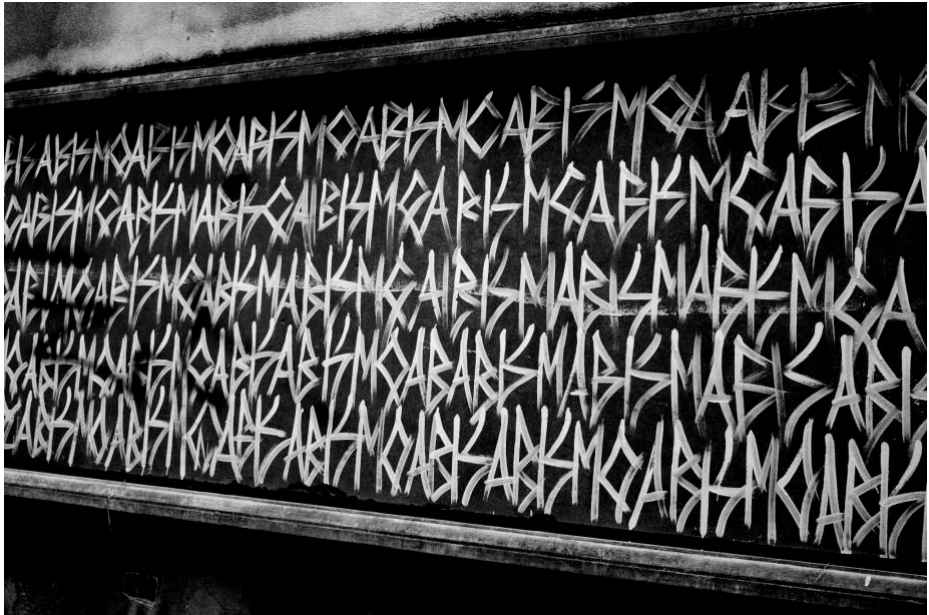


Fig. 4. Pichação, Anonymous graffiti on a school wall in Vila Maria Zélia, São Paulo, 2009. (Flickr, Marco Gomes, CC-BY-2.0).

Therefore my case is that in order to visually convey complex information it may be appropriate to consider vernacular forms of visual language and codes that are being established on digital networks and assume unconventional literacies. In this sense memes, reaction videos, viral animation can be considered a digital counterpart of ground up visual communication and should be understood by visual communicators, graphic artists, and audiovisual producers as an important form of expression that can both help fight misinformation on digital networks as well as a tool for communicating complex concepts such as economics, political system, financial transactions that in many instances rely on text and information graphics that assume visual conventions, literary, cultural and historical references that in many instances, given the enormous educational deficit, are very difficult to be comprehended by a significant part of the Brazilian population.

References

- Andrade, O. (1928). Manifesto Antropófago. *Revista de Antropofagia*, 1(1), 3-7.
- Barthes, R. (1992). *Mythologies*. Noonday.
- Bolter, J. D., Grusin, R. (2000). *Remediation: understanding new media*. MIT Press.
- Ciegliński, A. (2012, July 20). *Menos de 30% dos brasileiros são plenamente alfabetizados*. Revista Exame. Retrieved from <https://exame.com/brasil/menos-de-30-dos-brasileiros-sao-plenamente-alfabetizados>.
- Dawkins, R. (2007). *O gene egoísta*. Companhia das Letras.
- Knobel, M., Lankshear, C. (2007). *Online memes, affinities, and cultural production. A new literacies sampler*. P. Lang.
- Museu de Memes (2018). Ursal, Webpage, Universidade Federal Fluminense, 2018. Retrieved from <https://www.museudememes.com.br/sermons/ursal/>.
- Wainer, J. Oliveira, R. (2010). *PIXO* [Film]. Brazil: TX Filmes; Star Original Productions.
- Tecmundo (2015, April). *Trollface: o nascimento do meme que deu uma boa grana ao criador. Problem?*. Retrieved from <https://www.tecmundo.com.br/memes/77923-trollface-nascimento-meme-deu-boa-grana-criador-problem.htm>
- Varnelis, K. (2008). *Networked publics*. MIT Press.

Explaining ocean acidification to non-specialized audiences

Silvia Oliva¹ (0000-0001-9035-0538),
Javier Coello², Carlos Jiménez-Martínez³ (0000-0002-4991-3121)

^{1,2,3}Department of Fine Arts, University of La Laguna
solivape@ull.edu.es, alu0101039503@ull.edu.es, carjimen@ull.edu.es

Abstract. *Ocean acidification* constitutes one of the primary consequences of anthropogenic climate change, generating multiple negative effects in the marine realm. However, there is a generalized lack of knowledge of society on this specific topic. The acidic sublittoral volcanic vents located at *Punta de Fuencaliente* (Canary Islands) constitute an unequalled natural lab. Accordingly, a marine observatory of climate change associated to these vents has been recently established, the OMACC. Research conducted there will enable making projections of utmost utility to identify the roadmap on mitigation and adaptation to climate change. Yet, in order to involve and mobilize society accordingly, this research needs to be approached and made accessible to non-specialized audiences. To that end, from the Transference Unit *BISAGRA Visual Thinking* and in the framework of the project *visUaLL*, we developed a thorough communication program associated to the OMACC, based on visual thinking. Amongst the elements developed there is a motion graphics animation on *ocean acidification*. Here we explain the procedure followed and provide the results of a preliminary survey conducted to ascertain the usefulness of the generated animation in effectively approaching the topics to non-specialized audiences. Overall, surveyed people understood better the concepts in question after viewing the video, confirming that the developed animation significantly enhances the understanding of the contents addressed.

Keywords. Ocean acidification / CO₂ vent / Science communication / Visual thinking/ OMACC

1. Introduction

Ocean acidification constitutes one of the primary consequences of anthropogenic climate change, generating multiple negative effects in the marine realm. However, unlike other environmental problems on which it has been created an easily accessible narrative, there is a generalized lack of knowledge of society on this specific topic. Thus, providing here context on ocean acidification is pertinent. It can be simply defined as the decrease in the pH of seawater caused by the absorption and dissolution of atmospheric CO₂ excess in the ocean; but, what is the pH...? This commonly used (but generally unknown to most of society) term refers to the

amount of hydrogen ions present in a substance and, with it, to its level of acidity. The more hydrogen ions, the higher the acidity. It is measured on a logarithmic scale from 0 to 14, with a pH equal to 7 being neutral, a pH greater than 7 being basic, and a pH less than 7 being acidic. Consequently, slight changes in pH units may entail enormous consequences, due to its logarithmic scale.

This decrease in the pH of seawater has multiple effects in the marine environment. On the one hand, the carbon sink function of the oceans is undermined, with the current loss of important ocean CO₂ sinks, such as seagrass meadows, mangroves or algal forests, exacerbating this decrease in the ocean's ability to store carbon emissions and mitigate the effects of climate change. On the other hand, the availability of carbonate ions decreases, since the hydrogen ions (now in excess) join the free carbonate ions in the water, forming bicarbonate ions. This negatively affects calcifying organisms, which need carbonate ions to form their calcium carbonate skeletal structures. As a consequence, their growth capacity, protection and survival are reduced, generating serious alterations in food webs and in ecosystems' functioning, as well as important biodiversity losses. These effects of ocean acidification on biota and the functioning of marine ecosystems constrain human persistence. On the one hand, a reduced capacity of the ocean to store carbon leaves a higher concentration of CO₂ in the atmosphere, which would require an even more significant reduction in CO₂ emissions to lessen the impacts of climate change. On the other hand, the loss of calcifying organisms has serious effects on the populations that depend on these systems for food, economic livelihood and coastal protection. Likewise, it is important to consider that ocean acidification does not operate in isolation, interacting with the rest of the stressors derived from climate change, as well as with other anthropogenic stressors, magnifying their impacts and the degradation of marine ecosystems (e.g., Hurd et al., 2018; Kroeker et al., 2017; Nagelkerken & Connell, 2022).

Although great advances have been made on ocean acidification research in the last decade, there are still many relevant gaps. In this sense, the acidic sublittoral volcanic vents located at Punta de Fuencaliente (Canary Islands) constitute an unequalled and promising natural lab, being hitherto the only one found within the Atlantic subtropical biogeographic region. With an annual variation of CO₂ emission between 459-988 μatm and of pH between 7.4-8.07, its values range within those that will be reached in the next 30-80 years, according to the Intergovernmental Panel on Climate Change (IPCC) projections (González-Delgado et al., 2021), thus meaning a window to future ocean. Accordingly, a marine observatory of climate change associated to these vents has been recently established in the lighthouse of Fuencaliente, the OMACC (Fig. 1). Research conducted at the OMACC is providing and will provide a glimpse of the potential synergies among environmental factors, and changes produced on species interactions and adaptive capacity under acidification. This will enable making projections of utmost utility to identify the roadmap on mitigation and adaptation to climate change.



Fig. 1. Lighthouse of Punta de Fuencaliente (Canary Islands), where it is located the Marine Observatory on Climate Change, OMACC. Photograph by S. Glez.

Yet, in order to involve and mobilize society accordingly, including local and regional stakeholders and global visitors, this research needs to be approached and made accessible to non-specialized audiences. To that end, from the Transference Unit *BISAGRA Visual Thinking* and in the framework of the project *visUaLL*, we developed a thorough communication program associated to the OMACC, based on visual thinking.

When we think of *ocean pollution* we have a quite clear and correct idea of what the term alludes, yet when the so-called (and somehow chimerical, but that is another topic) *general public* is questioned on what does *ocean acidification* mean and what are its consequences, most of the non-specialized audiences fail in their intent to answer correctly or even to vaguely approximate it. This is, to certain extent, because it is a less visible phenomena. This invisibility difficult creating emotional and personal connection. Yet when it becomes visible, it means that it is already having devastating consequences and thus too late to act. Therefore, it is key to anticipate this moment, in order to have an informed society, able to contribute to the change needed. The communication of scientific advances is essential for its social justification. This is particularly relevant in those aimed at addressing the challenges we currently face as society, such as climate emergency and its drivers, since its transmission is a fundamental requirement for the establishment of scientifically informed policies. In this context, visual communication design constitutes a key tool for the rigorous and effective transmission of complex scientific concepts to non-specialized audiences. Also, the use of visuals allows creating an attractive narrative that enables the emotional connection needed.

Further, numerous studies confirm that the assimilation of complex scientific information is greatly improved when received through dynamic animations instead of static visuals (Lin & Atkinson, 2011). Motion graphics, besides transmitting information by giving movement to its elements, may create a story that optimizes the reception of this information, together with a visual poetry that remains engraved in the viewer's mind, and with it the content that is intended to be

transmitted. The basics of this animation technique lie in applying movement to the design to transmit a message more effectively. The main objects used in this technique are 'pictorial elements', such as images, icons or logos, and 'texts' *brought to life* by applying movement, on many occasions also adding a piece of music to accompany the animation and a locution that narrates what is being showed in the screen, facilitating the assimilation of the message by the viewer.

Amongst the first elements developed by *BISAGRA Visual Thinking* for the communication program of the OMACC there are its Logo, its corporate image and identity, the signaling and associated panels and the web. Yet, besides providing a coherent image to the OMACC, we also identified a gap on locally developed visual materials encapsulating concepts on *ocean acidification* and the research conducted locally. Accordingly, to transmit these complex concepts on *ocean acidification* and locally developed research, we generated both, static (a mobile exhibition, *in progress*) and dynamic (a motion graphics animation) visual materials. In this article, we explain the procedure and outcomes of the latter.

2. Objectives

The objectives of our project were (i) to generate a motion graphics animation on ocean acidification and the OMACC based on visual thinking, developed in the framework of the project visUaLL by the Transference Unit BISAGRA Visual Thinking and as part of the Final Degree Project of author Javier Coello; and (ii) to ascertain the usefulness of the generated animation in effectively approaching the topics to non-specialized audiences.

3. Materials and methods

To generate this animation, we followed a transdisciplinary approach. First, the team was multidisciplinary, composed by an expert in marine ecology and climate change (Dr. Silvia Oliva), who developed the script and supervised the storyboard and scientific rigor of the piece, and two experts in design; one in visual thinking (Dr. Carlos Jiménez), who supervised all the design aspects of the piece and another in motion graphics (Javier Coello), who developed the storyboard and executed the animation. Second, the workflow to generate the animation followed a combined approach, interconnecting and intrincating the work derived from each of the two visions. This approach allowed us to put design at the service of science, generating a visual narrative that prioritizes scientific rigor without disregarding the aesthetic component.

Regarding the methods of the animation design and execution, the *animatic* was conducted with *Storyboarder*. On what refers to the color palette, the main color is blue, to give the corresponding prominence to the ocean, and the remaining colors

of the palette were generated trying to create a good contrast and figure-ground color ratio (Fig. 2). Subsequently, to check the good legibility of the shapes and optimal figure-ground contrast of the selected palette, a series of ‘layouts’ (i.e., design of static frames of each scene) were created and revised in iteration, in order to get an animation as refined as possible (Fig. 3). The animation was executed with *AfterEffects* (Fig. 4). The locution was made by a professional dubbing actress. For the remaining sound elements, we chose a well-balanced musical composition, with good progression and a grave tone, which is neither excessive in the dramatic nor in the cheerful. Also, some extra sounds (such as that of the sea) were applied in different parts of the video, to enhance certain actions and facilitate the information retention by the viewer.

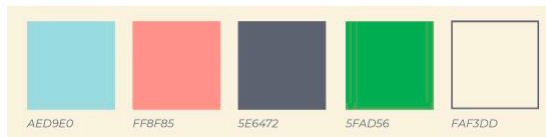


Fig. 2. Main color palette. Motion graphics animation *Efectos del cambio climático en el medio marino: acidificación oceánica*, by Coello, 2020 (Property of the author).



Fig. 3. Example of layout. Motion graphics animation *Efectos del cambio climático en el medio marino: acidificación oceánica*, 2020 (Property of the author).

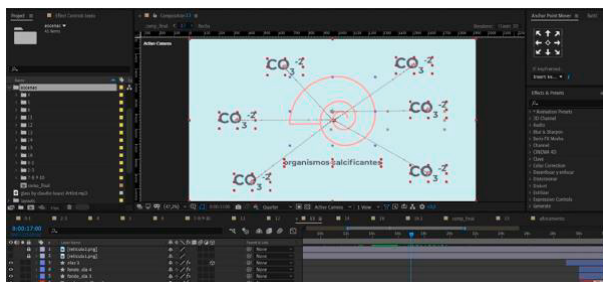


Fig. 4. Layer movement in AfterEffects. Motion graphics animation *Efectos del cambio climático en el medio marino: acidificación oceánica*, 2020 (Property of the author).

Once the piece was created, we conducted a preliminary survey to assess its actual usefulness to reach society, i.e., to verify the suitability of the generated animation

in effectively transmitting the visualized topics on *ocean acidification* as one of the main effects of climate change in the marine environment and its consequences to non-specialized audiences. The survey consisted on a three-step procedure. On one hand, a two-phase questionnaire (*ex-ante*, *ex-post*), composed of eight questions (single answer from 3 options) related to the content of the animation.

The *ex-ante* questionnaire was to verify the degree of prior knowledge on *ocean acidification* and its effects in the marine environment, to be answered without consulting any documentary source. The *ex-post* questionnaire was to verify the degree of knowledge acquired on the same topics after viewing the video. On the other hand, the visualization of the animation “*Effects of climate change on the marine environment: ocean acidification*” (7’49”) between answering the *ex-ante* and *ex-post* questionnaires. This survey was targeted to a group of 20 anonymous individuals with Higher Education background, and ages ranging from 20 to 69.

4. Results and discussion

The animation style is consistent with the objective of the project and the skills of the designer that executed it at the moment, being then in the last stage of his degree (Fig. 5). The student, Javier Coello, obtained an excellent for this work, and the colleagues of the *Faculty of Design* of the *University of La Laguna*, some of them with an extensive experience in motion-graphics, gave positive feedback after reviewing it thoroughly.

However, although the script is rigorous and concise, we acknowledge that the video is quite linear and long, exceeding seven minutes of duration. This constitutes a drawback in these times of flash multimedia content consumption. Yet it could be prevented, to certain extent, by emphasizing and highlighting the main concepts, breaking the linearity and improving its pace.

Notwithstanding, the video, hosted on the youtube channel of *BISAGRA Visual Thinking*, has more than 6,800 visualizations, being the fourth video that appears when conducting a google search (typing acidificación oceánica) and having only positive comments. Mexico is the country with the highest proportion of views, followed by Peru, Chile, Spain, Ecuador, United States of America, and Argentina. All of this without conducting any kind of publicization. However, the average proportion viewed of the whole video was 48%, corresponding to 3’45” of view duration. Also, there were three key moments in which the audience peaked, corresponding to the general introduction and the explanation of the pH and ocean acidification concepts.

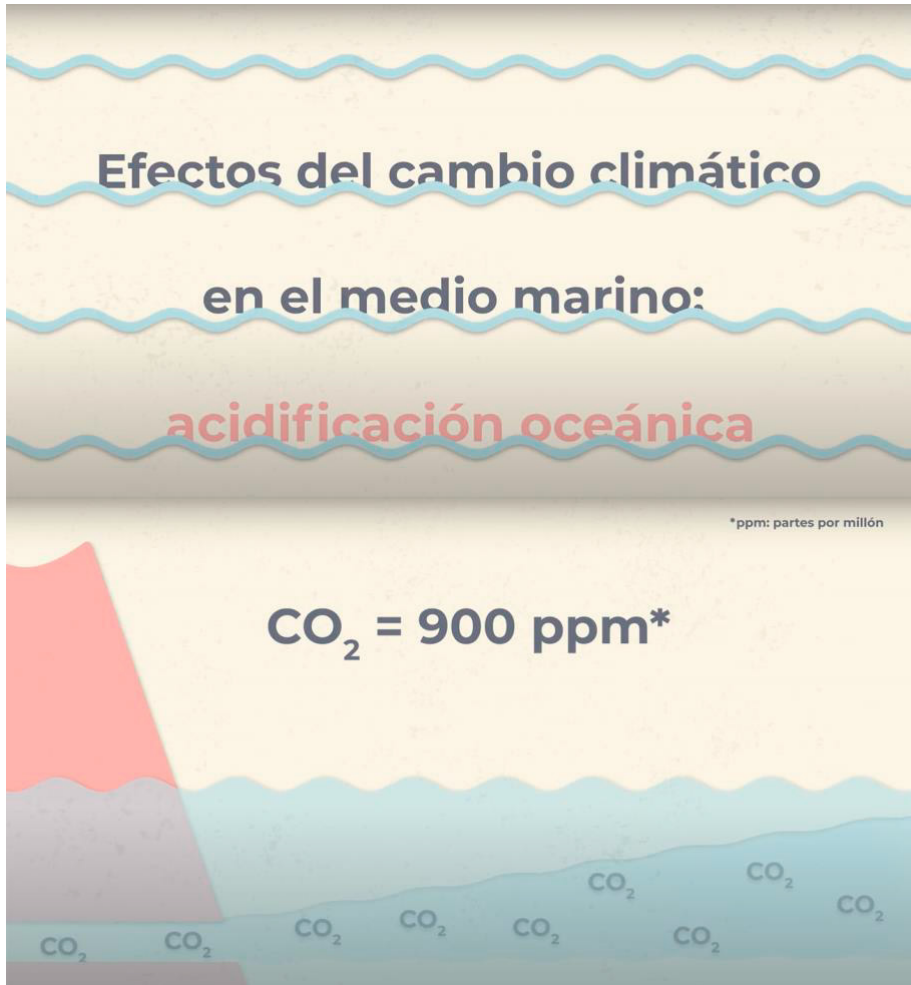


Fig. 5. Final video frames. Motion graphics animation Efectos del cambio climático en el medio marino: acidificación oceánica, 2020 (Property of the author).

On what refers to the preliminary survey conducted to assess the usefulness of the developed motion graphics piece to reach society, the proportion of hits and misses of each questionnaire was variable, yet the results indicate that the animation significantly enhances the understanding of the contents addressed. The proportion of people that answered right (and wrong) each question of the questionnaire before viewing the video (*ex-ante*) was as follows: one question 40% right (60% wrong), two questions 50% right (50% wrong), one question 55% right (45% wrong), one question 60% right (40% wrong), two questions 90% right (10% wrong), one question 95% right (5% wrong) (Fig. 6). On the other side, the proportion of people that answered right (and wrong) each question of the same questionnaire after viewing the video (*ex-post*) was the following: one question 45% right (55% wrong), one question 60% right (40% wrong), one question 80% right (20% wrong), two questions 90% right (10% wrong), one question 100% right (0% wrong) (Fig. 6). These results confirm that, overall, surveyed people understood better the concepts in question after viewing the animation. However, there is still some confusion regarding the *pH*, *ocean acidification* and *its effects in the marine environment* (Fig. 6). Thorough surveys including other audiences, formats (text vs. animation) and comparisons are needed. However, we may assert that the animation generated in the framework of this communication program based on visual thinking associated to the OMACC will be of great utility in approaching the basics of *ocean acidification* to non-specialized audiences.

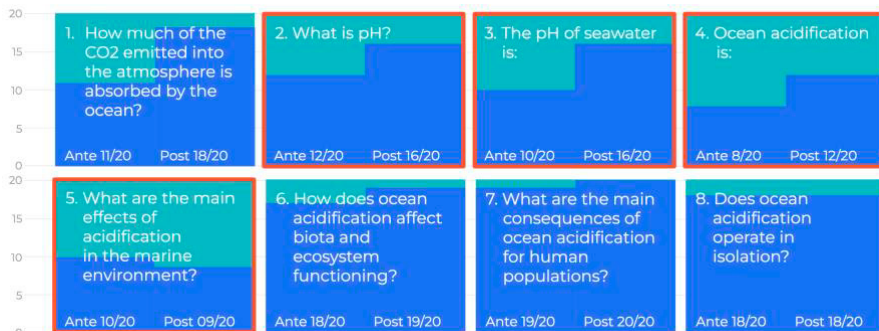


Fig. 6. Survey results. Motion graphics animation Efectos del cambio climático en el medio marino: acidificación oceánica, developed, 2020 (Property of the author).

5. Conclusions

From invisibility to implication, passing through understanding. The results of the preliminary survey conducted to assess the usefulness of the developed motion graphics piece to reach society indicate that the animation significantly enhances the understanding of the contents addressed. Overall, surveyed people understood

better the concepts in question after viewing the animation. Thorough surveys including other audiences, formats (text vs. animation) and comparisons are needed. However, the animation *Efectos del cambio climático en el medio marino: acidificación oceánica* will be of great utility in approaching the basics of ocean acidification. It constitutes the first animation on ocean acidification made at the Canary Islands. Ocean acidification is a major concern, being often made invisible, with consequences that are ahead of other disturbances with narratives more emotionally engaging such as plastics entangled in turtles.

Between increasing the pace, or training mindfulness as an Intelligence Quotient. The visual style was coherent with the purpose of the message and the skills of the designer at that moment. However, we recognize that it is quite linear and long, exceeding seven minutes. Emphasizing and highlighting the main concepts could break this linearity and improve its pace, in order to better retain them. Yet in our times of greedy multimedia consumption it is worth resisting falling into that maelstrom, and offer the chance of time and full attention to the audiences we want to reach to.

6. Acknowledgements

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References

- González-Delgado, S., et al. (2021). Chemical characterization of the Punta de Fuencaliente CO₂-enriched system (La Palma, NE Atlantic Ocean): a new natural laboratory for ocean acidification studies. *Biogeosciences*, 18 (5), 1673-1687.
- Hurd, C. L., Lenton, A., Tilbrook, B., & Boyd, P. W. (2018). Current understanding and challenges for oceans in a higher-CO₂ world. *Nature Climate Change*, 8 (8), 686-694.
- Kroeker, K. J., Kordas, R. L., & Harley, C. D. (2017). Embracing interactions in ocean acidification research: confronting multiple stressor scenarios and context dependence. *Biology Letters*, 13(3), 20160802.
- Lin, L., & Atkinson, R. K. (2011). Using animations and visual cueing to support learning of scientific concepts and processes. *Computers & Education*, 56(3), 650-658.
- Nagelkerken, I., & Connell, S. D. (2022). *Ocean acidification drives global reshuffling of ecological communities*. *Global Change Biology*.

Cultural heritage convergence: the intersection of animated docudrama and communication design

Vincenzo Maselli¹ (0000-0002-1455-7972),
Giulia Panadisi² (0000-0002-5862-1104)

¹PhD, La Sapienza University of Rome, vincenzo.maselli@uniroma1.it

²PhD, G. D'Annunzio University of Chieti-Pescara, giulia.panadisi@unich.it

Abstract. Animated documentaries for cultural heritage are not new forms of production and, thanks to the informative power and the imperative historical accuracy, they have been used by public entities, research and cultural institutions to promote knowledge of historical events, works of art, social contexts, and characters of historical or scientific importance. This paper questions the power of narratives belonging to a specific subcategory of documentary, namely docudrama, to convey information, communicate and enhance cultural heritage. Animated docudramas compromise between the fly-on-the-wall documentaries' typical approach and a scripted narrative based on real characters and events, and – according to Andy Glynn (2013) – more than any other form of documentary, are capable of evoking memories, representing subjectivity, and building a bridge between the external world made by people and objects, and the internal world made up of thoughts and emotions. What does change if we decide to narrate Cultural Heritage in an animated form that exploits the design paradigms of documentary and fictional storytelling? By exploring a bunch of selected case studies, the paper defines hypothetical strategies to recognize and produce an animated docudrama for Cultural Heritage that hybridize production coordinates and communication design parameters, and formulates an evaluation matrix that compares animated docudramas in terms of languages, narrative structures and codes of representation.

Keywords. Animated docudrama / Cultural Heritage / Communication design / Codes of representation / Fictional media tools

1. Introduction

A documentary is a non-fictional film "based on real events or circumstances, and intended primarily for information, instruction or historical record purposes" (Oxford English Dictionary). The first experiments of documentaries date back to the films projected at the Nickelodeon Theatre in New York at the beginning of the 1900s (Winston, 2013). Different genres of films were staged, with a variety of styles and subjects, such as fictional narratives, *scenics* (views of the world from moving trains), stop-action sequences and *actualities*, that are considered the precursors of the later

defined documentary films (Agnew, 2020, p. 28). The word *documentary*, indeed, was coined by Scottish documentary filmmaker John Grierson in his review of Robert Flaherty's film *Moana* in 1926 (Curthoys & Lake, 2004). Starting from the short film *The Sinking of Lusitania* by Winsor McCay in 1918, also animation has *invaded* this audio-visual genre, bringing important innovations in terms of languages, narrative structures and codes of representation (Ceccarelli, 2012; Honess Roe, 2013). According to the Italian scholar Nicolo Ceccarelli, by replacing live action footage with animation – in all forms of graphical animated sequences, abstract animation, cut out animation and character animation – animation demonstrated to hold a central role in the documentary genre as this audio-visual technique “embodies values, empathizes with the public, and conveys complex information” (Ceccarelli, 2014, p. 139) by adopting a versatile language, different stylistic and technical solutions, and undertaking narrative qualities that combine information, communication and entertainment.

This paper looks at a particular form of animated documentary based on fictional narrative, namely docudramas, and aims at identifying patterns and defining strategies for creating animated artifacts that hold both the informative impact of a documentary film and the emotional involvement of fictional narratives. It will be suggested exploiting the design paradigms of documentary and fictional storytelling as an effective strategy to narrate Cultural Heritage in an animated form. In the following sections the structure and the requirements of an animated docudrama, on one hand, and the approaches for communicating cultural heritage on the other, will be investigated to build a matrix for recognizing and outlining strategies to design animated docudramas for communicating Cultural Heritage.

2. Animated docudramas' coordinates

From the first animated documentaries to the most recent Oscar Award nominated animated documentary feature films *Waltz with Bashir* by Ari Folman (2009) and *Flee* by Jonas Poher Rasmussen (2022) the animation approach to documentary has evolved from that of the traditional live-action documentary, and has generated a new and powerful information means (Glynn, 2013) that embraces the library of fictional media tools (Martin, 2018; Aufderheide, 2007). The plastic relation between fiction and non-fiction in animated products has allowed new “forms” of documentaries that provide a creative solution to the structural issues of the documentary film genre, namely animated docudrama (Formenti, 2022). This specific subcategory of documentary compromises between the fly-on-the-wall approach – typical of documentaries – and a scripted narrative based on real events, situations and characters (Martin, 2018; Hampe, 2007). Docudramas' informative potentials have been explored since the beginning of the new millennium by Gary Rhodes and John Springer (2006), who first named docudrama that form of documentary that is proposed to the public in a fictional form. In recent years, scholars such as Cristina Formenti and Annabelle Honess Roe have contributed to give a scientific dignity to

this subgenre, recognizing that docudrama does not only share with documentary the reference to truly happened events, but it also asks the viewer to consider these events truthful portrayals even when they are supported by narrative structures and aesthetic reconstructions (Formenti, 2022; Honess Roe, 2013; Roscoe & Hight, 2001). Docudramas' design approach, therefore, still requires to depict what has been seen, understood and learned in the real world (Paget, 2011). Since the "Animated Conversations" series of short films by Aardman in the 80s, docudramas have proved to be powerful tools in the hands of animation to perform actions of social denunciation and psychological exploration (Hooks, 2017; Mitchell, 2017).

In the realm of psychological and social aimed narratives – according to the director Andy Glynne – animated docudramas, more than any other form of documentary, are capable of evoking memories, even traumatic ones, of giving shape to abstract thoughts, of representing subjectivity, of building a bridge between the external world made by people and objects, and the internal world made up of thoughts and emotions, and to make the message conveyed as university applicable (Glynne, 2013). He formulated a list of features that an animated docudrama should possess such as:

- to convey information in a narrative form;
- to build different level of narrative by using metaphor;
- to Evocatively capture a past for which there is little archive or that is historical and unfilmable (no existing archive or horrific and unimaginable events);
- to Represent subjectivity and character's internal world (memories, traumas, thoughts and feelings);
- to Protect the identity of the protagonist(s) and shift the focus onto the experiences rather than the individual. (Ibid.)

By addressing concepts such as universality, inner experience, internal process and anonymity Glynne recognizes docudramas particularly suitable for character-oriented documentaries related to social or psychological conditions. By moving the attention to the idea of cultural heritage docudrama we suggest substituting Glynne lasts instances with the following coordinates:

- to Represent existing heritages from an architectonic, geographic, anthropologic and historiographic perspective (monuments' history, social memories, cultural traditions);
- to preserve the memories of these heritages and arouse curiosity so that viewers are pushed to autonomously deeper explore them.

3. Communication strategies for cultural heritage

The application of innovative information and multimedia communication strategies for safeguarding and promoting tangible and intangible expressions of cultural

heritage has been one of the main objectives of the international community in the last decades (UNESCO). Audio-visual communication and information technologies have been thoughtfully explored in order to enhance communicating and experiencing the heritage and make information more accessible to different visitor segments, thereby becoming essential means for adding value to the heritage experience (Paolini & Rubegni, 2010). Original records, photographic reportages and moving images easily downloadable from the main online platforms and digital archives have brought culture into the digital global environment where both communities can recognize themselves and their traditions and heritages, and the entire world can learn and enjoy the same treasures. The multimedia dimension of information in communication today is a prerequisite to engage effective actions of world heritage enhancement. UNESCO, among the main examples in this scenario, in 2001 created an international computer-based database of humanity heritage masterpieces made of multimedia artifacts (texts, moving or still images and sounds) easily accessible from the outside through Internet links. The UNESCO's documentary heritage archive is a perfect example of a multimedia communication attempt to bring together the fly-on-the-wall approach of the documentary artifact with the requirement of an entertaining communication-oriented project. This online digital archive has demonstrated the usefulness and attractiveness obtained by engaging digital communication tools to preserve cultural heritage expressions of different kinds, from monuments to performing arts and from traditional craftsmanship to rituals and social practices.

An effective communication strategy requires to deliver information, avoid redundancy, define target and adapt language to it (Frascara, 2004), make proper visual choices that respect the aesthetic qualities of the communicated heritage, when relevant, and to create a compelling visual artifact adapted to a generalized target. Since animation visual codes do not just “merely reflect a world outside the bounds of the text, but [can] rewrite and reconstruct them” (Khun, 1985, p. 48), it provides a particularly suited tool for communicating contents that can benefit from “different codes of representation, [...] design approaches [and] different levels of abstraction using signs and symbols already encoded in the collective imagery” (Maselli & Mouri, 2021, p. 647). In animation the concept of abstraction refers to a type of filmic style that experiments with shapes, colours, narration and focuses on contents and meanings more than on the execution of the animation itself (Fauzi Naeim, 2017). Abstraction therefore is another important quality of the communication strategies that need to be considered for designing an animated docudrama.

These thoughts allow to formulate a *list* of requirements that help to formulate parameters for communicating and promoting Cultural Heritage in a digital scenario. A communication design project aimed at enhancing cultural heritage has to:

- deliver information;
- have a defined target;

- use consistent language and visual choices (i.e., vast target requires to use symbols and images encoded in the everyday experience of the addressed community);
- guarantee accessibility and be comprehensible from a vast crowd;
- be easily accessible through the internet and from different devices and communication/information channels.

4. Animated docudrama for cultural heritage: an evaluation matrix

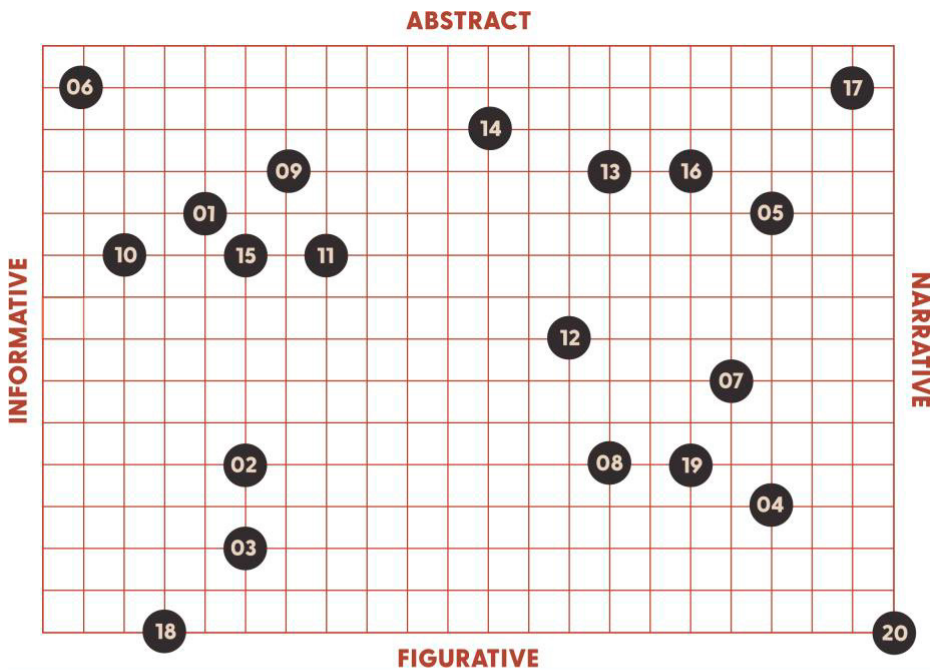
By mixing together the requirements above listed to outline animated docudramas, effective communication design composition and heritage-oriented audio-visual projects, we will suggest a pattern of parameters useful both for recognizing, cataloguing and producing animated artifacts for communicating cultural heritage. An animated docudrama for Cultural Heritage has to:

- deliver information in a narrative form;
- preserve the memories of past and present tangible or intangible heritages;
- be comprehensible for a vast target;
- be easily accessible through the internet and from different devices and communication/information channels;
- use consistent language and visual choices;
- benefit from abstract codes of representation;
- stage different visual elements of a communication design composition: graphics, illustrations, typography, pictures, sounds.

To validate these parameters, 20 animated artifacts have been selected by delving into internet digital archives, online databases (UNESCO), historical and cultural information web channels, and online portfolios of communication agencies that deal with the promotion of Cultural Heritage. Collected case studies differ by year of production, used animation technique, duration, and content narration, but all of them fill the requirements defined by the above formulated pattern:

- present a narrative structure to vehicle informative content about Cultural Heritage artifacts, traditions and institutions;
- use simple language and universally comprehensible codes of representation;
- use at least one of the different elements of a communication visual composition: characters, typography, photographic images;
- have been collected from internet archives, digital databased, online animation national and international boards all easily accessible through the internet.

Other parameters of analysis concern the code of representation (abstract or figurative) and the use of narrative conventions. Animated docudrama can stage different levels of abstraction (as for visual codes of representation) and move flexibly between articulated narratives that sometimes overshadow the informative goals and information-based artifacts with a narrative structure barely suggested. The following matrix (Fig. 1) classifies all selected case studies according to this dualistic approach: visual elements can be either abstract or figurative, and narrative structure and informative contents can have different weights, and these two extremes can successfully embrace either an abstract or figurative code of representation.



01. What should I study, 2019	11. Sustainable tourism and heritage, 2017
02. Introduzione agli statuti, 2018	12. The lost Kingdom of Kush? 2021
03. Una gironata al mercato, 2018	13. Selby district, 2014
04. Saludos amigos, 1942	14. The anthropocene reviewed, 2020
05. Los tres caballeros, 1944	15. The animated history of Italy, 2018
06. York castle museum, 2018	16. A Mini Guide to Medieval Castles, 2017
07. Anno europeo del patrimonio culturale, 2018	17. The Battle of Hastings, 2016
08. Le mura di Bergamo, 2016	18. Ancient Rome, 2019
09. UNESCO Natural world heritage sites, 2021	19. World heritage animation, 2011
10. The 1954 Hague Convention, 2017	20. A day in Pompeii, 2013

Fig. 1. Evaluation and classification Matrix of selected case studies, 2022 (Property of the author).

Case studies placed in the matrix stage all parameters used to describe the main components that an animated docudrama for Cultural Heritage must possess. Some of these components are fixed and invariable, as that they must be present within the artifact to define it as an animated docudrama for cultural heritage. Others are flexible: the artifact can employ a more abstract and less figurative style (and vice versa) or can be more informative than narrative (or vice versa). The matrix is made up of these four parameters, which oppose each other in pairs: on the one hand the abstract-figurative pair, on the other the informative-narrative pair. All analysed animations were placed in the matrix according to their degree of belonging to one of the parameters of each dichotomous couple. Therefore, each case study was evaluated and then classified by its informative-narrative or abstract-figurative characteristics.

5. Description and analysis

The analysis carried out within the matrix highlights different approaches that selected case studies show in formulating an animated language for communicating specific cultural – mainly historical – topics. Four case studies stood out as they have been judged as showing the characteristics expressed by the flexible parameters in a more prominent way than the others videos: *York Castle Museum* (2018) (informative-abstractive), *The battle of Hastings* (2016) (abstractive-narrative), *Ancient Rome* (2019) (figurative-informative), *A Day in Pompei* (2013) (narrative-figurative). These case studies are distinguished from the others as they have a very strong sense of belonging to a pair of parameters, and therefore are worthy to be deeply explored.

York castle museum (Fig. 2-3) is an animated video produced in 2018 and made with a 2D CGI animation technique: the story is about the history of the York castle. The video comes from the YouTube channel of the *English Heritage Archive*, a charity association that cares for over 400 historic buildings, monuments and sites around England. The main figures are all made with the style of the silhouette and animated as cut-out marionettes. The coloured and texturized backgrounds guarantee the dynamism of the narration. The representation tends towards abstraction as the figures are stylized at the highest level and characterized by black filling with no details apart from the ones laying on the external outline. The video stages a strong informative component that goes to the detriment of the narrative one.



Fig. 2. *York Castle Museum*, still frames, English Heritage, 2018 ©English Heritage Archive



Fig. 3. *York Castle Museum*, still frames, English Heritage, 2018 ©English Heritage Archive

The Battle of Hastings (Fig. 4-5), is a 2016 video made in 2D CGI animation and produced by the English film, TV, video and animation production company *Digifish*. The film illustrates the win of William in the battle of Hastings. The representation tends towards abstraction: the characters' shapes are very simplified and geometric, though coloured and provided with facial and body details, and the backgrounds practically absent. Contrary to the previous case study, this video presents a highly developed narrative component compared to the informative one not particularly explored.

Ancient Rome (Fig. 6-7) is a 3D CGI video from 2019 produced by *Smarthistory*, an international no profit academic association of art historians, curators, archaeologists, and artists committed to rewriting the legacies of art history by making the history of art accessible to more people, in more places, by using digital technologies. The associations created an online video essays and documentary platform that provides information about art and cultural objects. The documentary *Ancient Rome* presents the places of Rome as they actually were at the time of the Roman empire through a detailed 3D reconstruction. The 3D animated sequences come from the *RomeReborn* digital archive, a scientific project born in 1997 with the aim of reconstructing the buildings of ancient Rome in 3D (romereborn.org). This video, therefore, reaches a very high level of figuration. In parallel to this, detailed descriptions of the buildings and the urban structure of the city are provided without building a narrative around them, so it can be defined as an informative video.

A day in Pompeii (Fig. 8-9), is a video from 2013 produced by *Zero One Animation*, an Australian based studio specialized in digital animation and visual effects. Like the previous one it is made with a 3D CGI animation technique. The video reconstructs the day Pompeii was destroyed. A fixed camera frames the scene with only diegetic ambient noises from the background. Also in this case we are dealing with a video that is certainly very figurative, but which compared to the previous case study does not present any information, it simply narrates the event through the expedient of the time lapses. It is therefore a narrative and not so informative artifact.



Fig. 4. *The battle of Hastings*, still frames, Digifish Production, 2016 @ Digifish

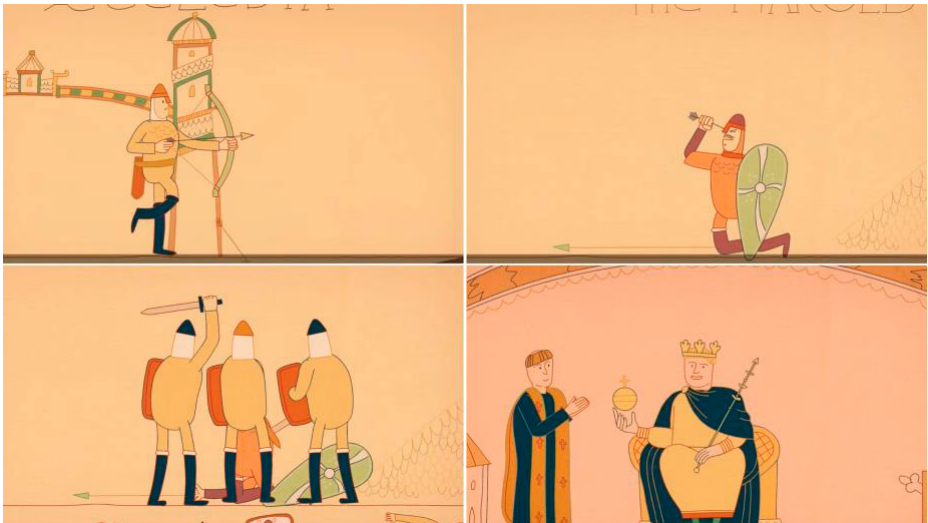


Fig. 5. *The battle of Hastings*, still frames, Digifish Production, 2016 @ Digifish

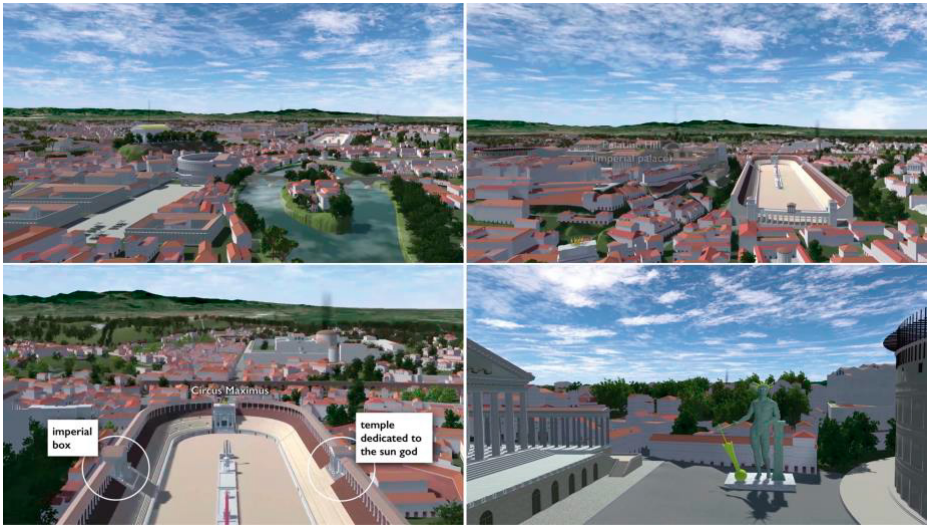


Fig. 6. *Ancient Rome*, still frames, Smarthistory, 2019 © Smarthistory, RomeReborn



Fig. 7. *Ancient Rome*, still frames, Smarthistory, 2019 © Smarthistory, RomeReborn



Fig. 8. *A Day in Pompeii*, still frames, Zero One Animation, 2013 © Zero One Animation



Fig. 9. *A Day in Pompeii*, still frames, Zero One Animation, 2013 © Zero One Animation

6. Conclusions

The literature in the area of animated docudrama features and communication design for cultural heritage provided the basic suggestions and strategies that contributed in defining the characteristics that an animated docudrama for cultural heritage must possess. These characteristics have been proven through the analysis of case studies and represent a starting point for the definition of a useful toolkit for the production of audio-visual artefacts that deal with this topic. Since the definition of docudrama is young and not yet unequivocally defined in the field of video production and film theory, and given that audio-visual artefacts are a rapidly growing category thanks to the most recent applications and future technological possibilities, the hypothesized pattern represents a first attempt to define this toolkit and for this reason some elements can be improved.

First of all, it might be important to expand the number of case studies to test the suggested parameters and define a more consistent and validated strategy. Furthermore, the field of investigation would become more interesting if it were expanded to VR and AR. The above-mentioned project *RomeReborn* is a valid example of this path of experimentation applied to the communication of Cultural Heritage. In the last 10 years the project has evolved into an immersive and interactive experience in VR in the world of ancient Rome allowing users to walk the streets of the virtual city, enter buildings and experience the life of the inhabitants of ancient Rome.

Another important improvement could be represented by the involvement of partners and organizations that can help to better identify the target and the main purpose of the video. An animated docudrama for cultural heritage can aim at communicating, teaching, advertising and, according to the defined target, can approach the informative and narrative content and the codes of representation with a more consistent and aware strategy.

Acknowledgments

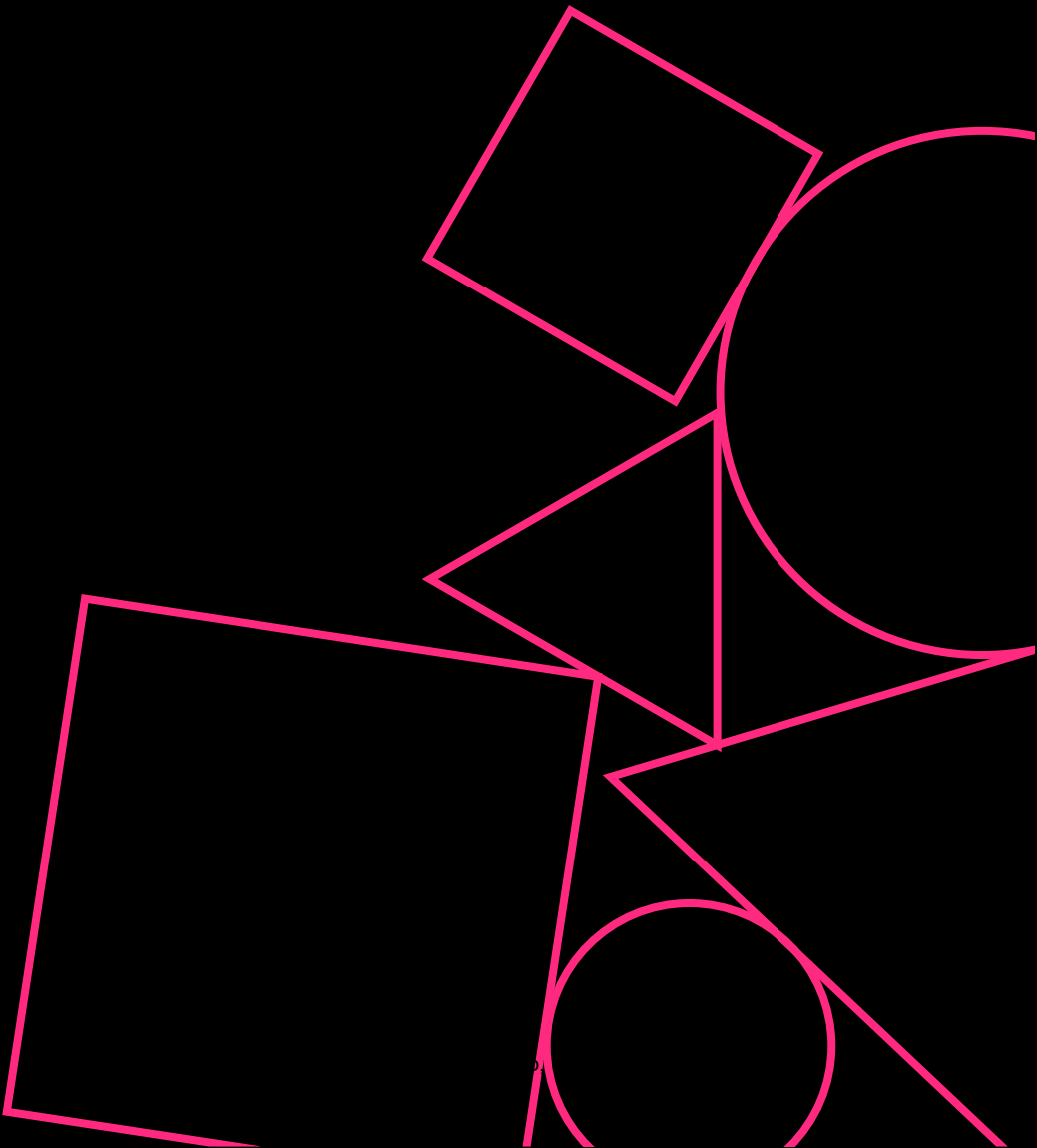
This paper shows the result of a common discussion and elaboration work, but the writing of paragraphs can be attributed to: Vincenzo Maselli (1, 2, 3) and Giulia Panadisi (4, 5, 6).

References

- Agnew, J. (2020). *The Landscapes of Western Movies: A History of Filming on Location, 1900-1970*. McFarland.
- Aufderheide, P. (2007). *A Very Short Introduction to Documentary*. Oxford University Press.
- Ceccarelli, N. (2012). Historical perspective of animation in documentary film". In Turri, C. (Ed.), *IP Informanimation 2011. Research, education and design experiences*, 118-122, FrancoAngeli.

- Ceccarelli, N. (2014). Let's Get Abstract! The Language of Animation in Documentary Films Between Information and Narrative. In Ceccarelli, N. & Turri, C. (Eds.), *IP Informanimation 2012. Research, education and design experiences*, 119-139, FrancoAngeli.
- Curthoys, A. & Marilyn, L. (2004). *Connected worlds: history in transnational perspective*. Australian National University Press.
- Fauzi Naeim, M. (2017). *Thinking Abstract Animation*. Paper presented in Asia Animation Forum, Bucheon, South Korea, Oct 23, 2017.
- Formenti, C. (2022). *The Classical Animated Documentary and Its Contemporary Evolution*. Bloomsbury Publishing.
- Frascara J. (2004). *Communication Design: Principles, Methods, And Practice*. Allworth Press.
- Glynn, A. (2013). Drawn From Life: The Animated Documentary. In Wilson, B. (Ed.), *The Documentary film book*, 73-75. Bloomsbury Publishing.
- Hampe, B. (2007). *Making Documentary Films and Videos*, 2nd edition. Henry Holt and Company.
- Honesty Roe, A. (2013). *Animated Documentary*. Palgrave Macmillan.
- Hooks, E. (2016). *Craft Notes for Animators: A Perspective on a 21st Century Career*. Taylor and Francis Group.
- Khun, A. (1985). *The Power of the Image: Essays on Representation and Sexuality*. Routledge.
- Martin, J.R. (2018). *Documentary Directing & Storytelling*. Real Deal Press.
- Maselli, V. & Mouri, E. (2021). Abstract to figurative, and everything in between: visual design approaches and linguistic codes of a traditional form of animated product. In *Design Culture(s). Cumulus Conference Proceedings*, 645-658.
- Mitchell, B. (2017). *Independent Animation. Developing, Producing and Distributing Your Animated Films*. Taylor & Francis Group.
- Oxford English Dictionary (N.A.). Documentary*. Retrieved from <https://www.oed.com/view/Entry/56332?redirectedFrom=documentary#eid>
- Paget, D. ([1998] 2011). *No Other way to Tell it. Docudrama on Film and Television*. Manchester University Press.
- Paolini, P. & Rubegni, E. (2010). Multimedia Communication in Cultural Heritage: Impact Assessment. In *Proceedings of the ESA Research Network Sociology of Culture Midterm Conference: Culture and the Making of Worlds*.
- Rhodes, G. & Springer, J. (2006). *Docufictions: Essays On The Intersection Of Documentary And Fictional Filmmaking*. McFarland Publishing.
- Rome Reborn® (N.A.) *Rome Reborn Virtual Reality*. Retrieved from <https://www.romereborn.org/content/home-0>
- Roscoe, J. & Hight, C. (2001). *Faking it. Mock-documentary and the subversion of Factuality*. University Press.
- UNESCO (N.A.) *Outline of Digital Archiving Project*. Retrieved from <https://www.unesco.org/archives/multimedia/subject/14/digital+archiving+project>.
- Wilson, B. (2013). *The Documentary film book*. Bloomsbury Publishing.

1.3 Interactive data visualization



Body-related data visualization. A study for design guidelines

Michele Zannoni¹ (0000-0003-2703-772X),
Ami Licaj² (0000-0002-0697-0441),
Giorgio Dall'Osso³ (0000-0002-4219-7513),
Eleonora Malacchia⁴

^{1,2,4}Department of Architecture, Alma Mater Studiorum, University of Bologna
michele.zannoni@unibo.it, ami.licaj@unibo.it, eleonora.malacchia@studio.unibo.it

³University of the Republic of San Marino, giorgio.dallosso@unirmsm

Abstract. This contribution is part of a broader research project entitled Human Body Interaction Design (HBID) started at the Advanced Design Unit of the University of Bologna in 2021. Consistently with the arguments addressed over the years, this recent part of the research investigates the theme of the relationship between body, data and environment while focusing on the user. Specifically, it explores the world of applications relating to the monitoring of body parameters through devices, i.e. the increasingly widespread phenomenon of the Quantified Self. The objective of the research is to understand the most effective ways of representing body parameter data through device applications, aiming at the final elaboration of an online tool that can serve as a support for designers in the future design of this type of data visualization. Starting from an initial state-of-the-art and preliminary research phase, the research then focused on the collection and systemization of case studies and the elaboration of qualitative and quantitative tests. The contribution summarizes the outputs of these firsts phase, highlighting the gaps recognized as priorities in this type of design project and providing some indications on how to approach some of the problems that emerged.

Keywords. Body/ Data visualization / Guidelines / Quantified self / User-centred

1. Introduction

Human body physiological parameter tracking processes have become essential components of multiple service design projects focused on quantified self-issues, becoming a relevant cultural phenomenon for contemporary society from 2010 onwards.

Parallel to this transformation in the understanding of one's own body, new forms of data visualization have gradually developed, whose primary objective is to make comprehensible the information that the various sensors collect in people's lives.

The human parameters tracked are in various examples represented with respect to a unit of measurement expressed in time, which can be understood by comparison. Measured data are often characterized by small variations and only comprehensible over a very large time interval. The aim of this contribution is to analyze how, depending on which aspects of the body one wishes to represent, there are different forms of visualization best suited for communicating this information.

The representation of the human body and its anatomy culminated in the Renaissance period in which the geometric construction of man by Leonardo da Vinci and Leon Battista Alberti defined the human form in its geometry and proportion.

The evolution in technical iconography reached an analytical level with the anatomical sciences, with the superimposed and interactive tables of Andrea Vesalius' *De humani corporis fabrica libri septem* (1543) that constitute a cognitive form in which the human eye violates the sacredness of the body and completes the map of the body parts, bringing vision to a scientific level (Maldonado, 1994). A paradigm arrives when the body related to issues of ergonomics in the 20th century with the formal schematizations of Le Corbusier's *Modulor* (1948) and the anthropometric charts in *Designing for People* by Henry Dreyfuss (1955). These immobile representations visualize the human being in relation to a space but not its variations over time. With the advent of medical systems, the vision of the body has become three-dimensional (Maldonado, 1994, p. 83), moving and parametric thanks to software processing, finally integrating with the advent of personal tracking systems with the small screens of smartphones becoming usable content in real time to understand oneself.

Starting to consider the relationship between human beings and interface with privileged attention to the artifacts that come into relationship with the body is a prerequisite for being able to start coding these new forms of project. Now the research question that we pose in this research focused on the needs to investigate the forms and ways to create visualizations of the immaterial parts and information of our body. To start thinking that the relationship between corporeality and data visualization opens a new project field needs an in-depth analysis of the state of the art that within this research project wanted to be analyzed through a permanent observatory already active in the field of human-body interaction since 2021¹. The complexity of the human's contemporary visual representation linked to the multitude of data generated by the wearable device becomes more and more important and it will have a primary role in body-machine interaction.

¹ The Human Body Observatory is a part of a more extensive project started in 2019 on the field of Design for the Human Body Interaction (<https://adu.unibo.it/hbi>). The data collected in the research was shared in 2021 at an international symposium in Bologna and opened to the public in the Observatory website at the end of 2021.

2. The research

A series of studies show that in the relationships between wearables, data and people there are significant problems related to storytelling, engagement, literacy, the time factor - which determines the type of attention paid to the tools - and finally the space factor - the pixel space available to display the data and its limitations at the interface level. (Rooksby et al., 2014; Parnow, 2015; Rapp & Cena, 2016; Ličaj, 2018; Zannoni, 2018; Dall'Osso, 2021)

The research therefore aims to explore these relationships and communication limits in order to understand the most correct ways of visualizing body-related data.

The first part of the research focused on defining the state of the art through the analysis of thirty applications between medical, sports and general monitoring (habits), the analysis of the type of monitoring – direct, documentary, diagnostic, reward collection and mono-data – (fig. 1) and finally the analysis of the types of representation.































Categoria di tracciamento personale	SPORTIVO	MEDICO	GENERICO
DIRETTO per raggiungere un'obiettivo	  		  
DOCUMENTARISTICO per registrare attività	  	   	   
DIAGNOSTICO per collegare diversi parametri		 	  
COLLEZIONARE RICOMPENSE per raccogliere incentivi			
MONODATO per interesse nei dati		  	 

Fig. 1. The monitoring type analysis of examined apps divided by the different areas.

Of each application, all trends on the types of parameters monitored, the types of graphs used and finally the types of color ranges used were extracted and put in system.

As a result of the first state-of-the-art phase, 30 specific cards for each App (fig. 2) and 8 specific cards for each parameter type (fig. 3) were produced.

Tipo di dato	Range dati	Tipo di grafico	Leggenda	Esempi	Palette
Contapassi	giorno settimana mese	donut chart bar chart line graph	quantitativa quantitativa quantitativa		
Frequenza cardiaca + peso	settimana mese	bar chart line graph	quantitativa quantitativa		
Monitoraggio del sonno	giorno settimana mese	donut chart bar chart line graph	quantitativa quantitativa quantitativa		
Monitoraggio dell'umore	giorno settimana trend (3 mesi)	/ bar chart donut chart	quantitativa quantitativa quantitativa		
Tag personalizzati	settimana trend	/ /	/ /		
Correlazione dati/tag	trend	spline graph bar chart	/ quantitativa		
Correlazione umore	trend	/ bar chart	/ quantitativa		

Fig. 2. Model sheet created for each app analyzing parameters and visualizations.



Fig. 3. Model sheet created for each type of parameter which synthesized all the types in which it was represented inside the different apps.

The second part of the research aimed to test – quantitatively and qualitatively – the different types of representation of the different parameters. The usability tests were conducted in two ways: online survey with 46 people and focus group with 10 participants.

In the online survey were submitted all the data visualizations analyzed in the state-of-the-art phase, subdivided in 8 sections in relation to the type of parameter represented. Users were asked to identify what form of data visualization was clearest.

The focus group has been tested one app in particular (Exist) among those previously studied to establish user gaps and bias.

The analysis of the state-of-the-art revealed the usefulness of using an online tool for designers as an aid in the design of data visualization applied to the Quantified Self theme. To this end, the relational database HBI Observatory (Zannoni et al., 2022) was chosen as a tool for construction of the online platform.

3. Discussion

The research attempts to provide user-centered solutions for the design of Data Visualization that take into account the perceptual and cognitive contextual limitations of users and explore the dichotomies possible in the field of Data Visualization both in its approaches – e.g. purity/anesthetization – and in its structural characteristics – e.g. static/dynamic fruition – trying to understand how these can be related to the theme of the Quantified Self. (Bertin, 1968; Cairo, 2012; Bihanic, 2015; Tufte, 1990; Holmes, 1991) The final outputs of the research will be as follows and will then be made available to the design community:

Design guidelines, which are a decision-making tool in the construction of body-related Data Visualization, on the themes of: (i) user literacy; (ii) most suitable UX and UI depending on the type of media, data and graphics; (iii) how to include potential non-visual feedback in addition to visual ones; (iii) how to take bias into account when designing DataViz.

Prototyping tools that then allow users to create free correlations between data.

Coding new narrative forms for users depending on the medium, target audience, body data and literacy level.

The research consists of four phases: preliminary research and testing, data systematization and analysis, construction of the platform that can be shared with the community, and development of the design guidelines. This contribution aims to show the outputs of the first phase, i.e. the preliminary research and testing, and part of the outputs of the second phase, systematization of the data and their initial analysis, from which three major trends emerged relating to the issues of multi-parameter data, temporality and a customizable UI-UX.

3.1 Multi-parameter

In the field of investigation described, there is a small percentage of graphs constructed on more than one type of data (fig. 4). The use of different parameters within the same graph is carried out in a few cases related and mainly to the monitoring of a specific activity: sleep or walking. In the first case the duration of sleep (time data), is related to: emotional self-evaluation data, blood saturation, heart rate. In the second case, the number of steps is compared with emotional self-evaluation data and calories burned. A third type of multi-parameter graphs is used to compare a real time data with a benchmark as a personal or interpersonal average (e.g. *Zepp | Heart rate HR; Heart rate zones*).

The objectives of multi-parameter graphs are threefold: to provide a comprehensive reading of the complex dynamics of the human body (e.g. *One Plus Health | Oxygen saturation SaO₂; Sleep tracking*); to provide the user with awareness of the cause-effect relationship of certain activities on the body (e.g. *Google Fit | Calories burned; Pedometer*); and to provide immediate awareness of the amount of a body parameter in real time should it fall outside a given threshold or area.

In the interfaces investigated in the research, multiple parameters are shown mainly through three modes: with multiple characterizations of the graph (e.g. in *Exist | Mood index; Pedometer* the size of the bars corresponds to the number of steps data while the color of the bars corresponds to the mood); with multiple graphs arranged parallel to a timeline (e.g. *One Plus Health | Oxygen saturation SaO₂; Sleep tracking*); with alphanumeric information of a parameter inserted to the side of the main graph (e.g. *Google Fit | Calories burned; Pedometer*).

The multi-parameter graphs analyzed relate data about the individual user's body to each other. The *Flaredown* application is an exception because in the same graph it shows the self-reported value of headache intensity and the average daily atmospheric pressure.

Two specific lines of insight related to multi-parameter graphs thus emerge within the explored case studies. The first concerns the time variable as the normalizing value of the parameters, and the second concerns the ability of the graphs to be customized following the user's needs.



Fig. 5. Data Visualization showing the type of time ranges used by applications to collect and represent data for various types of parameters.

3.2 Temporality

The time factor emerges as a key issue from the studies examined and the research in question, according to a double point of view: the time range of the data displayed in the various apps (fig. 5) and the amount of time the user spends reading and enjoying the information.

As we can see from the graph, most of the apps use the Day-Week-Month triad to show the data of the various parameters to users, and the Instant data to a lesser extent. It is therefore incredible how parameters such as Oxygen saturation or Heart rate HR, where the value of the instantaneous data could be of vital importance, do not provide the possibility of an instantaneous consultation or therefore do not grant the possibility of assisting with direct signals or feedback if necessary. Indeed, as Rooksby (2014) and colleagues argue, data is meaningful in the context in which it is produced and can lose meaning when removed from that specific context. Having immediate feedback about the actions that people are performing based on location makes it possible for monitoring activities to be more effective. Indeed, Tufte (1990) argued that at the core of quantitative reasoning, the most important question is: in relation to what?

As regards the issue of time at the communication/understanding level, immediacy is recognized as a fundamental value by users to the extent that it makes even the user incapable of understanding and reading the data, with negative implications in this case for involvement and interest in data and application. (Rapp & Cena, 2016)

The hunger for information, fast, without too much interaction and immediate is a result of the way we are now used to interacting with technology in general, but especially wearables or smartphones. Our minds are increasingly burdened by information overload (Gazzaley & Rosen, 2017), our attention threshold has declined sharply but we are increasingly capable of multitasking actions (Gausby, 2015) and passivity is therefore a key element in achieving high engagement thresholds (Ličaj, 2018).

3.3 Customization

The customization issue arises transversally to the topic of multi-parameter and temporality.

According to the app analysis, there are four maximum possible levels of customization: (i) filtering from the home data that one does not wish to view (Zeep, Zepp Life, Huawei Health, Google Fit, Mi Fit, One Plus Health); (ii) changing the type of graph (Daylo only); (iii) customizing the color scale of the graphs (Daylo, Loop Habit Tracker, Reflecty, Pexels and Everyday); (iiii) filtering and customizing the UX by correlating or omitting data from the various parameters (Daylo, Vos, Sleep as Android).

Only 1/3 of the analyzed applications thus allow for minimal personalization of the experience by customizing it according to the user's wishes or needs. But this level of customization of the UX was found to be too low. The usability tests carried out in this

research confirm how some testers attempted to select graphical elements expecting an interaction that would lead to an in-depth study of the data, thus demonstrating a desire for personal exploration. Often, these unsuccessful attempts at interaction are due not only to the free intention of the user, but also to the graphics themselves, which seem to invite actions that in truth have no feedback. See for instance the graphs Google Fit | Heart rate HR and Exist | Mood index; Pedometer (fig. 6). In the first case, it appears that the daily data is compared with an average - red area - but this is purely a deduction, there are no certain indications, and the area cannot be interacted with in any way. Even in the second case, the graph is unclear, especially since it should tell two types of parameters - pedometer and mood index - and what one wonders is where the mood index data is and how it relates to the pedometer.



Fig. 6. Case studies showing different issues related to data representation and the UX and UI of Apps.

4. Conclusions

Communicating a specific parameter to the user by a graph necessarily follows a consideration of the medium on which the graph is displayed. In particular, two aspects are brought to attention here: the size of the digital medium, the activities allowed by the device while the user acquires the information. Indeed, it becomes evident how a limited size of the display reduces the possibilities of giving complex

information. The small size also imposes a limited use of typography to support the information. The size can be partially compensated for with a UI based on sequential screens, however, which makes the overall reading less effective. The use of a device and its associated features is effective when it responds, in addition to the functions for which it was designed, to the contexts in which it is immersed. It is therefore necessary to highlight the difficulty that many wearables have found in staying within the uses of users after the first months of use (Zannoni, 2018). From the point of view of the information available on the devices, it is appropriate to identify multi-device user experiences that can manifest real time information directly on the body while the more in-depth and reflective ones (Bagnara & Pozzi, 2014) on more generous displays and interactive possibilities.

Second, from the analysis performed, an opportunity was identified to investigate design solutions that investigate the use of multi-sensoriality in data transduction. Multi-sensoriality is understood as the design of haptic or acoustic feedbacks that add to the prevailing visual information.

The potential of haptic (Zeagler, 2017) and acoustic (Chernyshov et al., 2016) feedbacks in the design of wearable devices have been partly already explored in both scientific research and commercially available solutions. The use of these feedbacks is due to the need to integrate information-abstracted individually or continuously-with the main activities the body is performing in which the sense of sight is most involved. Less evident in the research is the use of information acting synergistically on multiple sensory channels during the reading and comprehension phases of data visualization. In particular, such feedbacks are hypothesized to find effective application in communicating a parameter in continuity as the user navigates between multiple data visualizations; in addition, the same could be used as a tool for emphasis on single parameters communicated synchronously across two different sensory channels.

Finally, is the strong need to build experiences as customizable as possible that consider the user's level of literacy. Indeed, it has been seen that there are big differences between a naïve and an expert user (Rapp & Cena, 2016). The non-customizable experience in fact does not consider the differences of the various types of users, creating discrimination towards entry-level users, so to speak, or oversimplification towards the more experienced and demanding users.

On the other hand, one cannot expect people to be rational data scientists. (Rooksby et al., 2014) Data visualization literacy and the development of critical and inspectional skills must be built step by step in a progressive educational path as the learning process of writing or reading.

5. Next steps of research

The future goals of the research will focus on finalizing the last phases, i.e. finishing the data collection and analysis of the apps related to the Quantified Self by also integrating applications such as monitoring menstrual cycles. Furthermore, to

continue with the analysis phase by focusing on further gaps detected by the second collection phase. In the last phase, the project will focus on making the platform an increasingly useful aid in terms of designing Data Visualization for the Quantified Self by improving the consultation experience in the first place.

References

- Bagnara, S., & Pozzi, S. (2014). Interaction design e riflessione. In A. Bassi & F. Bulegato (A c. Di), *Le ragioni del design*. FrancoAngeli.
- Bertin, J. (1968). *Semiology of Graphics: Diagrams, Networks, Maps (1st ed.)*. Esri Press.
- Bihanic, D. (2015). *New Challenges for Data Design (2015th ed.)*. Springer.
- Cairo, A. (2012). *Functional Art, The: An introduction to information graphics and visualization (Voices That Matter)(1st ed.)*. New Riders.
- Chernyshov, G., Tag, B., Chen, J., Noriyasu, V., Lukowicz, P., & Kunze, K. (2016). Wearable ambient sound display: Embedding information in personal music. *Proceedings of the 2016 ACM International Symposium on Wearable Computers*, 58-59. Retrieved from 10.1145/2971763.2971789.
- Dall'Osso, G. (2021). Haptic Rhythmics for Mediation Design Between Body and Space. *Diid - Disegno Industriale Industrial Design*, 74, 40-49.
- Dreyfuss, H. (1955). *Designing for people*. Paragraphic Books.
- Gausby, E. *Attention Span: Consumer Insights. Microsoft Canada (2015)*. Retrieved from dl.motamem.org/microsoft-attention-spans-research-report.pdf.
- Gazzaley, A., & Rosen, L. D. (2017, October 27). *The Distracted Mind: Ancient Brains in a High-Tech World*. The MIT Press.
- Holmes, N. (1991). *Designer's Guide to Creating Charts and Diagrams*. Watson-Guptill.
- Liçaj, A. (2018). *Information Visualization. Disciplina Liquida Intersoggettiva*. Retrieved from <https://iris.unige.it/handle/11567/1031290> [Tesi di dottorato, Dipartimento di Architettura e Design – Università di Genova].
- Maldonado, T. (1994). Corpo tecnologico e scienza. In Capucci, P. L., *Il corpo tecnologico*, 77-95, Baskerville.
- Parnow, J. (2015). *Micro Visualization*. Retrieved from <https://microvis.info/>.
- Rapp, A., & Cena, F. (2016). Personal informatics for everyday life: How users without prior self-tracking experience engage with personal data. *International Journal of Human-Computer Studies*, 94, 1-17. Retrieved from 10.1016/j.ijhcs.2016.05.006.
- Rooksby, J., Rost, M., Morrison, A., & Chalmers, M. (2014). Personal tracking as lived informatics. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Retrieved from 10.1145/2556288.2557039.
- Tufte, E. R. (1990). *Envisioning Information*. Graphics Pr.
- Vesalius, A. (1543). *De humani corporis fabrica libri septem*. Johannes Oporinus.
- Zannoni, M. (2018). *Progetto e interazione. Il design degli ecosistemi interattivi*. Quodlibet.
- Zannoni, M., Dall'Osso, G., Pezzi, M., & Celaschi, F. (2022). *Human Body Interaction Observatory [Database Casi Studio]. Human Body Interaction Observatory*.
- Zeagler, C. (2017). Where to wear it: Functional, technical, and social considerations in on-body location for wearable technology 20 years of designing for wearability. *Proceedings of the 2017 ACM International Symposium on Wearable Computers*, 150-157. Retrieved from 10.1145/3123021.3123042.

From data to concerns: gender equity in higher education

Maria Menendez-Blanco¹ (0000-0002-7353-5183),
Matteo Moretti² (0000-0002-0595-7114),
Seçil Uğur Yavuz³ (0000-0002-1603-7700)

^{1,3}Free University of Bozen-Bolzano
maria.menendezblanco@unibz.it, secil.uguryavuz@unibz.it

²Sheldon.studio, matteo@sheldon.studio

Abstract. “Show me the data!” is a phrase often meant as a request for “raw” data to prove a statement. People request data to prove claims that might seem anecdotal or lacking evidence. In these situations, data usually refers to numbers and usually in large amounts. Even though large quantities of systematically collected data can help create awareness or address scepticism about the existence of a complex issue, numbers can be limited in meaningfully addressing that same issue. In addition, the emotions, stories, experiences, and worldviews are rendered invisible in the process of collecting and normalising large amounts of descriptive data. In this chapter, we present our initial attempts to use quantitative data as a starting point for eliciting concerns about equity in higher education through data visualisations and data-objects. We describe our interventions as part of a research project that aims to generate debate on equity in higher education with an emphasis on gender. We focus on gender due to data availability while keeping an intersectional perspective on other power-mediating dimensions, such as nationality. This work adds to a growing corpus of work on how data representations are instrumental to deal with complex societal issues while bringing to the fore the importance of complementing the so-called facts with situated concerns.

Keywords. Data visualisation / Transmedia design / Interactive storytelling / Data feminism / Gender issues

1. Gender equity in higher education in Italy

In 2021, the Italian Department for Equal Opportunities (DPO) published the “National Strategy for Gender Equality”¹, which urges to consider gender issues in professional and institutional contexts. In the context of higher education, the proposed strategies range from considering gender in funding allocation to promoting the representation of women students and researchers in science, technology, engineering and mathematics (STEM). Despite this and other strategic plans at the local, national, and

¹ www.pariopportunita.gov.it/wp-content/uploads/2021/08/strategia-Parit%C3%A0genere.pdf (last access 27th June 2022)

European levels, gender differences persist and are even exacerbated by the global pandemic (Carli, 2020).

In Italy, a total of 56% of university graduates are women; still, only seven out of the 84 university rectors in Italy are women accounting for 8% of the rectors². In addition, there is a significant difference in gender participation between disciplines such as computer science and engineering, with an average of 22% of women graduates. Furthermore, a recent study shows that graduated women earn up to 20% less than their men colleagues five years after graduation³. These numbers focus on gender, although other intersectional dimensions should be considered when discussing equity, such as race, background, or sexual orientation (Crenshaw, 2017; Nichols & Stahl, 2019). In spite of these appalling numbers, the systematic and structural barriers in higher education make it difficult to identify and implement effective strategies toward equity (Ahmed & Swan, 2006; Ahmed, 2012). To investigate these barriers, we argue that there is a need for bottom-up approaches that identify and make visible related concerns in a concrete context. In that way, it is possible to implement situated actions that allow for open discussions not only among “the usual suspects”, meaning those already interested and engaged in working towards gender equity.

2. From data to concerns

Equity in higher education can be considered a wicked problem meaning that it is ill-defined and does not have a single and simple solution (Rittel and Webber, 1973). Wicked problems are structural and systematic and therefore are better addressed with interventions that deal with a specific issue at a time and produce thick descriptions of the topic (Latzko-Toth et al., 2017). When designing interventions to address the lack of equity in higher education, a common practice is to collect, analyse, and represent data that help put issues into numbers. For example, in the European Union, there are policies at the national and transnational levels to collect gender-disaggregated data and women’s participation quotas in the different academic disciplines, funding grants, or leadership positions (e.g., Rosser et al., 2019).

These practices are driven by policies and fueled by a general tendency to turn to quantitative data when dealing with the inherent messiness and uncertainties of wicked problems. Even though these practices are instrumental in mapping the current status of an issue, making comparisons, and creating public awareness, they are limited in fostering engagement. More importantly, they leave aside people’s emotions, stories, experiences and non-predominant narratives, which can be key to driving meaningful structural changes (D’ignazio & Klein, 2020). Finally, a focus on

² <https://pagellapolitica.it/articoli/fact-checking-il-ritorno-di-letta-a-porta-a-porta> (last access 10th October 2022)

³ www.almalaura.it/informa/news/2022/01/28/rapporto-tematico-genere (last access 10th October 2022)

quantitative reports portrays numbers as objective and neutral, which risks proposing actions based on the false belief that fixing the numbers will fix the issue. Differently, we want to use quantitative data as a prompt to invite students and researchers to share their concerns on equity at our university.

We want to investigate how data representations can help elaborate facts into situated concerns to foster debate about equity in higher education. The theoretical grounding for this interest stems from Latour's work on matters of facts, which are expressions that claim to report objective conditions, even though they are partial and political renderings of matters of concern, which instead represent "highly complex, historically situated, richly diverse" political and social conditions (Latour, 2004). Our project adds to the growing corpus of work that explores how interactive artefacts and design interventions can help represent and act on complex and often controversial matters of concern (e.g., Latour and Weibel, 2005; DiSalvo et al., 2014; Menendez-Blanco et al., 2017).

Especially relevant to the project presented in this chapter are those works which use data as design material (Wolff et al., 2016). We find extremely inspiring those contributions that explore the materialities of data to generate public engagement, such as data-objects, which are artefacts that can be used "for individual and collective reflections through a physical portrayal of data." (Karyda et al.; 2020, p. 1). Relatedly, Sosa et al. (2018, pg. 1693) defined data-objects for design activism that "re-frames key features of the present reality and exposes people to significant issues through verifiable and accurate data". To do that, data visualisations can go beyond the visual representation to a more bodily and tangible interaction with data. For instance, "Clever on Sunday" is an example of an installation which produces rubber objects based on statistical data on gender balance in education and invites people to interact with data through tangible artefacts (Starrett et al., 2018).

These types of installations make intangible and complex data graspable and experienceable, creating space to reflect on what quantitative data might mean and sharing emotions, stories, and experiences. Following this approach, Jose Duarte brings the DIY concept to data visualisation by using easy-to-find materials like balloons and tapes to generate physical visualisations of data. His EasyDataViz⁴ project gathers different methods of hand-made data visualisation in an online platform and explains how to use analogue tools to visualise data for public attention and interaction in public places.

3. Methodology

Our project follows a Participatory Action Research (PAR) approach (Baum et al., 2006). This methodology consists of three main phases, collectively identifying, diagnosing, and reflecting on an issue while investigating the potential of digital technologies in

⁴ <http://easydataviz.co/> (last access 10th October 2022)

each phase [ibid]. Due to the limited scope of the project, the focus is on identifying concerns and experiences relevant to equity at our institution.

The gender-disaggregated data on students and researchers were collected from official sources at our university. All the data we use are anonymised. It is important to notice that we use the available data, which presents some limitations. For example, the dataset contains self-reported data, where students can select either “male” or “female” as gender. These binary options refer to sex, not gender, and are not inclusive towards non-binary or trans students. The university is in current discussions on this issue, and we believe that interventions such as the one presented below can help trigger further discussions that lead to changes towards equity and inclusion.

4. Exploring data as a design material to foster debates on equity

We started the project in 2021 with an explorative analysis of the quantitative gender-disaggregated data of our university, which is openly available on our intranet. The results showed remarkable differences between faculties and positions; although these differences were appalling, there were by no means unique to our institution and were very much aligned with national and EU statistics. For example, the percentage of woman students in the Bachelor in Computer Science was 25%, whereas the percentage of women in the Bachelor in Social Work was 10%. In addition, in all the faculties, the percentage of women decreased as the level of seniority increased.

Even though the limited participation of women in STEM fields and in positions of power is a well-known and broadly researched phenomenon, we wanted to know more about the specificities of our institution. With that purpose, we decided to conduct a series of interventions starting from the statistical gender-disaggregated data of the students and moving into our university’s students, staff, and researchers lived experiences.

The first explorative intervention took place on International Women’s Day. On the 8th of March 2022, we “hacked” a total of 13 in-between spaces (e.g., bathroom, stairs, elevator) at our university’s main building with pamphlets stating: “7 out 10 students at [institution] are women and what I really want to know is...” (Figure 1) with coloured round stickers that represent the data. We chose the orange colour to represent women, and the remaining stickers were in different colours to avoid a binary representation. Next to the sentence, we placed a QR code for people to scan and publicly express their concerns by posting how they would complete the sentence on a digital bulletin board (Figure 2). In addition, people accessing the digital bulletin board could express their support for the concerns already published by “liking” them.

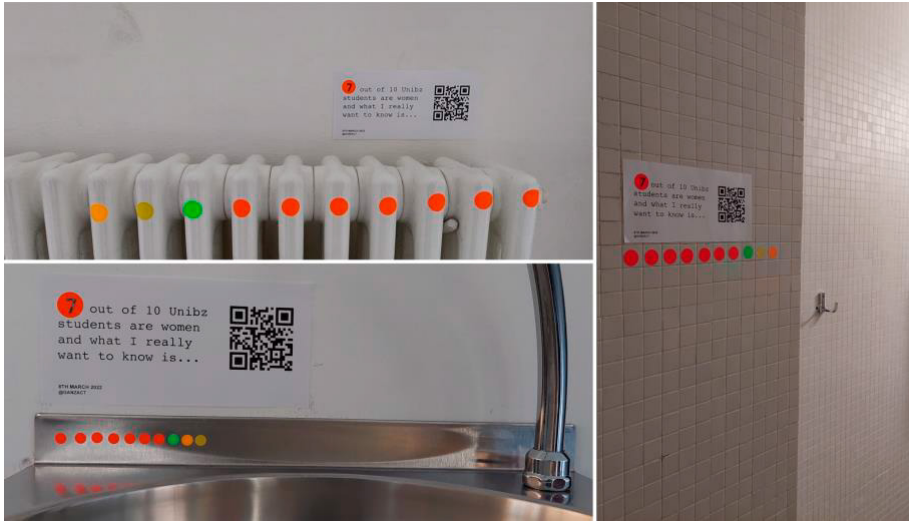


Fig. 1. Pamphlets and coloured round stickers representing the data in different spaces.

The posts were moderated, meaning that two authors of this paper manually accepted the written concerns before they were publicly posted and, therefore, visible to everyone who would access the digital bulletin board. The choice to manually moderate the content was meant to avoid insulting posts or trolling behaviours. Still, no content needed to be moderated and all 26 anonymous concerns were publicly posted on the digital bulletin board. The concerns received a total of 54 “likes”. The most supported posts were “7 out of 10 students at [institution] are women and what I really want to know is...if they perceive they are a majority” and “...if they have ever experienced gender discrimination” each of them was liked seven times. The popularity of these two posts points to an urgent need to make women’s lived experiences visible – beyond numbers and statistics.

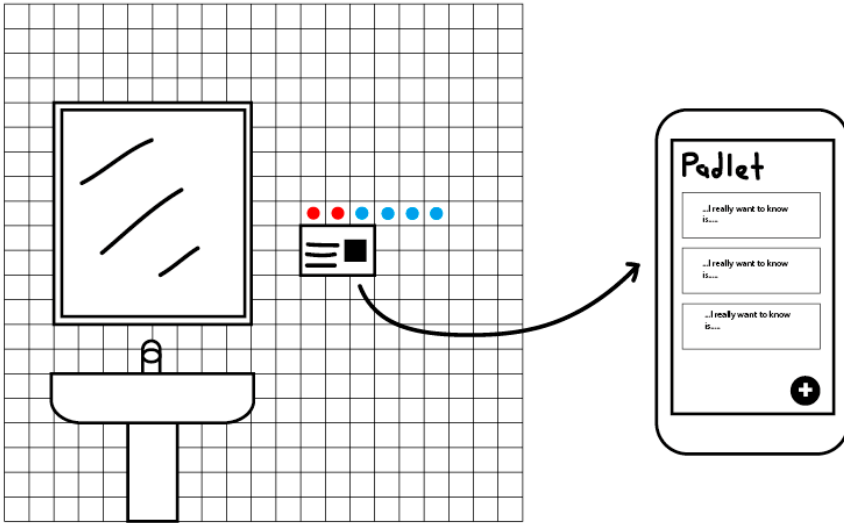


Fig. 2. Scanning the QR code in the pamphlets gave access to a digital bulletin board where people posted their concerns.

One of us analysed the posts using thematic analysis, the themes were discussed among two authors, and disagreements were resolved (Braun & Clarke, 2012). The results show that the posts related to lived experiences were not only the most popular but also the most common. In a total of 12 posts, people expressed a desire to know more about the gendered daily encounters and experiences that might be taken for granted. In addition to the two quotes stated above, people wanted to know *“if they experienced ‘mansplaining’”, “if they are happy”, or “why still we can’t feel safe”*. These posts bring to the fore that, in spite of the reported majority of women presented in the pamphlets, people’s concerns were about women’s daily experiences of respect, well-being, and safety on campus.

The second most popular theme related to career and included six posts where people expressed a desire to know more about the students’ perspectives after entering the labour market. Most of them questioned issues of power and gender in the context of career development, as when someone wanted to know *“how many of them will end up in higher or better paid positions than their male-read colleagues”* or when someone questioned, *“why can’t we be properly represented at high levels? Why are there so few women directors or cover important positions compared to the number of women that study here?”*. Interestingly, some of the posts included terms that were unknown to us, such as when someone asked, *“gender gap in employment - why finding a job is much tougher for women”*, which opened new spaces to be addressed by additional descriptive data and thickened through future interventions. This post exemplifies how our intervention not only elicited concerns but also highlighted

further facts, opening up an iterative process in which data and concerns are intertwined and mutually elicited through data visualisations and data-objects.

The third theme had five posts about the extent to which women were represented at the university and posed concerns on whether the numerical majority was also represented in power positions or administration support. For example, someone questioned, *“Why then the quota among tenured associate professors is ~4 out of 10, among tenured full professors is ~2 out of 10, and among rectors is 0 out of 3? #glasceiling”* or *“if they really receive 70% of the administration’s support”*.

The last theme contained four posts which dealt with intersectionality concerns, such as nationality and background. For example, people wondered *“what countries they are coming from”* and *“which languages they are speaking”*. No posts referred to gender representation in the stickers, but in discussions with people, this question came up often. Even though we tried to avoid a binary colour representation by choosing different stickers, the representation was not clear and did not foster critical reflections on what was actually represented. This result highlights a challenge when designing data-objects that elicit individual and collective reflections through physical data representations. Data-objects are meant to represent verifiable and accurate data; however, these data might also encode hegemonic narratives. Therefore, an open challenge when designing data-objects is how to foster people to question the data and the assumptions embedded in their collection or representation.

Our first intervention helped us explore how low-tech tools and materials could elicit concerns from data. The results are modest but encouraging. Even though we did not advertise the action, many people proactively reflected and shared the concerns fostered by the data. The next steps include the development of a data visualisation and data-objects, on which we are currently working and outlined in the following paragraphs.

We decided to create another playful and provocative intervention that had the ability to reach a broader audience within the university. With that purpose, we are designing and implementing an interactive artefact that represents gender-disaggregated data through a mobile-first interface. The interactive artefact consists of two components focusing on data visualisation and storytelling. The interactive data visualisation component visualises the university data not only by gender but also by faculty and nationality, thereby introducing an intersectional perspective (Figure 3).

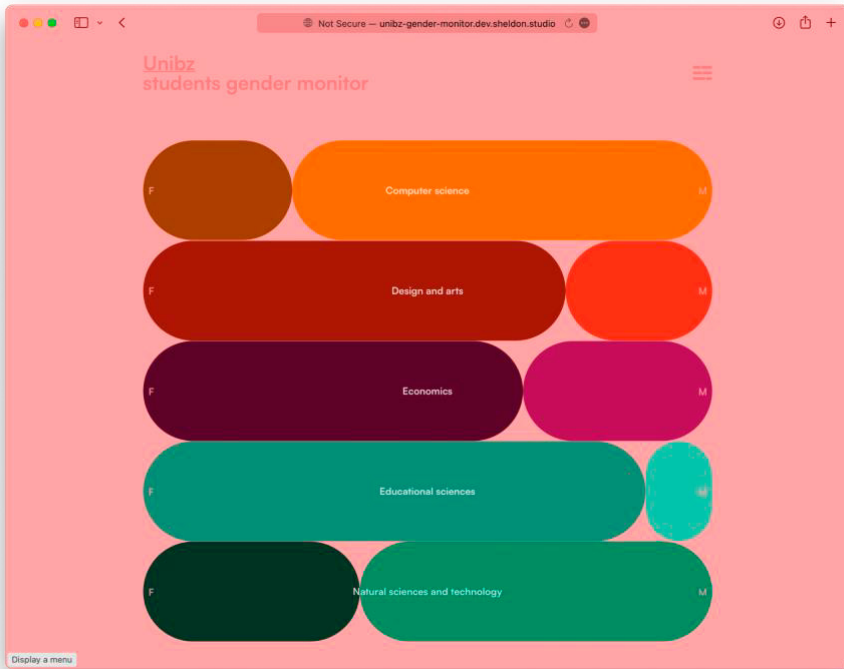


Fig. 3. The interactive data visualisation component depicts university data.

The storytelling component provides a reader-centred storytelling experience (Figure 4). The narration builds upon the students' and researchers' self-reported gender, faculty, and age, providing an immersive experience and inviting them to share their concerns about gender in their faculty.

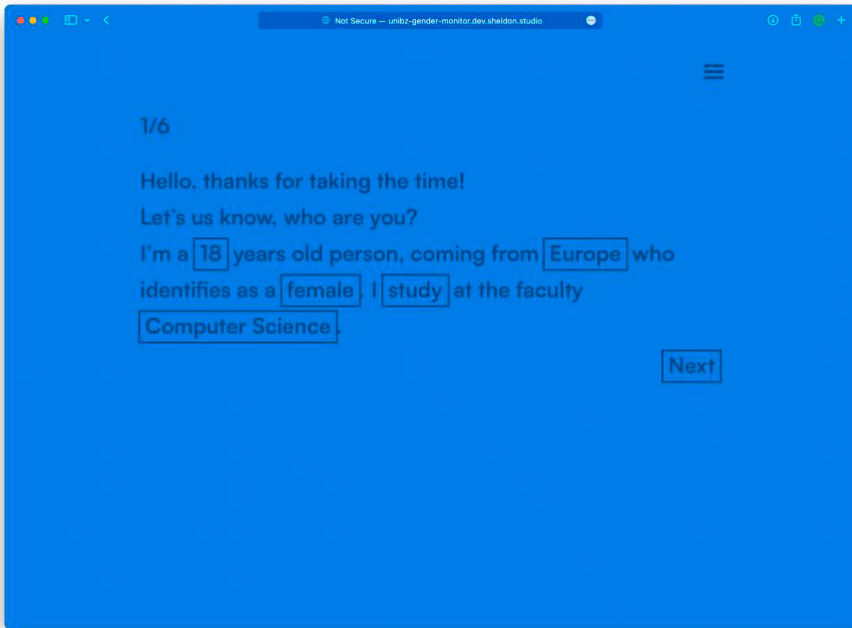


Fig. 4. The storytelling component provides a reader-centred storytelling experience.

We intend to collect people's assumptions and experiences through a survey. The collected data continue the iterative process in which data and concerns are intertwined and mutually elicited through data visualisations and data-objects.

5. Discussion and conclusions

In this chapter, we have presented our initial explorations to use gender-disaggregated data to elicit equity concerns through interventions. Our first intervention shows how a data-driven debate can take place in a temporary manner in public places by using low-tech tools and materials (Wolff et al., 2016). This intervention created curiosity, attracting participants' attention to unconventional places while turning these places into temporary portals for debate. Besides, it gives access to a digital platform in which the conversation continues, although the participants do not physically meet in the same place at the same moment. Our explorative interventions exemplify how data visualisation can be used as an inquiry tool to shed light on issues and concerns about gender in an institution (DiSalvo et al., 2014; Menendez-Blanco et al., 2017), supporting the opening of debates and personal reflection (D'ignazio & Klein, 2020). Finally, this work contributes to how data

visualisation and data-objects can be instrumental in making concerns visible and outlining solutions to complex societal problems.

References

- Ahmed, S., & Swan, E. (2006). *Doing diversity. Policy futures in education*, 4 (2), 96-100.
- Ahmed, S. (2012). On being included. In *On Being Included*. Duke University Press.
- Baum, F., MacDougall, C., & Smith, D. (2006). *Participatory action research. Journal of epidemiology and community health*, 60 (10), 854.
- Braun, V., & Clarke, V. (2012). *Thematic analysis*. American Psychological Association.
- Carli, L. L. (2020). *Women, Gender equality and COVID-19. Gender in Management: An International Journal*.
- Crenshaw, K. W. (2017). *On intersectionality: Essential writings*. The New Press.
- D'ignazio, C., & Klein, L. F. (2020). *Data feminism*. MIT press.
- DiSalvo, C., Lukens, J., Lodato, T., Jenkins, T., & Kim, T. (2014, April). Making public things: how HCI design can express matters of concern. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 2397-2406.
- Franke, B. *Design as a Medium for Inquiry Sense and Meaning*.
- Karyda, M., Ryöppy, M., Buur, J. and Lucero, A. (2020). *Imagining Data-Objects for Reflective Self-Tracking. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI '20). Association for Computing Machinery*, 1-12.
- Latour, B. (2004). Why has critique run out of steam? From matters of fact to matters of concern. *Critical inquiry*, 30 (2), 225-248.
- Latour, B., & Weibel, P. (2005). *Making things public: Atmospheres of democracy*.
- Latzko-Toth, G., Bonneau, C., & Millette, M. (2017). Small data, thick data: Thickening strategies for trace-based social media research. *The SAGE handbook of social media research methods*, 199-214.
- Lupton, E., & Tobias, J. (2021). *Extra bold: A feminist, inclusive, anti-racist, nonbinary field guide for graphic designers*. Chronicle Books.
- Menendez-Blanco, M., Bjorn, P., & De Angeli, A. (2017). Fostering cooperative activism through critical design. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing*, 618-629.
- Nichols, S., & Stahl, G. (2019). Intersectionality in higher education research: A systematic literature review. *Higher Education Research & Development*, 38 (6), 1255-1268.
- Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy sciences*, 4 (2), 155-169.
- Rosser, S. V., Barnard, S., Carnes, M., & Munir, F. (2019). Athena SWAN and ADVANCE: effectiveness and lessons learned. *The lancet*, 393 (10171), 604-608.
- Sosa, R., Gerrard, V., Esparza, A., Torres, R., & Napper, R. (2018). Data objects: Design principles for data physicalisation. In *DS 92: Proceedings of the DESIGN 2018 15th International Design Conference*, 1685-1696.
- Starrett C., Reiser S., and Pacio T. (2018). Data materialization: a hybrid process of crafting a teapot. In *ACM SIGGRAPH 2018 Art*.
- Wolff, A., Gerd, K., Gooch, D., Giaccardi, E., & Speed, C. (2016). Designing with Data: A Designerly Approach to Data and Data Analytics. In *Proceedings of the 2016 ACM Conference Companion Publication on Designing Interactive Systems*, 53-56.

Clustering to synthesize and scattering to reveal. Interactions and animations in the visualization of complex hierarchical data in Atlante Calvino

Tommaso Elli¹ (0000-0002-9818-1991),
María De Los Ángeles Briones Rojas² (0000-0002-8528-6399),
Beatrice Gobbo³ (0000-0001-7085-0017),
Michele Mauri⁴ (0000-0003-1189-9624)

^{1,2,4}DensityDesign Lab, Polytechnic University of Milan
tommaso.elli@polimi.it, mariade.briones@polimi.it, michele.mauri@polimi.it
³Centre for Interdisciplinary Methodologies, Warwick University,
beatrice.gobbo@warwick.ac.uk

Abstract. When working with data of a predominantly quantitative nature, aggregation and disaggregation are two well-known operations we can perform to discover patterns. However, the approaches above are hampered when working with data that embeds exceptions and individualities, often appearing in diverse fields such as contemporary urbanism cartography, forensic investigations, or digital humanities. Comparing the micro with the macro and bridging close with distant reading appear as open challenges for visualization research.

In this context, animated transitions support audience understanding: they demonstrate and explain how individual graphical elements are combined to create clusters and how clusters are unbuilt to reveal descendant nodes.

In this paper, we discuss three case studies from the design experience of Atlante Calvino which address the above issues in the field of literary criticism. Specifically, the contribution focuses on describing designerly means of data collection and employment of animated transitions in support of the inquiry of literary criticism.

Keywords. Data visualization / Digital humanities / Literary criticism / Animated transitions

1. Introduction

The presented research is framed in the experience of the project Atlante Calvino. Literature and Visualization¹ (2017–2020). The project, conducted in the area of research called Digital Humanities (Burdick et al., 2012) linked literary critics and researchers in information design.

¹ <https://atlantecalvino.unige.ch>

Italo Calvino is one of the most influential authors of the Italian Twentieth century (Barengi, 2009; Serra, 2006). Throughout his career, he mostly concentrated on short compositions, and he wrote more than two hundred short stories, that were published in magazines and newspapers before ending up in dedicated collections. His best-known works include the *Our Ancestors* trilogy (1952–1959), the *Cosmicomics* collection of short stories (1965), the novels *Invisible Cities* (1972), *If on a winter's night a traveler* (1979), and the essays *Six Memos for the Next Millennium* (1988).

The research involved literary critics and information designers experimenting together on the employment of data visualization in support of the production of literary criticism, a form of humanistic knowledge. The work embraces the tenets of the so called second wave of DH, which is "qualitative and interpretative", and is counterposed with the first wave, presented as computational, quantitative, and capable of "mobilizing the search and retrieval powers of the database, automating corpus linguistics" (Burdick et al., 2012; Schnapp & Presner, 2009).

When employing data visualization in support of humanistic reasoning it is useful to consider that scholars work with materials that are qualitatively rich in individualities and inconsistencies. Many aspects of their research are therefore difficult to aggregate to discover patterns and trends. Furthermore, the proposition of interpretations, which is scholars' central task and that by definition is something not reproducible (Bradley et al., 2018), builds on top of models of knowledge (i.e., theories, traditions, approaches, interests) that get embedded into their research process. Conveying and adapting to specific conditions of knowledge (i.e., subjective, situated, ambiguous), is of paramount importance for research in humanities; however, it is challenging to achieve it with ordinary visualization tools and we needed to inquire about new graphical conventions for doing so. (Drucker, 2014, pp. 190–191)

In the cases presented hereafter, we dealt with humanistic data that is manually harvested via dedicated means and that deals with hierarchies. It embeds several qualitative judgments and presents a pronounced qualitative essence. Our research focussed on identifying suitable means for harvesting data and effectively visualizing it. We took into particular account the interests of the scholars we were designing for, and, above all, their need to interpret Calvino's works in a traditional humanistic fashion that involves close reading (Hayles, 2012). In fact, visualization is for them only a means to return to texts and read them with new eyes.

2. Making sense of DH through animated transitions

The use of data visualization techniques has widely been identified and evaluated as effective when dealing with the computational analysis of literary works (Moretti, 2013) and with the representation of Cultural Heritage (CH). (Whitelaw, 2015; Windhager et al., 2019)

In this context, Windhager et al. have widely explored common approaches to the use of interactivity and how it can support data analysis tasks. Specifically, they identify

granularity and interactivity as key factors in the design of Cultural Heritage information spaces that make use of hierarchical data structures.

Indeed, the process of designing a complex digital information space to browse different levels of granularity often relies on interaction techniques to preview and overview units and collections of digital surrogates, both in their detailed or abstract representations. For instance, interactivity allows users to drill down into contents, enabling the “overview first, details on demand” (Shneiderman, 1996) task and supporting the back and forth between close and distant reading (Jänicke et al., 2015), transforming the information space in a “soft map, infinitely scalable, absolutely contingent, open to vision and hence revision” (Kurgan, 2013) and “elastic, coherent, and potentially infinite system” (Brüggemann et al., 2020).

When dealing with advanced interaction interfaces, animations are considered effective means for supporting the revelation of hidden content and tracking items during layout changes (Chevalier et al., 2016). Although Chevalier et al. draw general considerations that pertain to the larger field of Human Computer Interaction (HCI), similarities with the realm of DH have been identified. For instance, Brüggemann et al., when reflecting on the role of interactivity in visualization of Cultural Heritage data, identify animated transitions as pivotal due to their ability to “sheds more light on the in-between states of folding processes”.

Indeed, by readapting the concept of *The Fold* by Gills Deleuze (Brüggemann et al., 2020, p. 3), they encourage the simultaneous and coordinated consideration of interaction and representation in data visualization, where animated transitions are not “only an afterthought” but crucial building blocks of the design process that reinforce and guide the interpretation of the visualization within its elastic information space (Brüggemann et al., 2020, p. 11). Drawing on those considerations, our paper presents three examples of how animated transitions, together with hybrid visual models, can support the act of proposing interpretations in literary criticism.

3. Case studies

Our design work consisted of interpreting, structuring, and visualizing literary data. The data was created through manual collection and classification from the discursive information present in literary works, conducted using tailored tools realized by designers. The main goal was to represent the literary interpretation by ensuring a close reading of the materials. *Combining*, *Transforming*, and *Erasure* are three of the several visualizations present in *Atlante Calvino*. Each visualization is based on a dataset and/or a visual model that employs hierarchies. From the beginning of the data collection, the visual, animated, and interactive representation work focused on the visualization of the relationships and references that exist between the data. We understood that each single data point stands for more than a simple record, being part of a system and defined through its connections.

For each of the following cases, we briefly introduce the literary phenomenon studied and the main aspects of the data collection and data design. Then, we describe the

visual models, animation, and interaction that represent the interpretation of meaningful patterns and relationships between the data.

3.1 Combining

*Combining*² is built on *Marimekko* and *Iccle tree* (Meirelles, 2013) visual models. It represents nested narrative sequences in the volumes published by Calvino. We discarded dendrogram structures, which miss the possibility to map quantities of characters related to the segment and we choose the aforementioned models for revealing the combinatory nature of Calvino's narrations, which is visualized using columns of different thicknesses according to the length of the represented text. Interactivity and animations accompany users in the exploration, allowing to progressively reveal of layers of information that gradually detail the internal structure of narrative sequences.

Literary critics were interested in inquiring Calvino's habit of building narrations by recycling and recombining a limited number of narrative schemas, composing a modular structure (modules). In the dataset, volumes are divided into nested structures of sequences to show the internal layers of motifs in the text. All the segments were then categorized based on their type and distributed in a maximum of five layers. Inside each layer, colours specify the sequence type, and the horizontal juxtapositions represent hierarchical relationships of elements. The data represented is the results of manual work conducted by the literary critics, based on previous studies, and produced using a tool that designers built to manually annotate the sequences.



Fig. 1. Combining visualization by DensityDesign lab, 2021. By interacting with modules, users can reveal hidden structures of narrative sequences. Available at <https://atlantecalvino.unige.ch/form/phase2?lang=en>.

² <https://atlantecalvino.unige.ch/form/phase2?lang=en>

From the very beginning of the database design, we were clear in representing segments as modules that nest in other modules. In the same way, from the beginning of the visualization process, we understood that the two visual models required animations and transitions to guide the reader through the two moments of visual exploration and to follow the hierarchical relationship between modules. The gradual appearance of the modules towards the right side of the visualization emphasizes the fragmentation of how parent modules contain descendant modules. Reading horizontally the combination of the modules through the five levels, we can see the articulated sequencing strategies that the author applied.

3.2 Transforming

The second case study is *Transforming*³, a visualization that combines a beeswarm and a network graph for showcasing location settings in Calvino's works. The author was very attentive toward the settings of his narrations, thus, showing all the locations in his works is a means of reflecting on his representations of reality. Critics manually collected all the settings of Calvino's works by using a custom tool. This was necessary due to the fact that certain places couldn't be automatically recognized (e.g., a valley, a path, a beach). The researcher also collected hierarchical relationships, namely places belonged to larger ones, such as a café that can be found in Rome. This information was translated into data.

Beside hierarchical data, critics built a categorization of places, that results in a categorical scale: *unspecific cosmic* and *specific cosmic*, *unspecific terrestrial* and *specific terrestrial*, *invented terrestrial*, and *no location*.



Fig. 2. Transforming visualization by DensityDesign lab, 2021. By interacting with the visualization, users can explode bigger items and access their content. Available at <https://atlantecalvino.unige.ch/space/phase2?lang=en>.

³ <https://atlantecalvino.unige.ch/space/phase2?lang=en>

After iterating through different visual models, we decided to build a hybrid model that combines a beeswarm with a network graph. Individually, none of the two models managed to visualize the data underlying the relationship of places in a way that was adherent with critics' requirements. Places are represented as circles of different colours that correspond to different categories; the horizontal axis represents dates of publication, and the vertical axis the six categories of places previously mentioned. Through interaction and animation, the visualization reveals places contained in other places, and, although the main layout is built around categories, the expansion of a parent may reveal a descendant of a different type. Therefore, it accepts, for example, that unspecific terrestrial places may result as being located on the axis of specific ones after the animation has revealed them.

The hierarchical rendering of data clashes with the ordinal scale of categories through which the data is initially visualized, privileging hierarchies against categories. However, it hinted scholars in realizing how the author often framed fictional places into terrestrial ones or used those as frames themselves. This aspect, combined with the temporal distribution of all location categories, the visualization helps in inquiring about Calvino's relation with Realism and the progressive detachment from reality in his narrations.

3.3 Erasure

Third, we present *Erasure*⁴, a visualization based on a bubble chart (Friendly & Denis, 2005) that uses data-driven metaballs as glyphs. The visualization shows the stylistic phenomenon of the *dubitative text*, namely the tendency of undermining the stability of the narration through the expression of doubts. The phenomenon is described, categorized, and systematically harvested according to an interpretive grid that combines categories ("what is in doubt": *content, form, meaning*) with narrative styles ("the type of doubt": *negation, hesitation, reformulation*). The grid results in a matrix of nine possible combinations represented as sized bubbles that depict the amount of dubitative text in proportion to the total length of the work; the colour represents the categories of the matrix.

Literary critics manually collected occurrences of the dubitative text throughout the body of Calvino's work. In the process, each occurrence was classified according to the grid described above and, thanks to the data, we can learn the amount, position, and functioning mode of the dubitative process inside of a text and across years.

⁴ <https://atlantecalvino.unige.ch/doubt/phase3?lang=en>

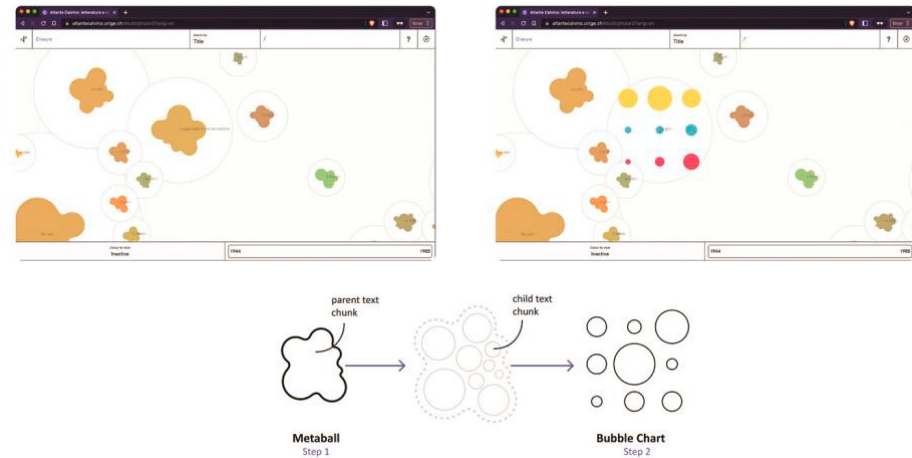


Fig. 3. Erasure visualization by DensityDesign lab, 2021. By interacting, users can explode metaballs to reveal the items that compose them. Items are organized according to a grid defined by domain experts. Available at <https://atlantecalvino.unige.ch/doubt/phase3?lang=en>.

In the visualization, the matricial data is organized into a superior level, represented as a metaball whose colour and shape is the result of the interpolation of inner elements. The data present no explicit hierarchical qualities since records are all independent of one another. However, they conceptually belong to the same stylistic phenomena. Hence, we grouped the occurrences of dubitative text into metaballs, namely agglomerations composed of circles corresponding to different styles and categories of dubitative text. The overview simplifies the presentation of data, reducing cluttering and the number of individual elements. Metaballs can be expanded, revealing details about the heterogeneous composition of the dubitative text, and helping the reader to understand further details about the previously seen shape. We deliberately introduced the hierarchical level to reduce the staged information's complexity. The coordinates of each metaball are calculated according to how the dubitative text is used: texts with common features are close to one another, while those with fewer in common are set further apart. Finally, a layer of annotations highlights the most relevant aspects identified by literary critics during the interpretation of the results.

4. Conclusions

In this article, we present research on visualization that is aimed at employing animated transitions and hybrid visual models in support of literary critics dealing with complex and hierarchical data. Operations of aggregations, disaggregation, and identification of patterns, that we can perform on quantities are here hampered by

individualities, inconsistencies, exceptions, and, ultimately, by the predominantly qualitative nature of our data. Still, we designed our visualizations to convey comprehensive overviews of specific aspects of Calvino's production, built according to scholars' interests and through to their meticulous manual data collections. In creating the visualizations, we invested significant efforts in understanding scholars' interpreting frameworks and in valorizing them with custom visual solutions. The outcomes of this process are the visualizations presented above: *Combining, Transforming and Erasure*.

According to scholars, visualizations manage in opening windows to previously inaccessible critical views; to do so, it looks useful to define interpretive grids and design requirements in advance. However, differently from the common belief that consider visualization and interpretation as two separate moments or tasks, we noticed how they were contingent and simultaneous one another. The definition of an interpretive grid is required by the production of data visualization, and affects the critical thinking of scholars, demanding them to act crisply during data collection. Grids forced them to take clear decisions even where it was challenging to select the most suitable option, leaving no trace of nuances and ambiguities. For instance, this is the case of some occurrences of dubitative text that, although ambiguous, had to fit one of the available options among styles and categories.

Visualizations, in turn, were designed starting from scholars' needs, at the point that they accommodate standpoints on Calvino's works. It is visible from the way in which they blend features from many different models, intending to represent data in a fashion that is as adherent as possible to scholars' interpretations. In the presented examples, clustering and transitions were of great use to enable and consistently present the scholar's inquiry, while reducing cluttering and staging graphic elements to the audience's view.

This interaction between visualization and interpretation took place in different moments of the design process. However, if data grids are to be settled before collecting data, what scholars were learning during data collection constantly influences the attempts to design visualizations. We observed, in this process, the development of several choices that took place across disciplinary domains in a shared and iterative fashion. We realized how we are still missing principles to address decisions more consciously and solidly. Methodologies of visualization co-design appear promising to address problems of this kind, however very little research was conducted in this regard (Dörk et al., 2020). Building on this we identify co-design techniques in the context of DH as a promising yet underexplored area of research.

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References

- Barenghi, M. (2009). *Calvino*. Soc. Ed. Il Mulino.
- Bradley, A. J., El-Assady, M., Coles, K., Alexander, E., Chen, M., Collins, C., Janicke, S., & Wrisley, D. J. (2018). Visualization and the Digital Humanities: *IEEE Computer Graphics and Applications*, 38(6), 26-38. Retrieved from 10.1109/MCG.2018.2878900.
- Brüggemann, V., Bludau, M. J., & Dörk, M. (2020). *The Fold: Rethinking Interactivity in Data Visualization*, 16.
- Burdick, A., Drucker, J., Lunenfeld, P., Presner, T., & Schnapp, J. (2012). *Digital Humanities*. The MIT Press. Retrieved from 10.7551/mitpress/9248.001.0001
- Chevalier, F., Riche, N. H., Plaisant, C., Chalbi, A., & Hurter, C. (2016). Animations 25 Years Later: New Roles and Opportunities. *Proceedings of the International Working Conference on Advanced Visual Interfaces*, 280-287. Retrieved from 10.1145/2909132.2909255.
- Dörk, M., Müller, B., Stange, J.-E., Herseni, J., & Dittrich, K. (2020). Co-Designing Visualizations for Information Seeking and Knowledge Management. *Open Information Science*, 4 (1), 217-235. Retrieved from 10.1515/opis-2020-0102.
- Drucker, J. (2014). *Graphesis: Visual forms of knowledge production*. Harvard University Press.
- Friendly, M., & Denis, D. (2005). The early origins and development of the scatterplot. *Journal of the History of the Behavioral Sciences*, 41(2), 103-130. Retrieved from 10.1002/jhbs.20078.
- Hayles, N. K. (2012). *How we think: Digital media and contemporary technogenesis*. The University of Chicago Press.
- Jänicke, S., Franzini, G., Cheema, M. F., & Scheuermann, G. (2015). *On Close and Distant Reading in Digital Humanities: A Survey and Future Challenges*, 21.
- Kurgan, L. (2013). *Close up at a distance: Mapping, technology, and politics*. Zone Books.
- Moretti, F. (2013). *Distant reading*. Verso.
- Schnapp, J., & Presner, T. (2009). *The Digital Humanities Manifesto 2*. 15.
- Serra, F. (2006). *Calvino*. Salerno.
- Shneiderman, B. (1996). The eyes have it: A task by data type taxonomy for information visualizations. *Proceedings 1996 IEEE Symposium on Visual Languages*, 336-343. Retrieved from 10.1109/VL.1996.545307.
- Whitelaw, M. (2015). *Generous Interfaces for Digital Cultural Collections*. 16.
- Windhager, F., Federico, P., Schreder, G., Glinka, K., Dork, M., Miksch, S., & Mayr, E. (2019). Visualization of Cultural Heritage Collection Data: State of the Art and Future Challenges. *IEEE Transactions on Visualization and Computer Graphics*, 25(6), 2311-2330. Retrieved from 10.1109/TVCG.2018.2830759.

To the extent possible: the experience of a design summer workshop on images and things that worth measuring

Alfredo Calosci¹ (0000-0001-8018-699X)

¹Department of Architecture, Design and Planning, University of Sassari, acalosci@uniss.it

Abstract. One relevant aspect of the times we are living is the effort in supporting every claim, line of reasoning, every description or interpretation of reality with magnitudes, metrics, indexes ... any abstract entity but measurable. The wealth of a nation, the academic productivity, the evolution toward a more sustainable development, the greatness of a poem ... the unavoidable simplification implied in every quantification remain often undisclosed under the impartiality we show while presenting our data. This common way of arguing leads sometimes to paradoxes. Most of us rejoice when the GDP is growing (shouldn't we ?) and someone find difficult to understand why a 2 degrees increase in the average temperature of the planet may represent a serious environmental threat (anyway, it's just 2 degrees Celsius). This contribution is about a collaborative design workshop that, starting from these premises, took place at "Fundacion Cereales Antonino y Cinia" (FCAYC) in August 2022. Aiming to explore the relation between language and mental images, an interdisciplinary and heterogeneous group of volunteer dedicated one week to envisioning alternative metrics and prototyping ways to communicate what they really would like to measure (or to try to) from a very specific perspective: the point of view of the few inhabitants of a rural underpopulated area close to León, in the north of Spain.

Keywords. Informal education/ Data visualization/ Design for social innovation

In the following sections, we will outline the context and premises of the workshop, detail the methodology employed during the activities, and delineate the theoretical framework used as a reference for the design proposals. The conclusions we draw from this experience will not be based solely on the workshop's results but, rather, on our reflections regarding the potential role of such activities in the field of design for social innovation.

1. The context: *el condado*

FCAYC is a private Spanish institution located in a rural area in the northern province of León, dedicated to local development and the transfer of knowledge to society through two lines of action: cultural production and ethnoeducation.

A significant portion of the ethnoeducational activities occurs during the summer season as 'Encerezados', a two-month program of workshops and cultural events. This program is designed for people of all ages and covers a wide range of topics, including art, music, technology, astrology, and botany.

The event 'To the extent possible' (*La medida de lo posible*) took place between August 8th and 12th, 2022, following a series of workshops dedicated to creative coding and data visualization, which were offered in previous editions of 'Encerezados'.

2. The premises: what we measure have an impact on what we do

The workshop was designed as a co-design activity. Instead of addressing the challenge of representing a predefined set of data, we encouraged participants to perceive data as 'artifacts' created by individuals. It was not intended as a data visualization training course, but rather as an opportunity to reflect on the significance of two actions – to measure and to represent – that often occurs simultaneously.

We began with a simple assumption: data do not exist in nature but are the results of human actions, specifically the act of measuring some aspect of reality. The necessity to measure arises from goals we have in mind, such as transforming, monitoring, or better understanding our natural and artificial environment. Through measurement, we establish a relationship between two physical phenomena, chosen with a certain degree of arbitrariness.

Furthermore, the act of measuring something results in two consequences: firstly, collecting data implicitly involves creating 'mental images' (or real ones) to highlight patterns of information among the samples we have gathered. Secondly, the act of creating data has a social impact; what we — or others — measure significantly influences our actions. Moreover, the mental images formed during this process exert a lasting influence on the way we perceive and interpret our environment.

In other words, what we measure has an impact on what we do, and all the images we create shape the way we see the world. Consider, for example, the Mercator projection of the world. Mapping the world onto a two-dimensional surface implies a projection, and in doing so, introduces a certain level of distortion. As we know, in the cylindrical projection designed by Mercator, distortion increases as we move from the equator to the poles. Consequently, continents like Africa appear relatively smaller compared to those in the northern or southern regions. Mercator's maps were originally designed for navigation but have been widely adopted for commercial or educational purposes. Although their unbalanced representation of landmasses is

now sometimes considered 'politically incorrect,' they have deeply shaped the way we perceive our planet.

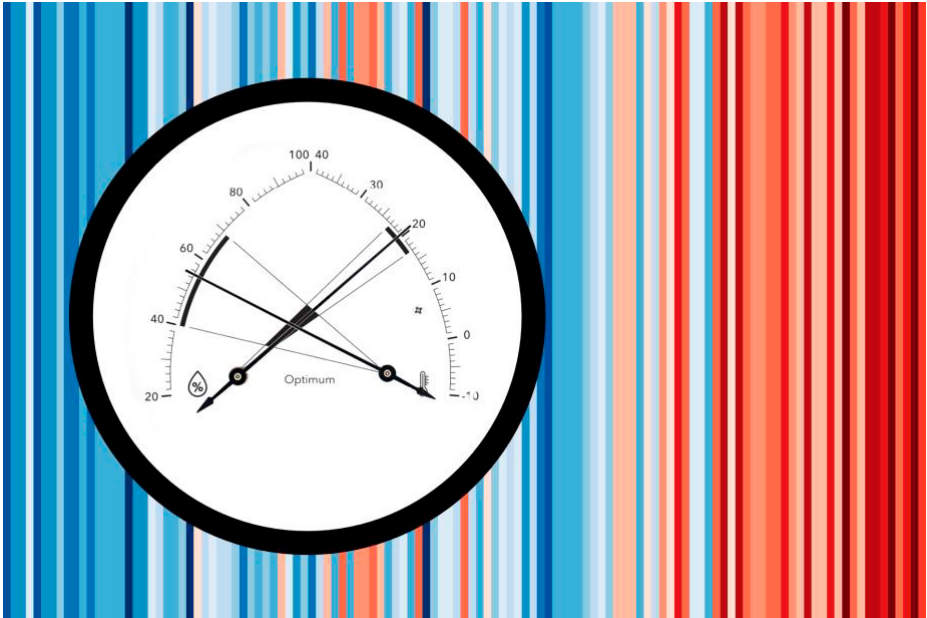


Fig. 1. To measure and to represent: an analogical thermometer / hygrometer on 'warming stripes'.

2.1 Planning the activities

We have learned from previous experiences that planning an informal design activity can be challenging. Attendees typically have diverse personal and educational profiles, and the ultimate goal is to share knowledge rather than transmit it. Instead of adhering to rigid design procedures, activities were designed to push participants far from the 'comfort zone' of their professional and personal skills, allowing unexpected contributions to emerge.

Hence, the formula we devised is essentially based on two steps: a 'trumpet call' introductory talk followed by a quick 'Minimum Viable Product' design collaborative challenge, aimed at envisioning a tangible (even if speculative) artifact. For a five days workshop we selected four main topics leaving intentionally a blank spot for the final day.

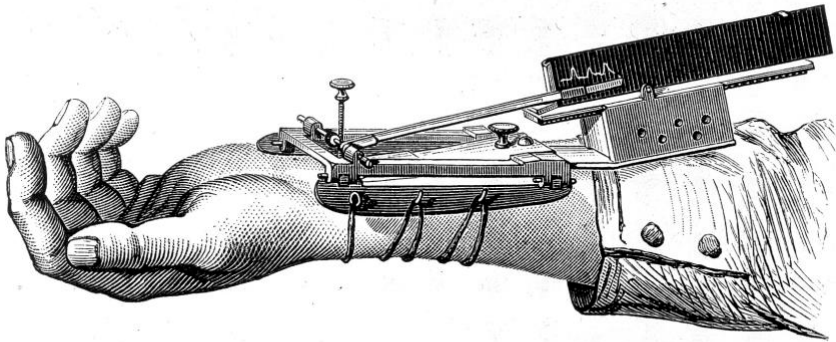


Fig. 142. Sphygmographe direct inscrivant le tracé du pouls.

Fig. 2. Measuring blood pressure analogically.

2.2 La méthode graphique

The first of them, our starting point, takes us back to the 'golden age' of quantitative explanations. Étienne Jules Marey's (1878) essay on the scientific graphic method of visual representation in science presents an incredible collection of devices conceived to produce natural analogical 'fingerprints' for a wide range of physical phenomena. Above and beyond the showcase of old-fashioned equipment for simultaneously measuring and representing dynamic events, the French physiologist offers a clear and, in many aspects, pioneering vision of the role of visual language in science and human knowledge.

Marey believed that language 'alone' was no longer adequate to express and describe scientific progress. Simultaneously, he was convinced that our senses provide us with a limited and often erroneous perception of reality. For these two main reasons, he was persuaded that images, and visual languages in a broad sense, had to play a key role in science. They would serve as a medium to express complexity, functioning as a scientific tool in their own right and – at the same time – they act as a 'memory aid,' serving as a communication resource.

Marey was aware that the physical phenomena observed locally result from the simultaneous action of various forces in multiple locations. His primary focus was on recording the dynamic evolution of physical variables, rather than confining himself to a limited set of static samples. In his vision, diagrams had to play a key role in this new dynamic scientific approach, acting as a tool against reductionism and serving as an efficient way to deal with complexity. Their appearance would be uninteresting with a limited number of samples. However, by enriching the representation with a

significantly larger number of samples, instead of losing readability, they would gain in comprehension.

In other words, Marey had high expectations for a new set of measuring devices that could assist us in describing and representing dynamic processes. However, he was aware that an improved representation did not necessarily correlate with a better understanding of the forces that generate them. For this reason, *la méthode graphique* was intended not merely as a means of representation but as a procedural approach aimed at fostering a deeper understanding.

By leveraging the ecosystem of sensors and actuators created within the 'Internet of Things' (IoT), we emulated Marey in envisioning new, contemporary measurement devices.

2.3 Wealth or prosperity?

The second topic is somewhat related to the financial crises of the year 2008 and arise from a report promoted by the then president of France. As part of the debate on 'reforming capitalism' to prevent its cyclical financial earthquakes, Nicolas Sarkozy tasked a group of international experts, led by Joseph E. Stiglitz, Amartya Sen, and Jean-Paul Fitoussi (2009), with exploring statistical indicators as alternatives to Gross Domestic Product (GDP) to measure economic and social prosperity.

GDP represents a classical issue among economists. As the report states, "it is the most widely used measure of economic activity, primarily capturing market production, although it has often been treated as if it were a measure of economic well-being". From our perspective, the GDP issue serves to direct our attention to 'what' we measure rather than 'how' we do it and encourages the consideration of data not only as artifacts but also as shared common resources.

The report addresses the challenge of measuring wellness instead of wealth and frames the issue from the perspective of sustainability, which has always been problematic for monetary-based economic indicators.

Supported by an exhaustive dissertation, the report is structured into three main sections. The first one is devoted to economic variables that can be expressed in monetary units concluding with recommendations to address distortions caused by GDP. These recommendations advocate measuring incomes and consumption in addition to production, adopting a household perspective, incorporating health indicators, prioritizing equal resource distributions, and integrating non-market activities into the annual balance.

The following section focuses on 'Quality of life' and addresses dimensions that are less easily converted into monetary units. The commission recommends considering both subjective and objective measures of well being, encompassing a comprehensive range of factors. This includes aspects not traded in markets and not captured by monetary measures. The domains covered involve health, education, personal activities, political voice and governance, social connections, environmental conditions, and personal and economic security.

The final part of the report introduces the sustainability perspective, addressing the issue of ensuring well-being for future generations and exploring potential quantitative measures for sustainability. The commission adopts a 'stock-based' approach where the well-being of future generations relies on the resources we pass on to them.

As an overall result, prosperity is defined as an interdisciplinary matter, and the method suggested for its quantification is based on a set of multi-dimensional social and physical indicators. This approach significantly influenced the definition of the Sustainable Development Goals (SDG), formulated by the United Nations Statistical Commission almost 10 years later, in March 2017, and its architecture of goals, targets and statistical indicators.

This topic had a special impact on the group of attendees, who later adopted 'quality of life' – expressed in terms of the ability to access a wide range of services – as the subject of their final design proposal.

2.4 Mental images

The two next subjects came from cognitive science; we dealt with two key concepts: mental images (and conventional ones), as described by Antonio Damasio (2021), and cognitive biases (and illusions) – from the perspective offered by Daniel Kahneman (2011).

The evolution of cognitive sciences has gone beyond the popular expression that 'a picture is worth a thousand words.' The concept of 'mental image' transcends what we commonly define as an image and generally describes a pattern of information without distinctions between the visual, the linguistic, or other possible attributes. Antonio Damasio has summarized very effectively some of these advancements in his essay 'Feeling and Knowing'. Our ability to remember, elaborate on, and modify these mental images largely defines the perception we can have of our environment.

The role of design is sometimes to envision future scenarios and attempt to take the first steps in that direction through concrete, albeit occasionally partial or symbolic, proposals. From this perspective, mental images play a key role in design for social innovation by helping communities to share a common alternative vision of the future. Building upon these reflections, we attempted to create new (mental) images describing some dynamics of our rural environments.

2.5 Cognitive illusions

Some of the paradoxes we mentioned in the introduction and our inability to interpret certain quantitative data 'correctly' stem from what Daniel Kahneman has described as 'cognitive illusions' and, more generally, from the biases we apply to our perception of our environment according to the 'dual process theory'. In addition to these 'physiological limitations,' there are countless graphic tricks that, involuntarily or with the worst intentions, try to lead us to incorrect conclusions. Designer Albert Cairo has

described some of these practices in his essay 'How Charts Lie: Getting Smarter about Visual Information.

Acting as the devil's advocate, we spent some time creating deliberately biased visualizations.

3. The workshop outputs

The group of attendees actively participated in all the daily design challenges and decided to work together on a final project about 'quality of life' in their sparsely inhabited rural area. They aimed to underscore the dichotomy between the quality of the natural environment and the disadvantages in terms of access to public services, such as health or education or just to do the grocery shopping.

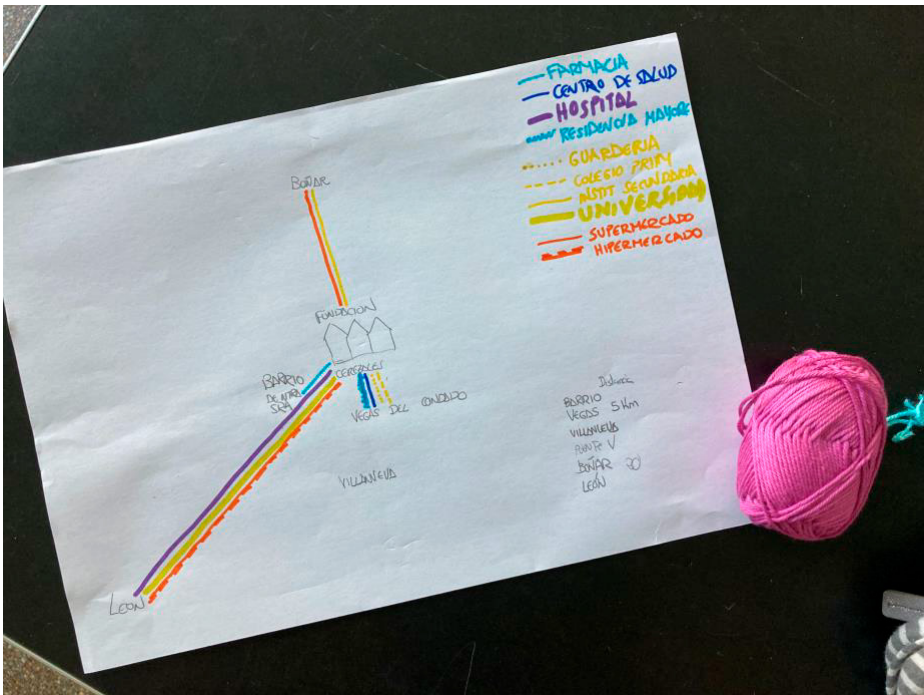


Fig. 3. A diagrammatic map of services.

For this task, they preferred to work with self-collected data. They agreed on a metric for accessibility — distance converted into time units according to alternative modes of transportation — and started elaborating a long list of 'targets', places inhabitants have to reach to obtain a given kind of service.

After evaluating alternative layouts, the group started working on a diagrammatic map. Most of them felt more comfortable working analogically, so they began prototyping on a cork-board using pins and colored wool threads. The resulting diagram can be seen as a 'specific instance' of a more general method to create service accessibility maps for a given place. At the same time, those who were more skilled with digital tools created a web based interactive alternative, shaped as a spiral diagram and fed by external data, using d3.js framework.

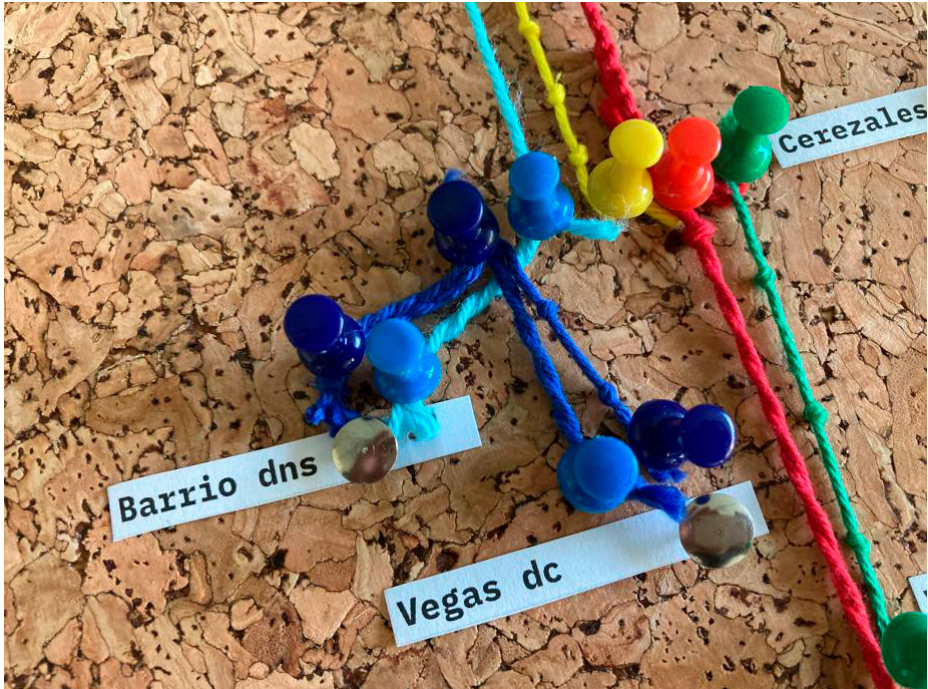


Fig 4 - Prototyping on a cork board.

4. Taling about results

Some may argue, and not without reason, that the final result is modest when compared with today's professional standards. The solution appears to rely mainly on common sense, with only a few of the theoretical inputs implemented in the final design proposal. Or, even worse, one way of analyzing the workshop's results may assessing that neither the dataset nor its visual display seems to add valuable information, or new perspectives, to a circumstance that is evident.

If we consider the list of workshop topics as a form of design brief, even if it was not intended as such, the final proposal does not require special devices for

measurement, as might have been suggested after Marey's session. Furthermore, it has not achieved the goal of creating an innovative and eye-catching visual representation, akin to what Ed Hawkins's 'warming stripes' did for climate change. It does contemplate an interdisciplinary vision of well-being based on multiple criteria, but, in hindsight (which is always 20/20), perhaps we should have focused more on a different way to highlight the advantages of living in a natural environment, rather than the evident disadvantages.

While all these considerations remain substantially true, according to Ivan Illich (1973), we believe that an informal education event should be evaluated not in terms of productivity but rather in relation to its opposite: 'conviviality'.

It has been widely demonstrated that co-design techniques can perform exceptionally well, particularly when it is crucial to aggregate distributed knowledge for problem-solving or envisioning new, suitable scenarios. Nevertheless, the primary reason for adopting it in our workshop is that it is, above all, a participatory methodology and very likely a 'conviviality tool'. Just as we stand for democracy because we believe in equal rights for all humans, not solely for its performance in decision-making.

We all expect Design for social innovation to excel and be 'productive', but we should never forget that it is primarily fueled by social abilities. Building trust and collective skills within a community is a slow process, where informal education plays a crucial role, and can often be achieved by engaging in apparently 'useless' activities, yielding no immediate tangible results.

FCAYC has been laying a steady groundwork in informal education for quite some time. Perhaps the most significant outcome of the workshop is that it was possible to contemplate an activity like the one we have described in a summer 'recreational' program... and it happened.

References

- Cairo, A. (2020). *How Charts Lie: Getting Smarter about Visual Information*. W. W. Norton & Company.
- Damasio, A. R. (2017). *Feeling & Knowing: Making Minds Conscious*. Pantheon Books.
- Fundación Cerezales Antonino y Cinia. (n.d.). *La medida de lo posible*. Retrieved from <https://fundacioncerezalesantoninoycinia.org/actividad/la-medida-de-lo-posible/>.
- Illich, I. (1973). *Tools for Conviviality*. Marion Boyars Publisher.
- Kahneman, D. (2011). *Thinking, Fast and Slow*. Farrar, Straus and Giroux.
- Marey, É. J. (1878). *La méthode graphique dans les sciences expérimentales et particulièrement en physiologie et en médecine*. G. Masson.
- Ordine, N. (2017). *The Usefulness of the Useless*. Paul Dry Books.
- Stiglitz, J. E., Sen, A., & Fitoussi, J. P. (2009). *Report by the Commission on the Measurement of Economic Performance and Social Progress*.

Unpacking onboardings in data-driven stories

María de Los Ángeles Briones Rojas¹ (0000-0002-8528-6399)

¹Polytechnic University of Milan, mariade.brione@polimi.it

Abstract. This work delves into the role of onboardings within data-driven storytelling and examines the characteristics needed to be effective. Onboarding is the entry point to the story, where readers encounter the theme for the first time as well as the visual and interactive elements which are employed to communicate it. The onboarding section introduces and anticipates to the reader what and how they will find. It is also the narrative space where the designer exposes the purpose of the project and the communicative objectives it pursues. Of the many formats that data-driven storytelling can adopt, this article examines those designed in the form of a website. Based on the observation of 18 cases from two didactic experiences, three conditions for effectively designing onboarding for data-driven storytelling are suggested: (1) it situates the subject in its context, (2) it guides the reading and usability of the artifact, and (3) it frames the communicative objectives proposed by the designer-author. These conditions are intended to be a starting point in the study of onboardings rather than rigid rules for their design. Further steps in this work will be the evaluation of data-driven onboarding with users, as well as considering online narratives.

Keywords. Onboarding section/ Data-driven storytelling/ Digital interfaces

1. Onboardings for telling stories with data

Data-driven stories are narratives that use data as evidence to tell certain facts and usually employ visual representations to attest to or augment a given story. By structuring the communication through visualizations, data-driven stories "can enhance a narrative with capabilities to walk through visual insights, to clarify and inform, and to provide context to visually salient differences" (Riche et al., 2018).

Extensive research on data-driven stories has been exploring narrative structures (Hullman et al. 2013), genres of narrative visualization (Segel & Heer, 2010), what techniques and aspects to considered (Hullman & Diakopoulos, 2011), and how they can be evaluated (Amini et al., 2018) among other aspects. But little attention has been paid yet to onboardings in data-driven stories.

Onboarding is a section that is presented in different formats across a wide variety of data-driven story types (see figure 1). Some recurring onboarding formats range from static text, video, and scrolling interface.

Onboarding for data-driven storytelling is the entry point to the story, where readers first encounter the theme and the visual and interactive elements which play a part in

it. The onboarding section introduces and anticipates to the reader what, where, and how to find within the story. It is also the narrative space where the designer exposes the purpose of the project and its objectives.

This paper offers a preliminary study based on a case study on how onboarding is presented today and what role it plays in data-driven stories. This paper concludes by proposing some conditions for designing effective onboardings.

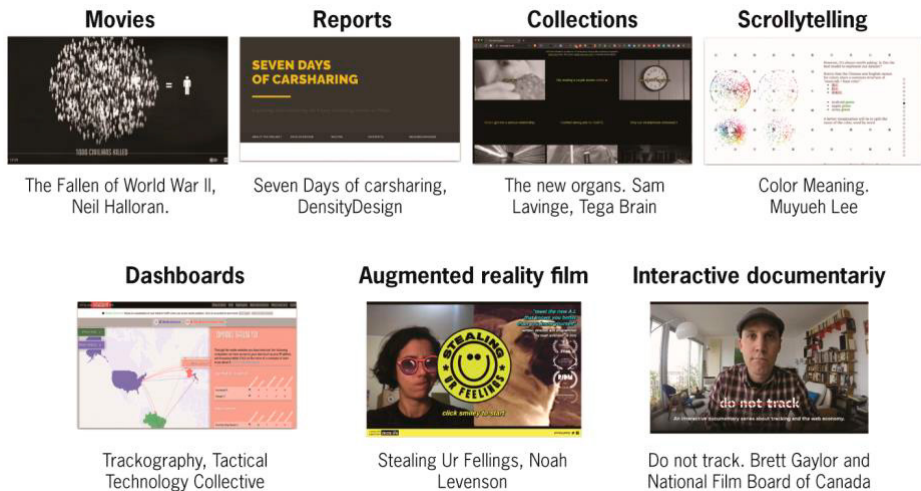


Fig. 1. Types of digital data-driven stories formats: as collections, dashboards, movies, *scrollytelling*, augmented reality film, interactive documentaries, and reports, among others.

1.1 Setting the audience for effective onboarding

Communicating with data effectively “requires the content author to recognize the needs, goals, and knowledge of the intended audience” (Drucker et al, 2018). Evaluating the effectiveness of the story is therefore dependent on the audience to whom the story is addressed. In the book chapter *Communicating Data to an Audience*, Drucker et al. set out a series of questions that content authors must answer to design the content that considers the audience's requirements for understanding the story. Defining a specific audience is key for designing the story and when “designers have to negotiate generality and specificity when trying to connect their ideas with an audience” (Tharp & Tharp, 2018, p. 167): to define what content is already familiar to the audience, what content should be introduced, explained, or excluded, and what is the appropriate language to address the audience. After defining the content according to the message and its communicative purpose, the process of organizing and shaping the content into a narrative begins. In this part of the process, the onboarding appears as a significant section in which to place the content to be transmitted in the first instance.

2. Case studies: deconstructing data-driven onboardings

The observation of case studies is based on two didactic experiences in which I have participated as a lecturer in a master's degree course in communication design at Politecnico di Milano, and as a thesis tutor of students of the same master. In both experiences, I followed the design process adopted by the students in designing digital discursive artifacts - usually websites and mobile applications - promoting a reflection on issues about the relationship between technology and society. Observing the students' design process allowed me to understand how they got to the final result, following the main design questions and taking the relative decisions. This way, the formulation of the conditions proposed in this paper investigates the design process and not only to the result of the design of the onboarding section.

The master's degree course is attended by students in their last year of the master's in communication design: they are students who have a solid background in visual communication subjects but not necessarily have experience working with data. The course is divided into three phases, each one "gradually introducing students to the criticalities arising when communicating with data and information in complex scenarios" (Mauri et al., 2018). Students work in groups over topics proposed by the faculty. Projects are articulated in two phases named data as material and data publics. The case studies used in this paper refer to the data publics phase where students are required to republish data-driven analytical research from the previous phase into a digital communication artifact - usually a website, that seeks to engage an audience.

As a master's degree thesis tutor in Communication Design, I take care of the thesis development of students who want to explore topics close to those previously addressed in the course: particularly data activism and data literacy. The thesis tutoring process lasts between 6 to 12 months depending on the type of thesis the students formulate. This process is carried out through one-to-one reviews which allow for richer discussions about the theoretical approach and design of data-driven narrative projects.

The case studies observed in this paper are data-driven digital narratives promoting a reflection in relation to how algorithmic mediations impact society. In these projects, data-driven storytelling is a narrative designed with more than just 'traditional' data visualization, but combining data with visuals, written text, and interactive elements to tell a story.

2.1 Selection criteria

From both didactic experiences described, in the last 3 years, I have collected a total of 42 student projects using data-driven stories that include an onboarding section. For this paper, I have selected 18 projects (see table 1) that best meet the evaluation criteria used in the master's course regarding the artifact narrative:

Audience definition: The selected projects clearly outlined an audience and defined a clear and simple message to convey. This criteria answers to *Who are you communicating with? What is your message?*

Coherent message for reflection and visual communication: The visual communication of the selected projects is consistent with the message for reflection and the defined audience. Special attention is placed on the coherence between written, visual, and interactive language. This criteria answers to *Is the visual communication consistent with the audience's message?*

	Master thesis projects	Master's degree projects
Total number	14	27
Projects with onboarding	9	21
Projects with no onboarding	5	6
Selected for this presentation	6	12

Table 1. Overall and selected projects.

2.2 Informative module analysis

Each project was analyzed by identifying three main elements: the subject matter, the message in relation to the identified audience, and the format of the onboarding section. The output formats that appear most frequently are the slides, scroll and video, each combining text and images in different ways. The slide format presents visual and textual information in a frame that covers the entire screen and switches smoothly to the next frame. The scroll format allows interacting with the displayed content continuously by scrolling in a predetermined direction (up, down, left, or right). The video format structures the content in a linear and non-interactive manner.

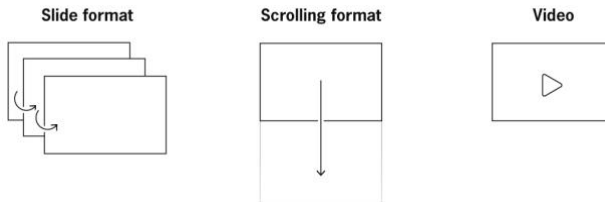


Fig. 2. Main onboarding formats present in the case study collection.

For each project onboarding, different informative modules were identified. An information module is defined as a scene that begins with the presentation of visual, textual and interactive information, and ends with the entry of new information. The deconstruction in informative modules offers an overview of the onboarding content.

Observing the deconstruction of the 18 selected projects, common patterns are identified that are the basis for formulating the conditions proposed in this work. For the purposes of this paper, three of the 18 cases illustrate the analysis used by means of onboarding deconstruction into informative modules and the informative patterns identified in them.

The first project is *Opinion Library*, designed by students of the master's degree course in the 2021/2022 edition. The project is a digital archive collecting the language and arguments used in comments to petitions on Change.org regarding the mask mandate in the United States. As stated by the authors, the aim of the project is to "make the dataset used in this research available to researchers and potential activists interested in the subject". The archive presents how often a word is used by a certain group and which are comments mentioning that word. The website has three sections: *context* where the landing and onboarding are, *library* which is the explorative tool, and an *about* section that discloses the main design decisions of the project (Briones, 2021a). The scrolling onboarding of this project is deconstructed in 9 informative modules. The first module corresponds to the landing page where the project's title and description are presented. Students are guided to look for project titles that are as concrete and close to the subject matter as possible, trying to avoid metaphors that are generally difficult to understand. Students are also guided to incorporate the landing page information that indicates the topic, the object, and the context of the study. In this case, "What do Change.org users think about mask mandates in the U.S.?" states the topic of user opinion in the context of the Change.org online petition platform in the United States. The following informative modules expand on aspects as outlined in figure 3.

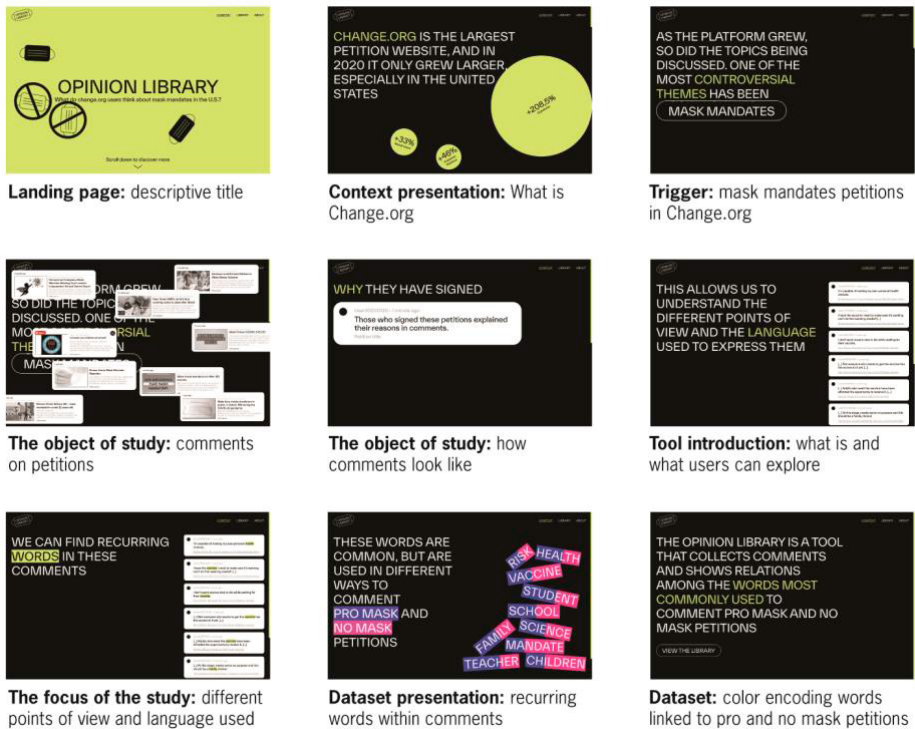


Fig. 3. Onboarding information modules of *Opinion Library* project by Alice Bocchio, Michele Bruno, Maria Celeste Casolino, Luca Draisci, Virginia Leccisotti, Barbara Roncalli, and Sara Zanardi, 2021-2022.

The second project is I SEE YOU designed by students of the master's degree course. The project is a web platform that shows six stories about leaked security camera footage founded in Insecam.com platform¹. Each story reveals the process of discovering where they are placed and what or who is being surveilled. The target audiences of the project are current or potential owners of security cameras and people who are directly or indirectly under the surveillance of security cameras. Each story takes the audience through an informative and interactive journey in which from the security camera record the exact location of the camera is tracked, and the name and contact details of the location being captured are recorded. At the end of the process, the audience is given the opportunity to contact the owner of the camera and inform them that their privacy is at risk. Additionally, a guide is offered that presents a series of tips for the safer use of security cameras. By exploring vulnerabilities from the misuse of security cameras, the aim of this project is to inform the audience "that leaked security camera feeds can be easily tracked using simple

¹ Insecam.com is a live cameras directory that gathers open security camera feeds on the Internet and list them at their website <http://insecam.org/>.

online tools in just a few clicks” as the authors stated in the about section of the website project. This project is a communication artifact that follows the form of what I define *experimental logbook* and is organized into four sections: landing and onboarding, story index (each story is an interactive video), the *about* section that reveals the main design decisions of the project (Briones, 2021b) and a *Guide* section. The video onboarding is deconstructed into 9 informative modules. The first module corresponds to the landing page. As in the previous project, the objective of the landing page is to present the title and description of the project in a concrete way in order to position the topic, the object, and the context of the study. The students choose an eloquent title that is complemented by the description *Investigating, exposing, and acting against privacy breaches in security cameras*, thus defining the topic of the vulnerability of security cameras. Figure 4 shows the identified informative modules.

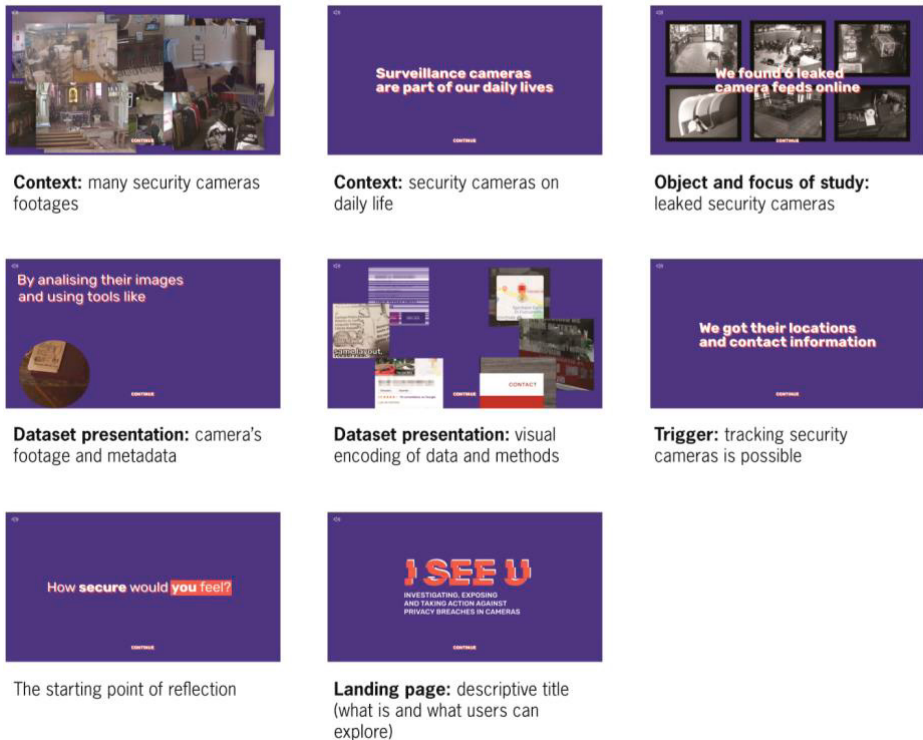


Fig. 4. Onboarding information modules of *I SEE YOU* project by María Cristina Pita da Veiga, Evansha Agrawal, Guilherme Appolinario, Maria Almeida, Natalia Malaver, and Rebeca Vittorazo, 2019/2020.

The third project is Invisible Trails, a master's degree research thesis. It is designed as an alternative narrative (Briones, 2021b) project. The work is developed as a mobile-first platform and exposes the complexity of the digital infrastructure of game apps by revealing the connections and flows between the companies that have access to users' personal data.

The narrative starts with a scrolling section that introduces and guides the user through the topic. The second part is a free exploration of the archive of 99 game applications. Finally, the project offers three sections: The project presents the motivations of the research project, what's behind exposes the method of data collection and dataset design, and starter pack offers links to useful tools to deepen the topic. The audience of this project is game app users based in Europe, who are generally interested in privacy and data exploitation issues but do not have the knowledge or means to understand them fully and independently. The aim of the project is to promote a critical reflection on how the personal data of app users are exploited, and thus increase the awareness of the target audience.

Unlike Opinion Library and I SEE U, the information architecture of this project is more complex, including different chapters that take care of deepening a variety of dimensions of the topic. The project has three onboarding moments that are placed throughout chapters of the narrative. The first scrolling onboarding introduces the topic, object, and context of the study. The second scrolling onboarding explains the visual encoding of the information, and the last video onboarding guides the use of the archive. Figure 5 shows the deconstruction into informative modules for each onboarding.

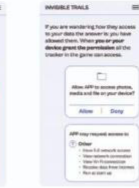
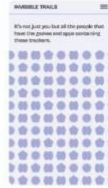
First scrolling onboarding: Situating the context, object of study and triggers



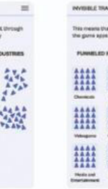
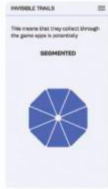
Landing: title and project purpose



The object of study: what are game app trackers (where they are, what they do, type of trackers)

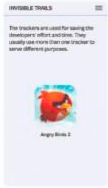


Trigger: game app trackers permissions existence



Trigger: game app trackers permissions: user's personal data is funneling unknown industries

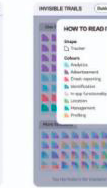
Second scrolling onboarding: Explaining the visual encoding of the information



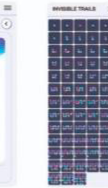
The object of study: look and feel of a game app on user's mobile device



The object of study: visual encoding of trackers in practice: color, shape, and composition



User guide: how to read and interact with the tool



Dataset presentation overall look to the collection of game apps

Third video onboarding: guiding the use of the archive



The object of study: look and feel of a game app on user's mobile device



The object of study: visual encoding of trackers in practice: color, shape, and composition



User guide: visual and animation encoding for personal data traveling through trackers servers



Recap and insights: overall look to the servers connected to game apps

Fig. 5. Onboarding information modules of Invisible Trails, a project by Anna Gazza, 2021.

3. Conditions for communication-effective on-boardings

From the deconstruction of the onboardings of the projects, similarities, and differences in their informative modules are recognized. The recurrent presence of certain modules is grouped and reorganized in order to articulate the conditions.

3.1 Onboardings situate the subject in its own context

The first group brings together the informative modules that introduce the subject and place the object of study in its own context. A common practice observed throughout the projects is the presentation of the actors who are part of the story. According to the issue mapping framework, actors are people, "non-human entities, institutions, practices" (Marres, 2015). In answering *Who is part of the story?* actors are the platform of study, the object of study, and the institutions present. In the case of *Opinion Library*, the actors presented are the Change.org platform, the comments on the petitions, and the words. In *Invisible Trails* project, the actors are the game apps, the trackers, the servers of the companies involved, and the companies themselves.

A second aspect observed as a recurrent practice to place the object of study in context is to introduce the relationships existing between the actors, answering the question *How do they relate to each other?* The informative modules that present the focus of the study address this issue by specifying the relationship between the actors that is of interest in the project. *Opinion Library* introduces the relationship that exists between comments that can only be created once a petition has been voted, making explicitly that analysed words come from pro and non-mask petitions. The project focused on the comparison of the use of the same words in the pro and non-mask petitions.

Finally, the informative modules that present the audience's touch point with the context will be those that present the trigger(s). These answer what is the relationship that the audience may have with the topic of study. In *Invisible Trails*, the trigger is presented by making the user knowledgeable that game app trackers' permissions use the personal data for funnelling unknown industries.

3.2 Onboardings support the reading and usability of the artifact

The second group gathers the informative modules that guide the reading and usability of the artifact by introducing the main visual and interactive features present in the narrative. This condition fulfills a function like that of the legends in dynamic and static data visualizations, presenting interpretative keys to decode the visual, animation, and interactive variables. A practice observed in the projects is to introduce the coding of the variables together with the explanation of the data they represent. Therefore, the dataset is introduced together with its visual and interactive representation. *I SEE U* presents the methods and tools they used to obtain the data

from the hacked cameras, and from there, present the visual and interactive variables of how the six documented stories are reported. *Opinion Library* also presents how the data was collected from the comments, and then categorized into pro-mask and no-mask using color as the visual variable.

3.3 Onboardings frame the communicative objectives proposed by the designer

Finally, a third group gathers the information modules that frame the communicative objectives proposed by the designer-author. Assuming that data-driven narratives are not neutral, the authors of the content make explicit the position from where and how they are designing the stories, highlighting a specific point of inquiry. In the didactic experiences mentioned above, students are encouraged to assume an authorial role by offering a point of view without imposing an opinion. The use of data as evidence is encouraged the audience to reflect and form their own informed opinion.

In *Invisible Trails*, the relationships between game apps, trackers, servers, and the companies that own them are made visible to reveal the complex network of interests through which users' personal data moves. The metaphor of the journey is used to emphasize the distance that personal data travels, translating it into kilometers. The project proposes a clear point of view on the criticality of users' misinformation about who has access to their personal data. Offering the designer's point of view helps the audience interpret the way the story was designed.

4. Results and final remarks

Based on the analysis of the cases presented, three conditions are proposed to answer the initial question of what conditions can help to design effective onboardings. These conditions are:

Onboardings situate the subject in its context: they introduce the platform of study, the object of study, the focus, and the triggers.

Onboardings guide the reading and usability of the artifact: they work as the legend of visualizations by introducing the main visual and interactive encoding for the dataset.

Onboardings frame the communicative objectives proposed by the designer: making explicit that the narrative is not neutral and seeks to highlight a specific point of inquiry.

The above conditions are a starting point for discussing how to design onboardings, and are not intended to be an absolute guide. The work presented is based on two personal experiences in the field of didactics as a starting point for future stages of research. Some avenues for future research will be: extending the analysis to include professional projects; evaluating the communicative effectiveness of onbc with users; and analyzing onboardings in mobile formats to examine the possibilities for user interaction on smaller devices.

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References

- Amini, F., Brehmer, M., Bolduan, G., Elmer, C., Wiederkehr, B. (2018). Evaluating Data-Driven Stories and Storytelling Tools. In Riche, N. H., Hurter, C., Diakopoulos, N., & Carpendale S. (Eds.), *Data-Driven Storytelling* (1st ed.), 108-135, Taylor and Francis Inc.
- Bach, B., Stefaner, M., Boy, J., Drucker, S., Bartram, L., Wood, J., Ciuccarelli, P., Engelhardt, Y., Köppen, U., & Tversky, B. (2018). Narrative Design Patterns for Data-Driven Storytelling. In N. H. Riche, C. Hurter, N. Diakopoulos, & S. Carpendale (Eds.), *Data-Driven Storytelling* (1st ed.), 108-135, Taylor and Francis Inc.
- Briones, M.d. (2021). Disclose to Tell: a Data Design Framework for Alternative Narratives. *Comput Supported Coop Work*, 30, 785-809. Retrieved from doi.org/10.1007/s10606-021-09416-1.
- Briones, M.d., Mauri, M. (2021). Alternative narratives data visualization archive. In *Proceedings of Cumulus Conference Roma 2021*. ISBN: 978-952-64-9004-5.
- Drucker, S., Huron, S., Kosara, R., Schwabish, J., Diakopoulos, N. (2018). Communicating Data to an Audience. In N. H. Riche, C. Hurter, N. Diakopoulos, & S. Carpendale (Eds.), *Data-Driven Storytelling* (1st ed.), 108-135. Taylor and Francis Inc.
- Hullman, J., & Diakopoulos, N. (2011). Visualization Rhetoric: Framing Effects in Narrative Visualization. *IEEE Transactions on Visualization and Computer Graphics*, 17 (12), 2231-2240. Retrieved from 10.1109/tvcg.2011.255.
- I SEE YOU. Retrieved from <https://densitydesign.github.io/teaching-dd15/course-results/es03/group02/>.
- Marres, N. (2015). Why Map Issues? On Controversy Analysis as a Digital Method. *Science, Technology, & Human Values*, 40 (5), 655-686. Retrieved from 10.1177/0162243915574602
- Mauri, M., Colombo, G., Briones, M.d., Ciuccarelli, P.(2019) Teaching the critical role of designers in the data society: the DensityDesign approach, in Börekçi, N., Koçyıldırım, D., Korkut, F. and Jones, D. (eds.), *Insider Knowledge, DRS Learn X Design Conference 2019, 9-12 July, Ankara, Turkey*. Retrieved from 10.21606/learnxdesign.2019.12046.
- Opinion Library*. Retrieved from <https://densitydesign.github.io/teaching-dd17/websites/g05/>.
- Riche, N.H., Hurter, C., Diakopoulos, N., & Carpendale, S. (Eds.). (2018). *Data-Driven Storytelling* (1st ed.). A K Peters/CRC Press. Retrieved from 10.1201/9781315281575.
- Segel, E., & Heer, J. (2010). Narrative Visualization: Telling Stories with Data. *IEEE Transactions on Visualization and Computer Graphics*, 16(6), 1139-1148. Retrieved from 10.1109/tvcg.2010.179.
- Tharp, B., Tharp, S. (2019). *Discursive Design: Critical, Speculative, and Alternative Things*. The MIT Press. Retrieved from 10.7551/mitpress/11192.001.0001.

Monumental data. Making information tangible in the complexity of a 'data-based' world

Nicolò Ceccarelli¹ (0000-0002-3262-3419),
Alfredo Calosci² (0000-0001-8018-699X),
Daniele Murgia³ (0000-0003-2840-0826)

^{1,2,3}Department of Architecture, Design and Planning, University of Sassari
ceccarelli@uniss.it, acalosci@uniss.it, d.murgia15@studenti.uniss.it

Abstract. A research assignment involving the historic center of our town has recently allowed us to frame the presentation of data within a new perspective. Part of the European Funded programme MedGaims, aimed at exploring *gamification* as a way to enhance the touristic experience, the project was aimed at responding to two key demands. In the first place, our *Playful Itinerary* was thought as a comprehensive presentation of a larger enterprise, the *Play Alghero* programme – a composite effort including ten different games, either in the physical and in the virtual domains. Scattered through the old city's centre, our 'itinerary' was then aimed at providing to the overall programme a robust visual identity. Secondly, the system we created was meant to highlight the city's spirit of place in a playful and engaging way. Part of these aspects being its rich historical layering, its natural environment, local stories and games, elements of the local tangible and intangible culture and of the experiences of those who either live in Alghero or just visit it.

This general design framework lead us to explore an unedited technique of data visualisation, which we have jokingly dubbed "data vulcanization", as it deals with establishing a direct correlation between information and system of solid – although unexpectedly soft – rubber-based surfaces, in which in our design were symbolically meant to embody extremely volatile data connected with tourism in the rather solid and 'monumental' installations we created for the project¹.

Keywords. Gamification/ Corporate identity / Data visualization

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1. Introduction

A recent project in the emerging domain of gamification as a way to empower and enhance the touristic awareness towards local heritage has allowed us to explore the display of data in a novel way. Within the *Playful Itinerary* we designed in the context of the European Funded project MedGaims, data has become part of a richer set of elements we used to present the *genius loci* of our city and of its surroundings. The key component of our design proposal was a series of large totems, aimed at highlighting the complex set of tangible and intangible, natural and anthropic, network of factors that constitute the spirit of a given place. The three totems we created for the project were distributed in as much focal points of Alghero's urban structure. The integration in this scheme of a series of experimental diagrams, presenting information related to the local economy of tourism, has hence somehow brought data to a 'monumental' status, as statistical information became one of the components of the rhetorical 'totemic' representation we devised to create meaning for the project.

Within this general scheme, and on the lines of the recent trends in gamification in urban settings (De Luca & Bertolo, 2012), although with a rather distinctive approach the general solution we came up with took the form of an itinerary, a small system in which – starting from the shuttle bus connecting the local airport to the town's centre – a series of artefacts punctuate selected locations, acting as something between a boundary object – in Star & Griesemer's definition – (Star & Griesemer, 1989) creating a connection between the reality of the physical experience and out artificial conceptual interpretation, aiming at stimulating a direct interaction based on an elementary playful approach (Rizzi, 2004) which according to a classic definition, is inviting, motivating the player to engage (Mayer, 2014). The itinerary therefore articulates as set of different elements, some of which tangible, and actually *playable*, while others – mainly aimed at evoking a general atmosphere than at to spark actual interactions with the public – are intended as ephemeral, although equally relevant in terms of identity, elements acting as visual bricks of a broader environmental visual system (Calori & Vanden-Eynden, 2015). In track with various recent trends and experiences in educational games (de Souza e Silva & Delacruz 2006), the system is complemented by a digital frame that combines real and virtual in a hybrid analog/digital environment.



Fig. 1. One of Play Alghero's key installations in the city's old centre (lab. animazione design).

At the project's core are three large totem-like structures – located in selected key points – that have a dual function: marking the urban space so to catch the visitor's attention, and highlighting the wider network of activities, and games, embraced by the Play Alghero project.

The 'totems' present themselves as large metallic frames incorporating a variety of different elements. The most striking component is a set of modular rubber tiles which were produced with the same compound, combining rubber chips and resin, mainly used in playgrounds and in athletics tracks. A first colourful 'layer' of such tiles, mainly intended to visually engage the public, is enriched by some simple 'playful' opportunities: a set of flap doors of the kind also often found in playgrounds – thought to attract younger kids – and a series of short interactive animations created with the arrier-grid, or Ombro-Cinéma technique.

These take the form of very elementary analogic animated sequences that recall elements of the local landscape – such as sun umbrellas, airplanes, sea stars, and so on – and that can be directly activated, 'animated' in fact, in the strict sense, by the users themselves, by manually sliding a knob.

The rubber tile system hosted in the totems is itself articulated in two subsets. The first one, in bright primary colors, presents an extended system of visual references to the identity of the city and of its surroundings, part of the visual program we designed and that was extensively used within the whole project. The system – which we like to refer to as 'hieroglyphic' – is thought to embody some iconic elements that directly refer to the local spirit, or genius loci, and history: ancient remains (roman votive limbs and spinning tops, stone-age arrow points, the eye-shaped decoration adorning a sunken Phoenician ship's stem, votive taurine bas-reliefs from the Iron age, and so on) hosted in the local archeological Museum; other historical presences such as ancient cannon balls, the old city's towers, a Roman bridge. Other elements of the system refer instead to the local natural character (a sea wave, the Posidonia Oceanica

seaweed, sea stars and sea urchins). The set is completed by a final series of elements – a beach umbrella, the airplane – recalling the contemporary touristic nature of the place.

In our design vision this ensemble is complemented by a second one, that embody a different set of elements that make up the city's heritage. To suggest the subtle nature of such other set – and to enhance the contrast with the previous one – the tiles that compose it were moulded in neutral grey. Part of this second are elements such as the ancient cobbles paving the historical centre's streets of (as well as the more prosaic modern cement tiles in its peripheral areas), architectural details, such as a wooden carved street doors and iron manholes, as well as more ephemeral ones, like the crests over the sea surface, barks of local pines trees, a specimen of the local dwarf palm's fan shaped leaf.



Fig. 2. Inspired by the original pre-cinema Ombro-Cinéma toy, our totems host a series of framed animations thought to engage the visitors.

Taken, whenever possible, through direct plaster casts, these latter were processed to produce the 23 by 23 cm moulds needed to re-produce the original shapes in a new

set of rubber tiles. Wherever the desired shapes were not available for direct moulding (i.e. the crests of the sea surface), we resorted to digital technology to ‘re-produce’ 3D moulds through a digital milling process. The same approach was also followed to produce tiles in more abstract shapes, such as the typographic elements that compose the PLAY-Alghero logo.

While we were selecting the elements we wished to pick to conceptually convey the components defining our city in terms of its “touristic desirability”, we felt that the picture would have been incomplete if we did not include direct references to the actual dimension of its economy of tourism. As the original goal of the *Play Alghero* project was to precisely to ‘talk’ to tourists, offering them an articulated way to understand the city and its surroundings, beyond its more obvious representation in terms of beaches, historical attractions and other places of interest, we reached the conclusion that elements directly recalling this aspect needed to be part of the complex symbolic mosaic we were composing.

Just as the primary ‘hieroglyphs’ system encompasses the local *Corallium Rubrum* coral – an element which for many Centuries has played a pivotal role in the economy of Alghero, we thought that iconic references to symbols of the actual tourist economy – the beach umbrellas, the airplane – would have been appropriate to introduce the idea of the city’s contemporary ‘treasure’: the continuous flow of tourist (...and their cash), mainly via low-cost flights.

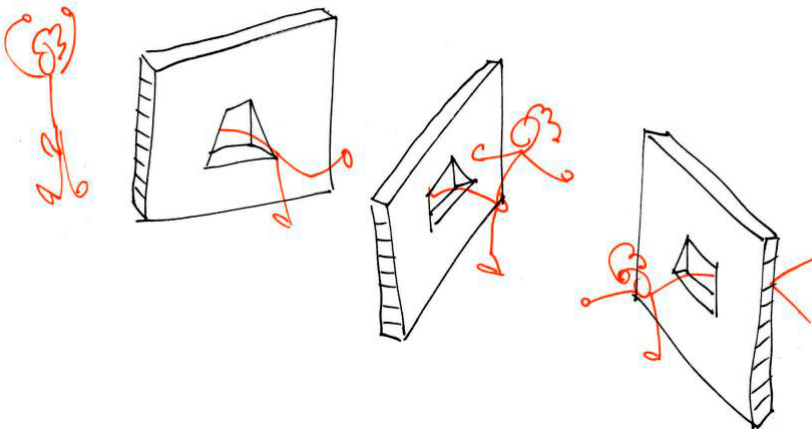


Fig. 3. The original itinerary and sketch for the playful concept: the public’s direct physical engagement and playful attitude are key elements (lab. animazione design).



Fig. 4. Detail of some of the elements within the totem we designed: some of the rubber 'hieroglyphic' elements recalling elements of the local spirit of place (lab. animazione design).

In the reality of a touristic city's economy, elements such as infrastructure and services, transport policies, the cost of living, and other aspects related the climate and its environmental consequences, constitute in fact factors that 'make it' attractive to prospective visitors. In this perspective, we decided hence to embed in our representation of Alghero's spirit of place of a selection of 'data-based' conceptual tiles, aimed at of symbolically marking the city's actual nature of a sought-after seaside destination, corroborating in doing so the relevance of tourism in a quantitative dimension.



Fig. 5. Moulds obtained either directly from the original shapes and through a digital reproduction process. The final rubber tiles are obtained by pouring in the appropriate mould a rubber and resin compound. (lab. animazonedesign).

2. Data ‘vulcanization’

The items we had originally selected to represent – through their translation in the very coarse structure of our rubber mix – the tangible and intangible historical and environmental heritage of our city, needed at this point to be paired with ‘tourism-related’ data: diagrams presenting the annual average cloudy/sunny weather, average temperatures, the amount of fallen rain, the numbers and countries of origin of tourist visiting the city. A body of Information that had to be embodied and presented within the size and resolution limitations of our relatively small rubber tiles. Three distinct data sets were taken into consideration. The first two, connected with the desirability of local weather conditions in connection with touristic presence, are averaged over the 12 months of the year. One presents the typical temperatures and rainfall, while the other displays average daily sunlight.

A third and last tile, structured as a very simple map of central Europe, presents the number of visitors flying to Alghero’s airport from a selection of European destinations.

Being the data-tiles of this set in monochrome grey, color could not be exploited as an informative key, we had to look for alternative solutions. We resolved hence to turn to elements such as length – as in the bars in a classic Cartesian diagram – and, in minor degree, and to depth (within the rather limited range offered by our tiles, as their maximum development in depth was 2,5 cm). This rather limited degree of expression necessarily gave way to some compromise.

In the chart displaying the volume of incoming visitors, for instance, the radius of a series of circumferences, centred in the relative location of the capitals of various European countries, displays the relative number of visitors: to help the viewers

distinguish between different circles/countries, whenever the circles were overlapping, relative different circumferences heights had to be introduced. The sole radius circumference represented an actual data value, as the height only served as a visual informative aid.

The chart that possibly works better in the set is that pairing data on temperatures and precipitations over the 12 months of the year. Ordered in month rows, the two horizontal quadrants represent the average min and max temperatures (top), and the (bottom) rainfall volume. The pairing provides an effective representation: the curve presenting the average temperatures over the seasons matches the display, in the below area of the bar-chart, of the relative amount of rainfall. The central rows that relate in the chart to the spring/summer season, effectively emphasize, in their intrinsic symmetry, the set of conditions – warm, sunny and dry weather – that make Alghero a fine seaside ‘seasonal’ touristic destination.

Further, more prosaic, sets of considerations determined by functional criteria – providing sufficient resistance/solidity to the matrixes to be machine-milled and filled with the rubber compound, the need itself for the moulds to ease the detachment of the completed rubber tiles (allowing a successful results in shaping/moulding the tiles) – also have became part of the overall chart’s design.

Besides the fact that designwise these latter practical matters turned out being unpredictably intriguing, it must be underlined that the main goal of incorporating such ‘data tiles’ within the totem’s broader set of meaningful elements was to highlight the relevance of statistics relating to economy of tourism in Alghero. From this angle, therefore, being the information *per se* less relevant in the strict sense, the selection of data to be displayed turned out as the product of a balance – after all the successful outcome of any design has at its heart some degree of compromise – between data publicly available and the very tangible and strict limitations posed by the format. The main scope of incorporating such data in our ‘monumental’ totems was to symbolically convey to visitors and tourists how their very presence, the way they relate to a place, the choices they make, what they decide to visit, and so on, are a relevant part of the equation regarding any sought-after touristic destination. More than having the tourists being able to read in detail the related facts, our actual goal was hence triggering some degree of awareness about how, within a vast series of elements – tangible and intangible, natural and artificial, functional end cultural – tourism contributes in determining the future of a given place, and plays a role in defining its current and future identity.

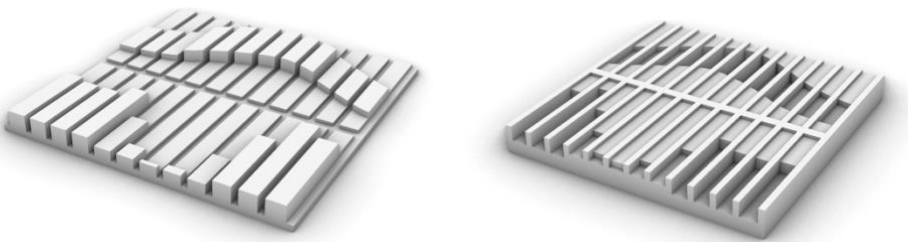
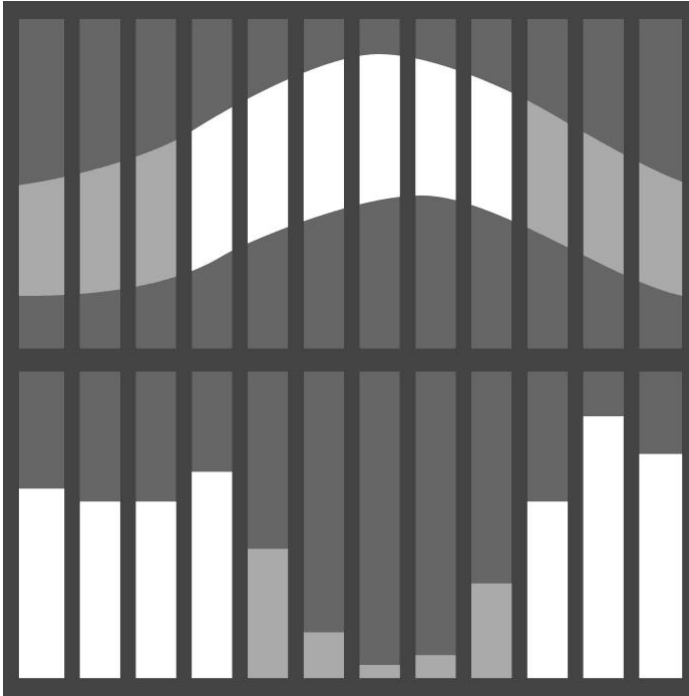


Fig. 6. Alghero's seasonal average temperatures and rainfall in the original chart (above) and in the respective 3D digital mould and counter-mould (below) developed to produce the rubber tiles that were incorporated in the Play-ALghero installations (lab. animazonedesign).

3. Conclusions

Overall, while we are happy by the preliminary results of our project, the idea of incorporating data in the complex rubber-based mosaic of identities we created with our Play Alghero installations, has proved intriguing and instructive.

Although extremely rough and limited by the reduced informative resolution of the rubber support, some key elements contributed – we believe – in making this experiment successful.

In the first place, the degree of curiosity and surprise that our installations were able to spark in the visitors and in the users of our installations allowed something as abstract as data to become part of a much broader and more articulated representation of the ‘reality’ of Alghero as a place.

At the same time, although very symbolic and partial, the mere presence of explicitly tourism-related data and the fact that these were paired with much more obvious references to the local tangible and intangible heritage, worked as powerful statement about their relevance in determine the city’s current identity.

Finally, the development of this project has taught us an important lesson about ‘coming down to earth’ when dealing with quantitative information.

Data: those intangible elements that allow us to explore the world with unprecedented sophistication are an unescapable element to know and interpret it, being indisputably a key component in representing and understanding the complexity of a touristic city. Still, this foundational element presents only one side of a richer and much more complex vision.

Although mostly symbolically, data have in our Alghero Playful Itinerary, certainly allowed us to corroborate the quantitative dimension of the local economy of tourism. Still, in order to understand any organism multi-faceted as a city implies confronting with a much richer and complex reality, which embraces a wide set of aspects – not all of which immediately *quantifiable*. It is only by taking into scrutiny a manifold series of elements, often very subtle, intangible, often connected with volatile factors, that we may hope to be able to read and interpret the nature of a place. This is, we believe, the message that, beyond the selection of meaningful fragments that make up our ‘Monumental totems’, lies in our project.



Fig. 7. Kids, the project's main target group, playing with the installations.

References

- Calori, C., Vanden-Eynden, D. (2015). *Signage and Wayfinding Design. A Complete Guide to Creating Environmental Graphic Design Systems*. Wiley & Sons.
- De Luca, V., Bertolo, M. (2012), Urban Games to Design the Augmented City, in Eludamos. *Journal for Computer Game Culture*, 6 (1), 71-83, No. 1.
- De Souza e Silva, A., Delacruz, G. C. (2006). Hybrid reality games reframed: Potential uses in educational contexts. *Games and Culture*, 1(3), 231-251.
- Majewski, J. (2015), Furnace Journal issue 2 de Souza e Silva, A., & Hjorth, L. (2009). Playful urban spaces: A historical approach to mobile games. *Simulation & Gaming*, 40(5), 602-625.
- Majewski, J. (2015). I videogame ludici: Gli Applied (o Serious) Game: come mezzo di coinvolgimento e di condivisione di esperienze culturali di vario genere (Morris et al., 2013). *Cultural Heritage in Role-Playing Video Games: a Map of Approaches*.
- Mayer, R.E. (2014). *Computer games for learning: An evidence-based approach*. MA, MIT Press.
- Plass, J., Mayer, R., Homer, B. (2020). (Eds.) *Handbook of Game-Based Learning*. MIT Press.
- Rizzi, P. (2004). Giochi di città. Manuale per imparare a vivere in una comunità equa e sostenibile. La Meridiana., J. Plass, R. Mayer, & B. Homer (Eds.), *Handbook of Game-Based Learning*. MIT Press.
- Star, S. L., Griesemer, J. R. (1989). Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's museum of vertebrate Zoology, 1907-39. *Social Studies of Science*, 19(3), 387-420.

1.4 Informative environments



Learning spaces as visuospatial instruments for working in/with complexity

Cara Stewart¹ (0000-0002-2230-9098), Luca Gatti²

¹CHÔRA Foundation, cara.stewart@chora.foundation

²CHÔRA Foundation, Copenhagen Business School, luca.gatti@chora.foundation

Abstract. Human social systems are complex and dynamic, perpetually involved in decision-making about themselves. Impossible for us, therefore, to *see* and *fix* their state and by reference to that design effective actions. To engage with the emergent and evolutionary dynamics of those systems we need to produce an initial, germinal, *good enough* rendering of their complexity. We introduce Learning Spaces as a cognitively engaging communication that makes available to strategic agency, decision-making protocols and governance processes a visuospatial multidimensional representation of the *backbone* of a social system. We argue the case for their utility as heuristic instruments that leverage meta-model ontological representations to position, design and activate impact and transformation options that afford, through iterative sensemaking, the situated learning, the constant and exponential supply of intelligence assets with which to affect and change those systems.

Keywords. Visuospatial Reasoning / Learning Space / Abstraction / Sensemaking / Decision-Making

1. Introduction

This paper introduces elements of design practice that have emerged from CHÔRA's experience in the design and dynamic management of Portfolios of transformation Options. CHÔRA offers a strategic knowledge ontology, processes and tools that enable social systems, organisations and institutions to manage their own and their world's complexity, design actions, make sense, form decisions and commit to enactment pathways, thus resolving uncertainty. For CHÔRA's Strategic Innovation Designers to work with people and stakeholders in complex social systems and co-design actions and arguments for policymaking, they craft instruments that communicate the presence and the implications of complexity so that they can engage effectively.

The core competence of CHÔRA as a space that offers a transformational capability is a distinct and robust *Strategic Innovation Framework* (Fig 1). At the heart of it is the capability to generate and leverage a Learning Space, the focus of this paper.

Strategic Innovation | System Transformation Framework
PHASES, Activities & OUTCOMES

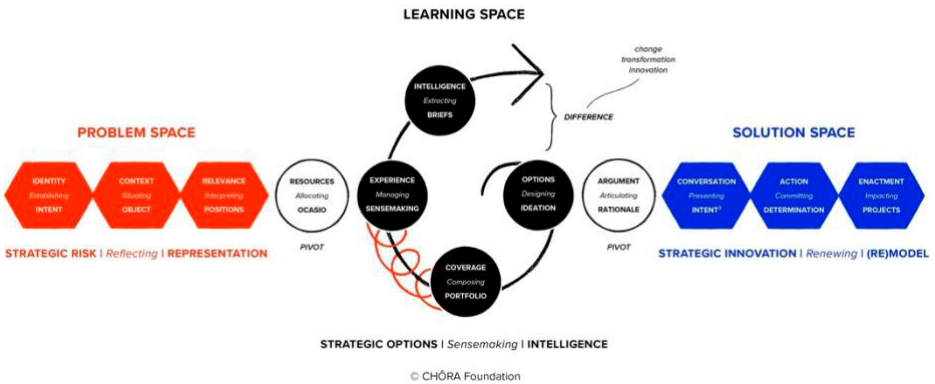


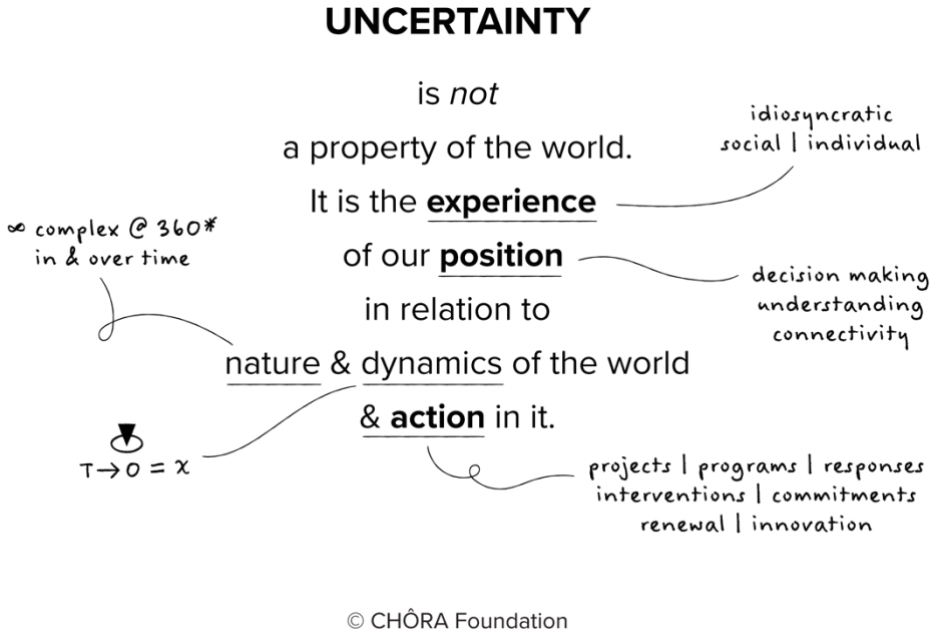
Fig. 1. CHÔRA's Strategic Innovation Framework, 2022. (CHÔRA).

This paper assumes that the extraordinary complexity of human social systems is given, structured by the role that meaning has within them as a constant evolutionary layering and by the relational implications of their negotiation of an ever shifting context. To think that this order of dynamic complexity can be mapped, truthfully represented, causally explained and projected and thus resolved is tantamount to painting a landscape from a moving train, so we will not do it. In CHÔRA we acknowledge that the act of decision-making that human systems perform when taking decisions about themselves occurs within a complexity that is constantly reconfiguring itself, and thus calls for more pragmatic, intent driven and intelligence-based solutions. Here, it is the coupling of strategic learning ability and visuospatial reasoning Learning Spaces afford that makes them instruments that facilitate communication of and engagement with complexity in the service of decision-making outcomes.

2. The problem: uncertainty

Complexity is, most probably, a property of the world. It certainly appears to us as a convenient toolkit for establishing what the problem is that human social systems deal with when designing actions to support their resilience and their performance. A key element of that concept is the extent to which the emergent dynamics of complexity mean that its evolutions are not easily projectable. Probably not at all. Hence, our uncertainty (Fig. 2).

Uncertainty, though, is not a property of the world; it is, instead, the experience we have of that world on account of its inherent complexity. And the problem with uncertainty is that it affects our capability to discern, draw connections and design actions in a social system (Kay & King, 2020).



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Fig. 3. Uncertainty CONTO, a working definition that outlines CHÔRA's dynamic and evolving understanding of uncertainty, 2022. (CHÔRA).

The problem that human systems have, therefore, is uncertainty. In CHÔRA we see complexity as the source of the problem: communicating complexity is not, in CHÔRA at least, the removal of it, or its mystifying simplification, but it is instead a practice of constant problem solving of the challenge complexity presents to decision-making agents. In other words, as Strategic Designers, our interest in complexity is the high degree of uncertainty that it induces.

The well-being and prosperity of all human social systems such as countries, cities and organisations is dependent on them engaging effectively in the process of designing policies and interventions, of problem-solving. In pursuit of their goals, they must come to terms with the implications of uncertainty. Therefore, collective and individual stakeholders that aim to enhance and accelerate the development prospects of a social system need capabilities, processes and tools with which to work in complexity and resolve uncertainty.

3. The solution: learning

The solution that CHÔRA proposes and practices to resolve uncertainty is learning. We understand learning, or *strategic learning*, as a discovery and generative space

that bridges problem and solution; the *in-between*. It is the co-implication of experiences and making sense of those experiences that generates pragmatic and adaptive forms of knowledge for the design of actions in the world. It is the discovery and the development of solutions, driven by intent, sourced by imagination and structured by relationships. Learning is the interpretation and representation of a Learning Space, a metamodel of experiences in which to discover pathways of inquiry that return information, access to resources, design of activities, models and strategic arguments for commitments and change (CHÔRA Foundation, 2021).

As uncertainty affects our decision-making capability, we need to generate tools that can dynamically and iteratively feed information back to us, thus building knowledge about the system we are and the systems we are in. Learning Spaces do just that, they are strategic design instruments that allow us to establish intent led and situated learning experiences. For learning to occur most effectively, i.e. fast and exponentially evolutionary, it needs to be intuitive, easy, and appealing. Therefore, we need to recreate the conditions in which our cognitive functions are most at ease, leveraging their structural disposition to move in and learn (Tversky, 2019). Hence the importance of recognising the value of visuospatial reasoning as a relevant field of research when the communication of complexity is intended to induce effective engagement with its decision-making implications. In its practice across geographic, sectorial and thematic differences CHÔRA draws extensively from spatiality (Meusburger, 2017) and visuospatial reasoning. To trigger the innate capability of spatial thinking we develop and communicate (by which we mean the representation of a meta-model for the purpose of engagement, exchange and design) a spatial landscape; that we call a Learning Space.

3.1 Visuospatial reasoning

We class Learning Spaces as visuospatial instruments as they utilise our innate, cognitive capability as humans to think spatially. Manipulating and abstracting elements in our environment to reduce complexity by making use of our spatial cognitive abilities is not a new craze but something that human beings have been evolving over time. From the creation of maps to the formation of pyramids, visuospatial reasoning is a basic function with which to abstract and draw inferences, and thus reduce complexity. More recently, Visual-Spatial intelligence was proposed by Howard Gardner as one of the eight types of intelligences in his 1983 book, *Frames of Mind: The Theory of Multiple Intelligences*. There has since been further discourse around visuospatial thinking and reasoning such as Professor Barbara Tversky's 2019 book, *Mind in Motion: How Action Shapes Thought* where spatial thinking is introduced as the foundation of all thought and action as a means to facilitate reasoning.

We understand reasoning to be the act of thinking in a way that is logical and pragmatic. Tversky breaks this down further by questioning the role that reasoning plays in human cognition, "How do we go beyond the information given?" (Tversky,

2005). She argues that this could be by adding information, but it could also be by transforming pre-existing information or assuming judgements from it. The form that reasoning takes in our context is visuospatial, meaning that we are considering the visual properties of objects and their relational dynamics and positioning in space. This demonstrates a multiplicity of spatial abilities including perception and spatial visualisation as well as mental folding and rotation (Fig 3). The theory of visuospatial reasoning is also noticeably apparent in the context of exhibition design, the intentional visual design of space through storytelling in service of learning and knowledge building. The purpose of any exhibition is to articulate an intended message to an audience through a clear arrangement of objects, or artefacts, and a carefully designed spatial and relational form in which they are presented (Dernie, 2006). And although we often view exhibition design as a highly skilled discipline, all humans share the innate capability to design in space, look no further than the exhibition you have designed in your own home.

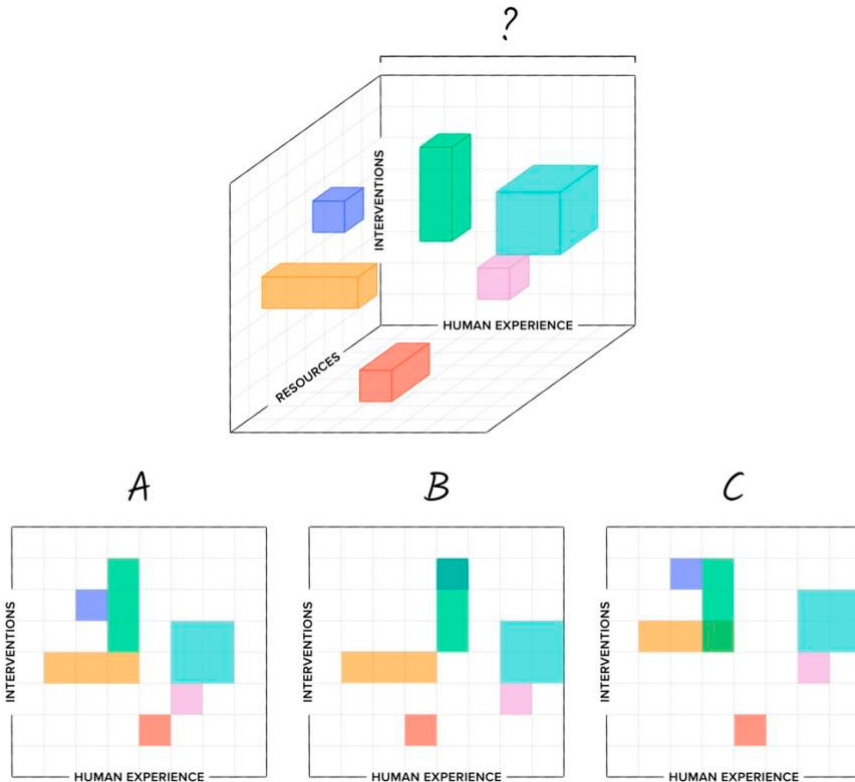


Fig. 4. Mental rotation of a Learning Space, an example activity to demonstrate mental rotation as a spatial ability, 2022. (CHÒRA).

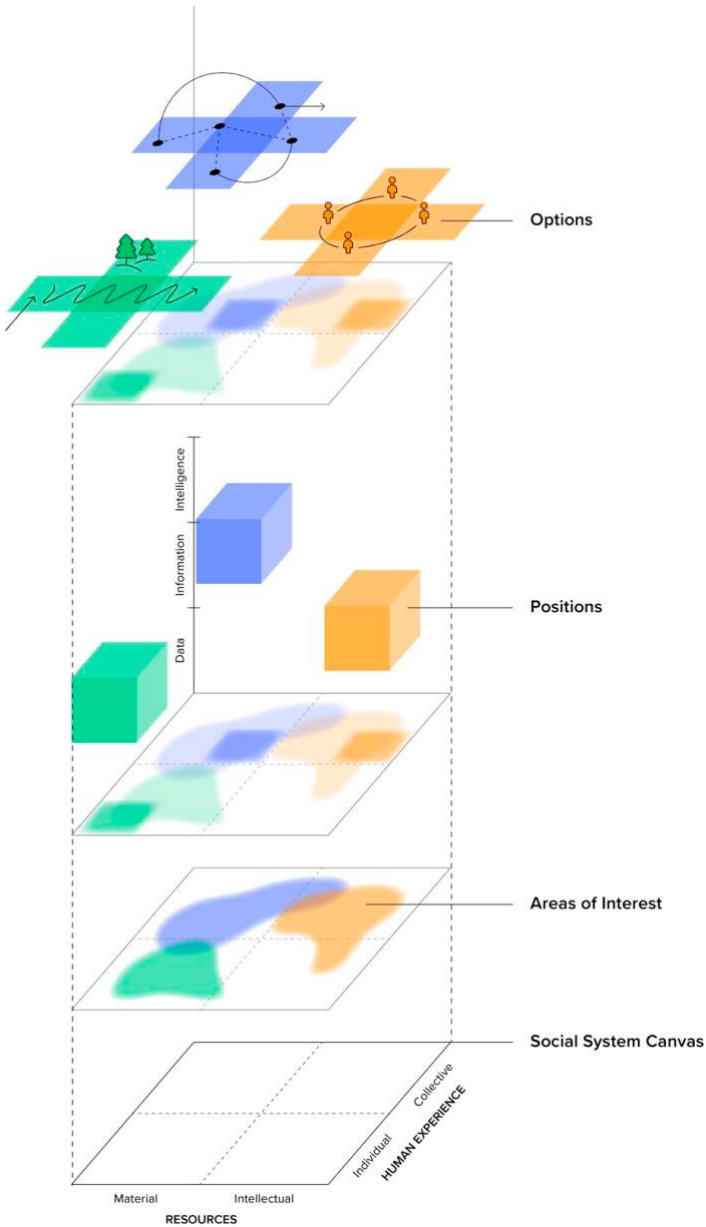


Fig. 6. Anatomy of a Learning Space, 2021. (CHÔRA)

We have established that human social systems are complex and that the uncertainty we face on account of this hinders our ability as designers to act and make decisions in the world. Therefore, in order for decision forming and making to happen, we need to engage with a rendering of this complexity. Human social systems are also noisy, visuospatial reasoning helps us transform the constant, expansive and insignificant noise into a structured message, information, through abstraction and the addition of visual elements such as lines and points arranged spatially with connections and clusters. Common examples of the output of this effort would be cognitive or stakeholder maps from which we would hope we could then extract intelligence, meaning that is emergent and authored and can generate action. The examples of cognitive and stakeholder maps use abstract reasoning and two-dimensional spatial visualisation, demonstrating two of the four types of spatial reasoning summarised by Wai, Lubinski, and Benbow in their 2009 paper on *Spatial Ability for STEM Domains*. They do not demonstrate mechanical reasoning, how elements operate in space nor three-dimensional spatial visualisation. Learning Spaces, on the other hand, exhibit all four types of spatial reasoning. Learning Spaces are, first and foremost, three-dimensional spatial abstractions of complex systems. However, they can also generate value in viewing them from a two-dimensional perspective by focussing on the dynamics at play between two of the dimensions. The emergent Portfolio exhibits mechanical reasoning by allowing the viewer to observe the mechanics of its dynamic, structural form, for example how the space transforms on account of changing the position of an element.

3.2 Learning Spaces

A Learning Space (Fig. 5) is a multidimensional, ontological representation of our emergent knowledge about a particular human social system. A Learning Space is not an output nor a solution. It is not an analytic and reductivist mapping of something, and it does not truthfully reflect the reality of a social system. The value of a Learning Space is, instead, its utility as a heuristic device and cognitively enhancing tool (CHÔRA Foundation, 2021). It is a generative meta-model that enables people to work with uncertainty through the design of a Portfolio; a range of activities that leverage different points in the system allowing us to aggregate distributed in-system learning and use this built, layered knowledge to eventually resolve uncertainty pragmatically. When designing a Learning Space, we come to it as designers and therefore merely need the image to be *good enough* to engage with. A Learning Space provides us with sufficient terms of reference to engage by only identifying the relevant structural features of the system or context that we are seeking to intervene in. The quality of the rendering therefore is not nearly as important as the co-curated experience for the user. By representing the complexity of a multidimensional system in a visuospatial, synoptic and tangible form, we are encouraging the user to play, to explore the system, to look across and around it and observe all of its perspectives, thus inducing a cognitive purchase of its structure and relevant dynamics that is *good enough* for a preliminary act of design.

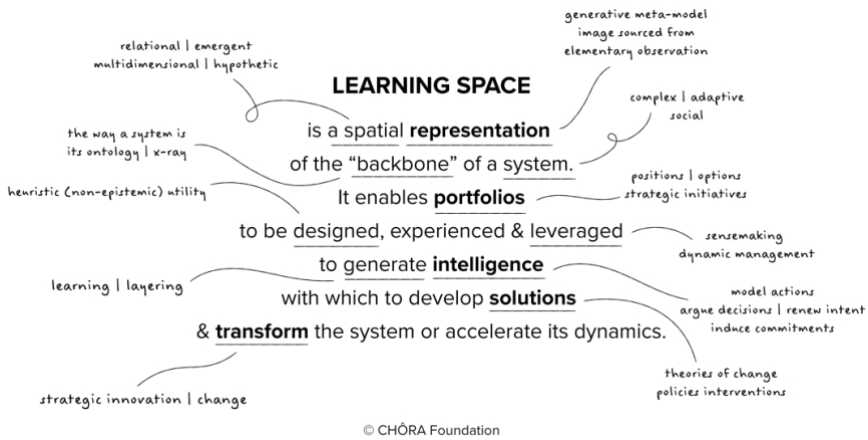


Fig. 5. Learning Space CONTO, a working definition that outlines CHÔRA’s dynamic and evolving understanding of a Learning Space, 2022. (CHÔRA).

Case Study: Agorà - A City Transformation Portfolio

In 2020, we worked in collaboration with the UNDP Istanbul Regional Hub to generate a Learning Space in response to the COVID-19 pandemic (UNDP Istanbul Regional Hub & CHÔRA Foundation, 2020). The intent here was to create a *City Transformation Portfolio*; a genomic arrangement that can be adapted for any city social system for the design and management of pandemic response and renewal plans addressing urban transformation (Chung, Järvelä, 2021).

A Learning Space is composed upwards (Fig 5) once the intent of the engagement, the strategic rationale, has been established. Starting with the base, we explore the relationship between the social needs and resources of the system and identify the sub-categories within each axis that will help us best respond to our intent. The Human Experience axis represents the actors that are most relevant to the system with the understanding that they will each have different needs. The sub-categories of this axis are clustered into individual needs and collective needs. The Resources axis are the assets and capabilities that are available to the system to satisfy these different social needs, here the sub-categories are clustered into material resources and intellectual resources. A lateral axis is then added, we are recognising that human social systems are not siloed and that there are higher or external dynamics that have influence and therefore need to be considered during the design and decision-making process. The most relevant lateral sub-categories identified for the city Learning Space were governance, environment, humankind and markets.

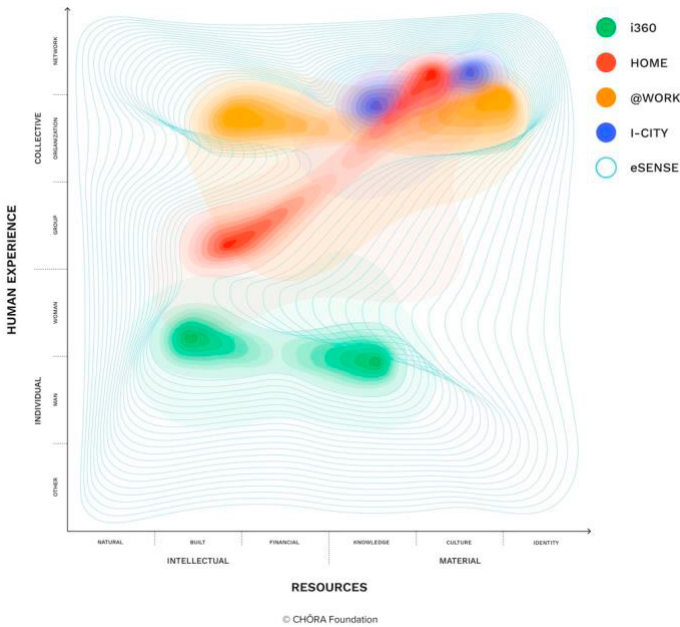


Fig. 7. Agorà Areas of Interest, a visual showing the floor-level of the three-dimensional cube with the identified focal areas, 2020. (CHÒRA).

Areas of Interest (Fig 7) emerge on account of the relational exploration between needs and resources. Here we are naming where in system human experiences are happening so we can direct energy towards these focal areas to respond to our intent. We identified 5 Areas of Interest for this Portfolio; *i360*, *HOME*, *@WORK*, *I-CITY* and *eSENSE*:

- *i360* is the single point of presence in a system, the individual. It represents the relationship an individual has to its social system, their interactions and capital, their identity and cultural beliefs.
- *HOME* is a domestic place, the routines of everyday life. It is the emergence of a space that combines resources and intents, supports outcomes, offers continuity, familiarity and affection.
- *@WORK* represents how the city is a platform of exchange. What is work as defined by a city, how is it performed, who performs it and what are the terms of engagement.
- *I-CITY* is the established infrastructure of a city, both natural and built, and how a social system dynamically emerges on account of what is there.
- *eSENSE* represents the different flows of information around a city and how it is shared. What information is available to the system in order for it to take actions?

We can now, quite literally, *go up* to the Decision Forming axis, which holds the elements to support the decision-making process. Here, we are questioning at what level of the system do we want to intervene at and what accordingly are the decision forming assets that we can or wish to leverage to do so. The sub-categories of this axis are data, information and intelligence. We understand data to be the record of stuff happening, constantly available and expansive; both real-time and historical noise that makes a message possible. Information is how we interpret this noise, it is a function of observation, discovery and selection, both the forming process of information and the distributive effect. Intelligence is the result of a generative and intellectual effort that gives meaning to information. It is a cognitive action, produced by an agent in support of its intent. Using the elements that have been generated so far, we can plot Positions; these are quite literally where we would like to position ourselves more specifically within a particular area of interest to engage effectively. We can imagine Positions as a project folder and within each folder we have Options which are the activities we design to learn more from our position and more generally produce distributed, in-system intelligence that we can leverage when forming decisions.

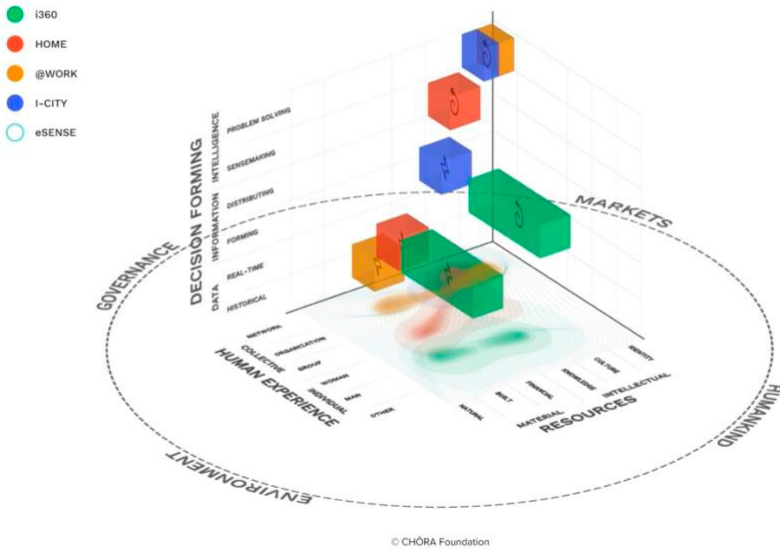


Fig. 8. Agorà - A City Transformation Portfolio, a three-dimensional SketchUp rendering of the Learning Space generated from this project, 2020. (CHÒRA).

What we have now generated is a Learning Space, a robust instrument of design and decision forming that is dynamic, constantly evolving and a perpetual source of intelligence when well curated and managed. Aside from the pandemic focus, what has emerged from this is a source for a *City Learning Space* which we have since applied to specific cities, most recently in our work for *Mayors for Economic Growth*;

an EU and UNDP program designed to support mayors and their teams in Eastern European municipalities.

4. Conclusions

Human agents are constantly confronted by two orders of complexity: that which is inherent to them as compounds of individualities constantly fabricating their systemic presence, and that of the context they are nested in with its emergent, time bound, evolving and accelerating dynamics. That relational experience is characterised by a perpetual negotiation of difference that gives rise to meaning (Luhmann, 1995) as literally the means by which the extraordinary complexity that is *there* is resolved with representational efforts that are communications to self in the service of designing the form of actions and engaging in processes of reasoning by which commitments can lead to enactment. CHÔRA has engaged in that space by bringing to the strategic intent and its implications an instrument that resolves the problem of complexity by acknowledging that its presence can only be resolved in time by a joint effort of representational abstraction (multidimensional rendering of Learning Spaces as heuristic instruments for *in system* positioning for learning and intelligence outcomes). The communication of complexity here is intended to make it manifest and draw the decision-making agent into it by articulating a spatial ontology that is *good enough* for the more fundamental act of designing oneself *in* the system and its complexities. It is here that experiential learning (Portfolios of Strategic Options) can occur, and it is here that the instrument with which complexity is negotiated becomes the budget of possibilities (Bateson, 2000) from which sensemaking extracts intelligence and social argumentation deliberates commitments. This paper has aimed to introduce terms of reference for the making of what are ultimately strategic communication devices with which to design actions in a complex world. Learning Spaces leverage our innate capability as human beings for visuospatial reasoning helping us design and work in complex systems where we experience high degrees of uncertainty.

References

- Bateson, G. (2000). *Steps to an ecology of mind: Collected essays in anthropology, psychiatry, evolution, and epistemology*. University of Chicago Press.
- CHÔRA Foundation (2021). *The Future of Development: "Making Happen" with Portfolios of Options*. *Green Paper 1.0*. Retrieved from <https://www.chora.foundation/field-notes/green-paper-the-future-of-development-make-happen-with-portfolios-of-options>.
- Chung, Y., and Elina J. (2021). *Agorà - A Transformational Dance with Urban Systems*. *Innovation for Development UNDP Europe and Central Asia, 22 Mar. 2021*, Retrieved from <https://innovation.eurasia.undp.org/agora-a-transformational-dance-with-urban-systems/>.
- Gardner, H. (1983). *Frames of mind: the theory of multiple intelligences*. Basic Books.

- Kay, J. A., & King, M. A. (2020). *Radical uncertainty*. Decision-making beyond the numbers. Bridge Street Press.
- Luhmann, N. (1995). *Social systems*. Stanford University Press.
- Meusburger, P., & Werlen, B. (2017). Knowledge, action, and space: An introduction. In *Knowledge and action*, 1-30. Springer.
- Tversky, B. (2019). *Mind in motion: How action shapes thought*. Hachette UK.
- Tversky, B. (2005). *Visuospatial Reasoning*. Cambridge Handbook of Thinking and Reasoning, 209-241. Cambridge.
- UNDP Istanbul Regional Hub & CHÔRA Foundation (2020). *Agorà: a Cognitive City Transformation Genome*. Portfolios of Development Options for Pandemic response in urban systems. Project Report. Available on request.
- Wai, J., Lubinski, D., Benbow, C. (2009). Spatial Ability for STEM Domains: Aligning Over 50 Years of Cumulative Psychological Knowledge Solidifies Its Importance. *Journal of Educational Psychology*, 101 (4), 817-835.

***The Betrothed Next*. Multimodal geo storytelling design: communicating a urban identity through its soundscape**

Letizia Bollini¹ (0000-0001-6491-4838)

¹Faculty of Design and Art, Free University of Bozen-Bolzano, letizia.bollini@unibz.it

Abstract. *The Betrothed Next*, here introduced as a case study, is a pilot project developed in three phases – the a geo-based urban augmented narrative (2011-15), the time-machine based on historical cartographies (2015-18) and in this last hypothesis the multimodal and multi-sensorial experience (2018-20) – of a mobile app aimed to discover the city of Milan according to an explorative and emotional perspective. In particular, the paper presents the last experimental round focused in conceiving, prototyping and assessing the the creation of a hypothetical urban soundscape crossing the tree historical thresholds – the novel (17th century), the author (19th century) and the contemporary city – to emotionally activating and interacting with people at a visceral level. The research, after exploring the state of the art and investigating the evolution of interface and interaction ecosystems in the cultural and intangible heritage field, focuses on the design of the acoustic and sound component in digital artefacts to enrich, according to a multimodal and synesthetic approach, the concept of *generous* interfaces.

Keywords. Geo-storytelling / Multimodal interfaces / Emotional design / Soundscape design / Cultural heritage

1. Intertwined historical geo storytelling

195 years ago Alessandro Manzoni, one of the most prominent figures of the Italian culture, published *The Betrothed* in the *ventisettana edition: I Promessi Sposi. Storia milanese del secolo XVII, scoperta e rifatta da Alessandro Manzoni [The Betrothed. Milanese history of the 17th century, discovered and redone by Alessandro Manzoni]*, the novel par-excellence of the Italian literature. Considered the first modern popular novel in Italian, the text is characterised by several levels of innovation. In the plot in which the numerous characters and their secondary stories are interwoven, managed thanks to various rhetorical stratagems and tones of voice, flash-backs, metaphors, the elegiac dimension. Manzoni also inserts different levels of interpretation. From the existential vision - the themes of providence and redemption – of a various humanity that deals with social injustice – Azzecagarbugli and the turmoil – of poverty to the political theme of domination – Spanish in the novel, Austrian in the author’s contemporaneity – and freedom.

Furthermore, in the lives and side stories of the protagonists intertwine with historical facts and places, thanks to multiple inventions. In particular, the writer “displaces” in time – the events described take place between 1628 and 1630 – the actions of this various human tragicomedy in the area between the Como lake and Milan. But the city recounted and the events of the plague are a metaphor for the author’s contemporary Milan and an urban space undergoing great transformation. A city still traceable today in some landmarks but transfigured by recent urban interventions that redesigned its spaces and its social and cultural vocation. By following in the footsteps of Renzo Tramaglino and his travels in Milan, it is possible to discover the vestiges of a remote and recent past, to connect totemic points of interest such as the Lazzaretto/Porta Venezia – the “LGBTQIA+ friendly,” neighbourhood – or Porta Nuova – nowadays part of the business centre and hipster Isola-Garibaldi district – by retracing the narrative and human experience of the author and his characters and superimpose them on our own being situated in the same places, as a key to interpreting the complexity of an urban organism and its evolution. The *Ventisettana* however is an evolutionary passage that allows Manzoni to develop two linguistic registers of the final version published in 1840. The first is the actual language, Italian, seen as an indispensable component in the construction of a national identity and thus of a political and territorial unity. Manzoni goes to “wash his laundry in Arno” to drink from what is considered the purest form of the *volgare* [vernacular], that same language that Dante had already created in his *Divine Comedy*. But the second invention lies in the collaboration with the engraver and illustrator Francesco Gonin, that leads to the creation of an iconography deeply connected and controlled by the author himself. A dialogue of narrative registers, the visual and the verbal, that synergistically construct – mirroring each other – a new and hybrid paradigm. The collaboration between Francesco Hayez – author’s portraitist and friend – did not materialise precisely because of Manzoni’s desire to control the creation of a detailed and consistent figurative imagery as well. As mentioned by Ippolito Nievo another protagonist of the literature scene in the XIX century “*la scena dei Promessi Sposi è proprio stupenda, più a vederla che a leggerla*” [the scene from *The Betrothed* is just beautiful, more to see than to read] (Zangradi, 2019).



Fig. 1. Francesco Gonin, *Promessi Sposi* illustrations: a) Addio monti [Farewell mountains]; b) I capponi di Renzo [Renzo’s capons]; c) il Lazzaretto, 1840. (Wikimedia).

The iconic scenes evoked in the text, such as the lyrical passage of the *Addio monti* (see fig. 1a onwards) or the sketching of the characters, in their physical and emotional characteristics constitute an intertextual figurativeness (Kristeva, 1969) played out between the author's lines and Francesco Gonin's imagery and the reader's imagination (Mendelsund, 2014). But what if this library of rhetorical, figurative and mental images were also translated into other linguistic registers or extended and augmented in a synesthetic and multimodal experience in which other senses besides sight were also involved? Experiences that, mediated by different means and support, would allow for an act that is no longer just only cognitive and imaginative, but also sensorial and embodied? Such a hypothesis introduces, both in terms of interpretation and in terms of design, new possibilities and keys to interpretation with the same text and context, both historical and spatial. In particular, this hypothesis implies the induction of a layer of experience that encompasses and covers a much broader spectrum and involves the so-called visceral level – behavioral, and reflective the other two (Norman, 2007) – in terms of processes of accessing and decoding messages and knowledge, experienced, in fact, on an emotional rather than cognitive basis. Moreover, many of the events narrated, as already emphasised, have very strong roots with the territories in which they are set, the landscape the places are not merely the context in which the actions take place, but almost protagonists, characters themselves, with great evocative and symbolic powers. The novel in the duality of attribution of the lake area and the cities of Milan and surroundings (Gorgonzola, Monza, and so on) attributes to the rural landscapes, in the first case, urban, in the second one, a moral value. That is, the journey through space becomes an existential metaphor shown in the physical world – following the classic model of the hero's journey (Vogler, 2010; Baricco, 2022) – but also, and above all, an inner journey of change and catharsis.

2. *The Betrothed Next*: experiencing a digital soundscape

The distinct temporal and spatial interpretations and the multiple symbolic meanings thus offer different perspectives and numerous interpretative possibilities, open to manifold cores or different reconfigurations of the macro-themes. It is in this richness of possibilities that the project the *Betrothed next*, here introduced as a case study, is a possible pilot approach to communicate and experience both the temporal line as an interpretative key to the Lombardy-Milan area and as a gateway to discover present but not visible aspects of this evolution (see Fig. 2 and Fig. 3).



Fig. 2. Urban evolution of Milan through historical cartography: a) 17th century; b) 19th century; c) 21st century.

Developed in three phases – a *geo-based urban augmented narrative* (2011-15, see Bollini, De Palma & Nota, 2013), the *time-machine georeferenced on historical cartographies* (2015-18, see Bollini & Begotti, 2017) and in this last hypothesis the *multimodal and multi-sensorial emotional experience* (2018-20, see Bollini & Della Fazia, 2020) – the research has been translated in a mobile app aimed to discover the city of Milan according to an explorative and emotional perspective. Organised according to the three historical thresholds – the novel (17th century), the author (19th century) and the contemporary city – the pilot is aimed to emotionally activating people in interacting with the *Point-of-Interests* geolocated around the city at an emotional, visceral, and embodied level.



Fig. 3. Urban evolution of Milan through pictures of Porta Nuova area: a) Representation of Porta Nuova in 1630 depicted by F. Gonin in 1840 b) Photograph (Author unknown, c. 1850); c) photograph of Piazzale Clotilde (2018).

To explore these possibilities two approaches were adopted: one theoretical, oriented to the interface language and interactions and behavioral patterns, the other design-related aimed to explore the multimodal aspects of site-specific communication with a focus on the acoustic and sound component – both at a perception as well as at a synesthetic level – of the experience.

In the first case, the starting point was Mitchell Whitelaw's study on the digitisation of cultural heritage, partially influenced by the work of Ahlberg and Shneiderman (1994) about interface design, information visualization and the "visual information seeking", i.e. the visual exploration of digital collections: "overview first, zoom and filter, then details-on-demand". He, then, develops the original notion of *generous interfaces* as an innovative alternative to more traditional ways of search or retrieve information: "Decades of digitisation have made a wealth of digital cultural material available online. Yet search – the dominant interface of these collections – is unable to represent this abundance. Search is ungenerous: it withholds information and requires interrogation." Conversely "generous interfaces are not a neat implementation but a productive wrangling of digital materials, formal abstractions and conceptual concerns, as the following sections aim to show". According to his perspective, this design approach provides an alternative: "rich, navigable interfaces that reveal the breadth and complexity of digital heritage collections" (Whitelaw, 2015). Although not directly mentioned in his definition – which is very much oriented towards the iconic-bidimensional space of Graphical User Interfaces – a further possibility of enriching the experience of access, exploration and fruition is offered by the extension of communication channels or registers, including spatial, proxemics, haptics, and acoustics, in addition to the visual, according to a multimodal interpretation of the project. Two aspects have been then investigated in the pilot project as potential drivers: on the one hand, the construction of urban identity through the *soundscape* and specific *sound-marks* – here declined in a historical perspective – on the other hand, the *holophonic* recording or the so-called *three-dimensional* sound. In 1969 by the psychologist Michael Southworth introduces the concept of *soundscape* while experimentally exploring the relationship between acoustic and visual perception in the built environment according to people's perception. His study was conducted involving both blind as well as deaf people to understand and compare the different experience. It showed on the one hand the close relationship between the different factors of urban perception and the uniqueness role played by the acoustic landscape in terms of information and environmental knowledge. The concept acquires meaning in expressive and creative, rather than analytical terms, thanks to Canadian composer Raymond Murray Schafer (1969) to whom the definition of "soundscape" is attributed. Back to the 1970s he theorised it as everything that makes up the acoustic environment – natural and artificial resources – within a given spatial area. In describing the fundamental elements that make up a *soundscape* he lists three constitutive elements:

- The *Keynote sounds*. In musical terms, they are identified as the key of a piece, not always audible. In other words: "The character of the people

living there” in the translation of the acoustic characterisation of a place. They are created by nature (i.e., geography and climate) such as wind, water, forests, plains, birds, insects, animals. In many urban areas, traffic has become the keynote sound – or *biophony* following other interpretation– as well.

- The *Sound signals*. These are the foreground sounds, which are listened to consciously. For instance, alerts and warnings from devices, bells, whistles, horns, sirens, and so on, also called *antropophony* been noises mainly generated by the human’s presence and activities.
- The *Soundmark*. Inspired by the crisis and term *landmark*, a *soundmark* is a sound that is specific to an area, and, in some way, it defines the unique personality, not only acoustically, but also identifiably at an urban level.

Many artists and musicians have been experimenting with this sensorial dimension of the sonic expression – from Lee “Scratch” Perry who explored and recorded environmental whispers, to Brian Eno experimenting with ambient sounds of *non-lieux* such as airports – and recently a soundscape composition has been experimented as a form of electroacoustic music during the *World Soundscape Project* (WSP). The performed melody is characterised by the presence of recognisable sounds of environmental contexts, in order to evoke the listener’s associations, such as memories and imagination related to the proposed soundscape. These aspects were investigated within the research and explored in design terms. From a more conceptual and theoretical exploration from the point of view of languages, we then moved on to consider the possibilities offered by technology to orchestrate and produce, better design, soundmarks, sound environments and acoustic effects that, combined with the visual interface of the pilot and the geo-localised experience, would expand the emotional and experiential component of the users of *The Betrothed Next* application. In order to do this, *holophony* was considered as a way of constructing a spatialised ambient sound. *Holophony*, in fact, is a particular recording technique created in the 1980s by Hugo Zuccarelli, an Argentinian scientist and Umberto Maggi, an Italian musician with the intention to emulate the idea of holography at a sound level. This almost hypnotic effect cannot be perceived with headphones nor by the classical stereo arc, but “out of the mind”, almost in the exact spatial coordinates of recording, though. To overcome this limitation, an alternative acoustic recording approach was preferred, and, in the pilot, the binaural registration technique has adopted instead, i.e., a method of sound recording that uses two microphones, arranged with the intent to create a 3D, stereo, moving, directional sound sensation. A three-dimensional sound recording method optimised for listening through headphones, reproducing as faithfully as possible the acoustic perceptions of a listener located in the original environment of sound event, maintaining its 360° spherical directional characteristics. Because the holophonic effect can be defined only when the sound is recorded through a special microphone, in absence of more professional tools, each audio track has been developed through the emulation of this technique, thanks to the collaboration of a sound designer. Each the final audio is the

combination of several selected and mixed sounds, and to simulate the movement and 3D perception two different tools have been used: the *panning* and the *reverb*.

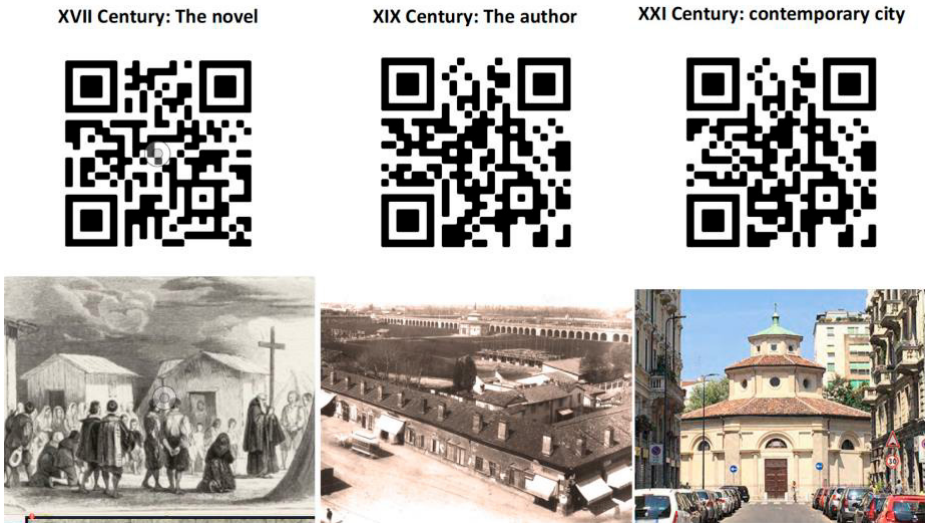


Fig. 4. Soundscape of the Lazzaretto area according to the three historical thresholds.

The project recreates three possible hypotheses of 3D sound-marks linked to one of the geolocalised points of interest – in this case the Lazzaretto the hospital originally active during the plague has been developed in the pilot – declined according to the three historical layers that can be experienced by the users thanks to a contextual/site-specific interaction. Thanks to holophonic sound that creates an embodied and directional flows, people have an immersive experience aimed at visceral activation in terms of emotional engagement as a privileged way of reflecting and decoding complexity of the place.

3. Testing to understand

Using a mock-up (see Fig. 4), the application has been tested and evaluated using qualitative research methods. In particular, user testing tasks/personas-based to evaluate the *efficacy*, *efficiency* and *satisfaction* of the experience according to a quick & dirty (Krug, 2009) and the *thinking-aloud* protocol were carried out. The participants were then involved in a final in dept narrative interview to understand and evaluate the emotional involvement elicited by the acoustic component of the interaction.



Fig. 5. Application mockup used in the testing activities.

The 15 experimental subjects have been selected among the three persona spectrums developed in the previous project's waves, i.e., Inhabitants, tourists, high school teachers, age 23–65-year-old, 9 women and 6 men. They have been requested to perform five tasks in situ assisted and recorded by a facilitator and a researcher. Two parameters have been considered: *efficiency*, time used to complete a task, and *efficacy*, the success rate [S], partially executed tasks [P] and failures, the thinking-aloud protocol was adopted during the testing sessions. Qualitative aspects have been investigated by means of narrative interviews to understand the overall *satisfaction*, comments, and feedbacks. Quantitative results have been then processed according to Polillo (2010) *average usability* [AU] formula $[S + (P/2)] / n$. executed tasks = AU. Experimental results were analysed and clustered in an attempt to formalise and model guidelines to be further developed. But above all to further understand and explore a transition from a vision and task-based conception of digital interactions in favour of a complex and ecosystem approach of multimodal directing in digital design and interactions. Among the most interesting aspects that emerged especially from the qualitative interviews were the insights into the emotional-experiential component experienced by testing the narrative voice accompaniment (based on VUI Voice User Interfaces principles) and the soundscape.

XVII Century: The novel
Fear, anxiety, suffering,
terror, discomfort

XIX Century: The author
Shop noises, train's whistle
in the distance,
animals, bell tower

XXI Century: contemporary city
Cars, road noise,
multi-ethnic music



Fig. 6. Narrative interviews highlights: tag clouds.

The more the sounds are related to a common experience part of everyday life, such as traffic noise and so on, the less people seem to be affected, by the acoustic channel (see Fig. 6): recurring and familiar anthrophony is not perceived in terms of message or attentional activation, but becomes a kind of background noise, a *white* noise that does not influence the subjects. The further we move back in time, the more dramatic the sounds are perceived to be in relation to, for example, the original function of a place. As in the case of the Lazaretto, which at the time of the novel was the hospital to which the sick were brought during the plague: the gloomy descriptions of the novel, which set here some of the most tragic moments of the narrative, are matched by images and sounds that are highly activating on a visceral level. The pragmatic descriptions of the contemporary historical threshold instead become powerful evocations of emotional moods and feelings that are increasingly abstract even in the terminology used, such as stress, anxiety, or fear.

4. Conclusions

However, this first experience conducted on a partial prototype of the application has made it possible to focus on some fundamental issues both in the specific project and more generally with respect to complex communication contexts. First and foremost, experimenting with different languages within an integrated multimodal ecosystem makes it possible to offer an experience that in making complexity accessible in this case, the stratigraphy of an urban organism interpreted from a historical perspective - but instead of simplifying it, seeks to restore the experiential richness in which the in which digital technologies – at low resolution, generally speaking – allow instead to

augment the experience. Secondly, the inclusion of an acoustico-spatial channel creates the conditions to make fruition accessible not only in cognitive and practical terms, but also in sensory ones. That is, it enables people and allows them to choose which mode to prefer according to the different contexts of use, as well as according to their specific characteristics and mental models. As mentioned the research represents a pilot project to be further explored, but nevertheless it represents a possible approach to an intentional creation of a soundscape, not only connected to the spontaneous ambient sounds, but intentionally conceived designed.

References

- Ahlberg, C., & Shneiderman, B. (1994). Visual information seeking: Tight coupling of dynamic query filters with starfield displays. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, 313-317.
- Baricco, A. (2022). *Le vie della narrazione*. Feltrinelli.
- Bollini, L., Palma, R. D., & Nota, R. (2013, June). Walking into the past: design mobile app for the geo-referred and the multimodal user experience in the context of cultural heritage. In *International Conference on Computational Science and Its Applications*, 481-492. Springer.
- Bollini, L., & Begotti, D. (2017). The time machine. cultural heritage and the geo-referenced storytelling of urban historical metamorphose. In *International Conference on Computational Science and Its Applications*, 239-251.
- Bollini, L., & Fazia, I. D. (2020). Situated Emotions. The Role of the Soundscape in a Geo-Based Multimodal Application in the Field of Cultural Heritage. In *International Conference on Computational Science and Its Applications*, 805-819.
- Kristeva, J. (1969). *Sēmeiōtikē; recherches pour une sémanalyse*. Éditions du Seuil.
- Krug, S. (2009). *Rocket Surgery Made Easy: The Do-It-Yourself Guide to Finding and Fixing Usability Problems*. New Riders.
- Mendelsund, P. (2014). *What We See When We Read*. Vintage.
- Norman, D. (2007). *Emotional Design: Why We Love (Or Hate) Everyday Things*. Basic Books.
- Polillo, R. (2010). Facile da usare. Apogeo.
- Schafer, R. M. (1969). *The new soundscape*. Don Mills: BMI Canada Limited.
- Southworth, M. (1969). The Sonic Environment of Cities. *Environment and Behavior*, 1 (1), 49-70. Retrieved from 10.1177/001391656900100104,
- Vogler, J. (2010). *Il viaggio dell'eroe. La struttura del mito ad uso di scrittori di narrativa e di cinema*. Audino.
- Whitelaw, M. (2015). Generous Interfaces for Digital Cultural Collections. *Digital Humanities Quarterly*, 9 (1). Retrieved from <http://www.digitalhumanities.org/dhq/vol/9/1/000205/000205.html>.
- Zangrandi, A. (2019). Manzoni, Nievo e il romanzo storico. *Accademia di Agricoltura, Scienze e Lettere di Verona*. CLXXXVIII, 97-112.

Writing connection.

How writing impacts on designing informative experiences

Chiara F. Albanesi¹

¹oblo.design, chiara@oblo.design

Abstract. This paper aims to explore the practice of writing within the design process, decoding its role and impact in shaping the informative experiences we create throughout a design project. An anthropological and ethnographic perspective on the design projects ecosystem, and participatory design dynamics, informed and inspired the classification here introduced. The proposed classification highlights essential meanings and values of the practice of writing. The purpose of this reflection is to raise awareness around writing as a design tool and, consequently the potential and the impact of its practice in influencing dynamics of conflict, collaboration, and engagement, and ultimately shaping the role of individual and collective authorships across the whole design process and in the design practice itself.

Keywords. Design Research / Participatory design / Writing / Auto-Ethnography / Informative Experiences

1. Introduction

The reflection developed in this paper has been kindled and inspired by the experience of the past ten years working as a design researcher in service design and participatory design projects.

The personal perspective of being part of a design community as a trained humanist without formal or structured training in design-related disciplines sparked a willingness and attentiveness to experiment across time with different solutions to make the collaboration not only possible but inclusive, effective, and enriching.

This study analyzes the informative environments we, as design professionals, create throughout our projects and focuses on writing as the skill and practice transversally adopted to make the design process accessible to projects' stakeholders and participants.

Regarding methodology, the following reflection and the proposed framework are the results of observations, auto-ethnography, and unstructured interviews conducted in recent years as a design researcher in oblo, a hyper-specialized service design studio, working on participatory design projects across multiple geographies and industries.

2. The role of ethnography and anthropology: a relational perspective on the practice of writing

Ethnography represents here not only the methodological references behind this study but also an alternative perspective on the practice of writing itself.

Applying an anthropological perspective on the practice of writing allows us to explore and analyze it as a relational practice, influencing and being influenced by dynamics of powers, negotiations, and definition that usually regulate the interactions within specific communities, here the social groups developed around a “project,” as a frame of reference. (Ladner, 2014)

This chapter aims to provide the theoretical references that guided the exploration of the proposed relational perspective on writing within the design process, starting with an analysis of ethnography itself as a practice and then introducing two concepts from anthropological studies.

2.1 Ethnography as an act of writing

Writing is an essential part of ethnographic studies. Ethnographers have been stressing and problematizing (Bear, 1995) in the past years the relevance of ethnography as a practice of writing about culture and, consequently, questioning the role and the positioning of the ethnographer themselves as writers.

This fundamental aspect seems to have been underestimated in the transition when ethnography became part of the human-centered design (HCD) toolkit (IDEO, 2015). HCD mainly values it as a technique to gather contextual, qualitative data related to people's behaviors and needs more effectively. It is employed to ease the process of empathizing with the people the project is addressing, considering the fieldwork, the activity of directly observing and interacting with the studied community, as the central aspect and focus while referring to it.

2.2 A perspective on writing processes: arenas

This study pursues re-balancing the focus, raising awareness on the act of writing while adopting ethnographic methodology and throughout the whole design process, can be possible by deconstructing and decoding this embodied (Bourdieu,) practice.

This process can be possible by applying an ethnographic perspective on the whole design process and, more precisely, by looking at the writing process within design projects as a *social event*, an *arena* (De Sardan), a concept introduced by anthropologist J.P. Olivier De Sardan, to describe the ecosystems of actors and stakeholders regulating and influencing processes and projects of change, development, and innovation.

De Sardan uses the metaphor of *arena* to identify the social field that originates from connections and relationships among the stakeholders of a specific project. These arenas are populated by heterogeneous actors, players, considered both as

individuals and strategic groups, all pursuing their interests and goals and contributing, at different levels, to the project's success.

While common sense tends to think of structured groups as cohesive and guided by the same cultural references and goals, O. De Sardan stresses here the role of conflict. Conflict is depicted as an intrinsic element of social life and a critical factor in influencing dynamics and outcomes in projects of change and innovation.

If we adopt and translate this vision to the context of design projects, we can see how they are indeed arenas characterized in the same way by dynamics of *conflicts and negotiations*, where different stakeholders apply strategies and tactics to pursue their interests. Writing could be deconstructed following the same criteria and parameters as a practice in this arena.

It emerges then as a way to define roles such as interviewers, participants, facilitators, processes, or structures, ultimately shaping and influencing the informative environments designers and project stakeholders use within the design process.

The following chapter introduces a developed analysis of the different meanings and approaches to writing within the design project arenas.

2.3 A perspective on words: commodities and lenses

Staying with this anthropological perspective on the design project, it is possible to take a closer look at writing, and, more in detail, how words are created, selected, translated, and exchanged across all the design activities.

In this sense, words can be treated in the same way as objects, goods, exchanged and traded within the projects and the design arena.

Considering them as *commodities* will allow us to extend to words and writing as the act of managing and dealing with them, the same vision and theories anthropologists, with material culture studies, have used to define the relationship between societies and objects, humans and things.

According to material culture studies, and here the reference is to the work of Professor Arjun Appadurai the theory he developed in the study *The Social life of things*, (Appadurai, 1988) by analyzing how societies, communities, use, consume, exchange specific goods, and how their usage and perception evolve, across time, geographies and social classes, we can learn about how those societies changes, and identify the dynamics that are influencing this change.

The proposed approach follows Appadurai's theory and considers words as commodities and artifacts that influence and drive relationships not only within the social group defined by the project but among the extended design community.

Biographies of things can make salient what might otherwise remain obscure. For example, in situations of culture contact, they can show what anthropologists have so often stressed: that what is significant about the adoption of alien objects - as of alien ideas - is not the fact that they are adopted, but the way they are culturally redefined and put to use (Appadurai, *The Social Life of Things*, p.67).

By following words' journey, from the moment they enter the project ecosystem as inputs to the moment they become part of the project's outputs, we can understand how their meaning and values changed depending on the moments, frameworks, and actors they have been managed by or relate to.

Analyzing the way words are chosen, adopted, used, and exchanged by the actors and stakeholders of the design process, we can use them as a lens through which we can analyze these dynamics of change and the factors and values influencing them.

The suggestion here is that by identifying the different values and meaning writing assumes across the design process and its activities, we can id

3. Proposed framework

The reflection here proposed moves from the theoretical references presented in the previous chapter to analyze the mutual impact between writing practice and design process and activities.

It explores informative experiences and frameworks, usually part of the design process, to understand what kind of role writing has in shaping them.

The main criteria taken into account in the analysis are the specific phases of the design process, with the double diamond phases as the main reference, classification, the type of stakeholders involved, and the scope of the activities in which the analyzed frameworks were applied.

The resulting categorization proposed here consists of four main approaches to writing:

- Writing to activate;
- Writing to understand;
- Writing to define;
- Writing to envision.

These four approach are clustered and mapped according to two main parameters related to the writing approach and style:

- *From fragmented to coherent*: referring to the style of writing, and the type of written artifact, from scattered elements to consistent and interconnected outputs.
- *From observation to fiction*: expressing how the intention behind writing changes, from merely reporting collected and observed data to complex and stylized elaboration.

3.1. Writing to activate

The first category refers to the activities and usage of writing aimed to *grant participation and inclusiveness* across the design process. In this sense, writing to activate includes all the artifacts and initiatives (e.g.: recruiting form, call to action, interviews, or questionnaire scripts) formulated to make collaborations and cross-pollination possible.

Adapting and shaping the linguistic register, deciding whether to use or not a specific term based on the audience, and the expected answers are strategies aimed at increasing the effectiveness of the initiatives and of the research itself, influencing the quality of the participation, and ultimately, of the data that would be collected.

Openness is a crucial value to pursue since the ultimate goal of these activities is to create the conditions for the hybridization of authorship across the whole project.

The chosen expressions should make people comfortable and at ease sharing their perspectives, valued in their decision to participate, and supported in understanding conditions of engagement and the goal they contribute to, without friction or suspicions.

Trust is the consequence of it and the ultimate goal of this writing practice, which sets the conditions for it to be created. Encouraging people to share their perspectives throughout the whole process, be it in structured sessions like interviews or workshops, or informal ones, like meetings or chats.



Fig. 1. Overview of the proposed framework.



Fig. 2. WFP Dalili, using emoji to facilitate a design sprint with Syrian refugee in Lebanon, 2017.

3.2 Writing to understand

Securing knowledge transfer and facilitating sense-making among the different stakeholders and team members is the common goal connecting the writing practices that fall under this category.

Writing here represents the delicate process of organizing, labeling, and connecting data and information that are still raw and scattered to make them easy to navigate and digest.

On the one hand, it is a matter of accessibility: making participants' perspectives and words accessible to everyone involved in the project. At the same time, protect their perspective, ensuring their opinions and words are not misunderstood or misdirected. The writing process becomes an act of establishing connections, where the structure we create to organize information and how we select them sets the basis for interpretation. It is a matter of turning external inputs, like collected perspectives and opinions, into information that becomes part of the project's community and, because of it, needs to be fully understood and embedded by team members and stakeholders.

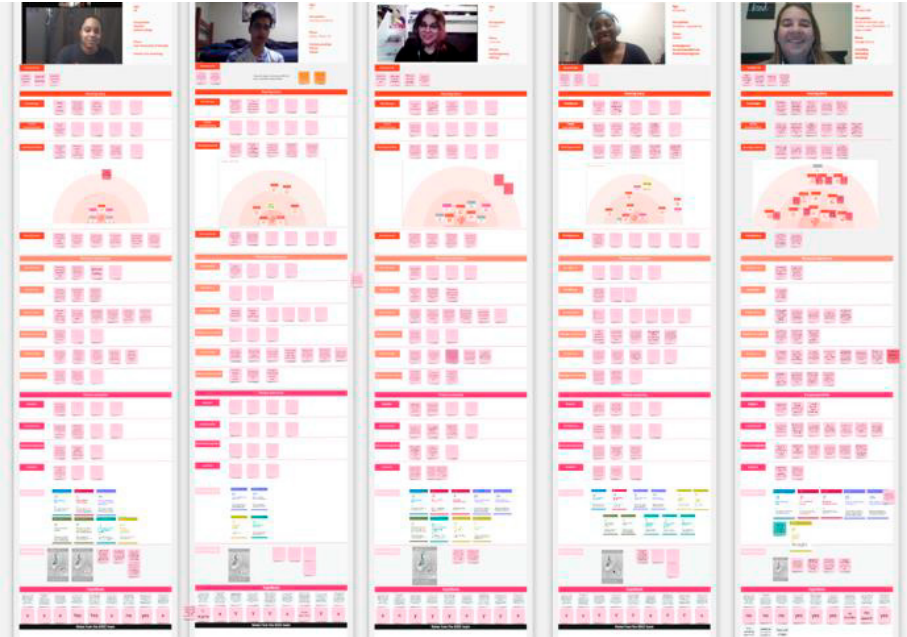


Fig. 3. Example of a research wall on miro where raw data from interview sessions are organized in order to make them accessible to all team and client stakeholders.

3.3 Writing to define

Writing to define refers to the practices aimed at crystallizing learning and establishing solid and shared perspectives.

This is the phase among the four introduced where the writing process becomes more prescriptive, and its role and value are in the operability of the written output.

The way we describe a problem, indicate an opportunity, decide how to collectively refer to a goal, an issue, or future steps in the process, delineate a perimeter of action for the following design phases, and impact decision-making.

A definition carries with it acts of separation and selection. The challenging aspect in designating written outputs lies in making emerging needs, requirements, conflicts, and perspectives converge into a unique expression without sacrificing individualities. Clarity becomes essential, resulting from the verbal ability to synthesize the emerging tensions so that the framing results are compelling, accepted, and recognized without friction.

3.4 Writing to envision

The last category of the proposed framework is the one where writing assumes its most rhetorical value. We refer here to composition techniques that influence and inspire decision-making outputs designed to stimulate the creation of a shared vision across stakeholders.

On one side, It is a matter of turning a concept, a vision, into something more tangible and easier to grasp, to be told and communicated.

Memorability is vital when crafting terms and definitions, supported by rhetorical devices such as metaphors, to make concepts, ideas, and solutions more straightforward to compare and remember.

Polishing words to inspire and engage project stakeholders is not just a matter of facilitating engagement and capturing attention through them.

The final act of editing here represents the creation of a new, shared language, able to bring people closer and strengthen their sense of appropriation and belonging. It is the moment where the language we shape contributes to bringing forth a new culture within the project community/ecosystem.

We are doing a final act of translation, turning the initial inputs provided by single actors or strategic groups (De Sardan), initially connected by a project goal statement, into a choral and cohesive output.

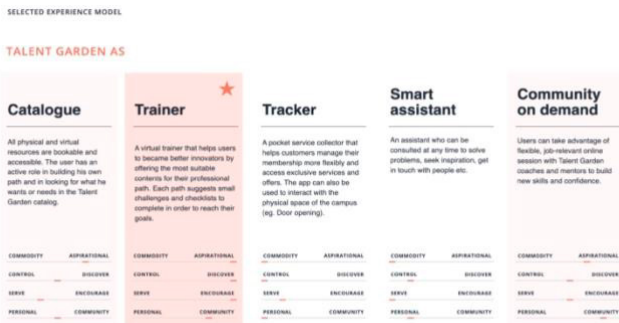


Fig. 4. Talent Garden Coworking Experience - Examples of usage of metaphors to express difference between a set of possible experience models for a digital service.

4. Conclusions

Writing has been considered throughout this reflection as key to deepening knowledge and consciousness about how we deal with complexities and information. The proposed classification aims to support a more conscious approach to designing informative experiences by unraveling the role that words and writing have in shaping

the tool, methods, and frameworks we have adopted and developed to deal with complexity.

The perspective here is that by increasing the level of awareness toward the writing practice, it would be possible to deal more consciously with the dynamics of conflicts, power, negotiation, and inclusion that the writing practice itself reinforces or obstructs.

Deconstructing these types of relationships and connections could help us deal more intentionally with the kind of authorship, whether collective or individual, the informative experience we create encourages or weakens and helps us uncover and manage the dynamics that, positively or negatively, drive contribution, decision making, and power.

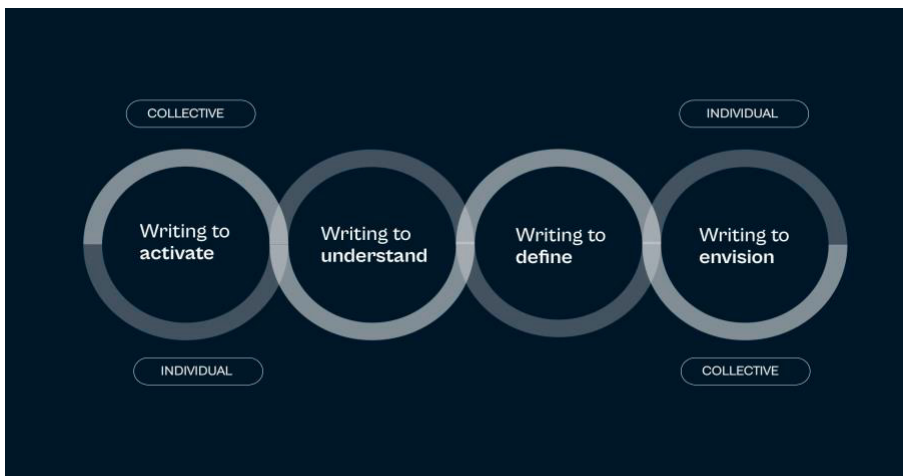


Fig. 5. Overview of the proposed classification, underlying how authorships evolve across different moments and approaches to writing practice.

References

- Appadurai, A. (Ed.) (1988). *The social life of things*. Cambridge University Press.
- Bear, R. (1996). *Women Writing Culture*, University of California Press.
- Leijten, M., Van Waes, L., Schriver, K., & Hayes, J. R. (2014). Writing in the workplace: Constructing documents using multiple digital sources. *Journal of Writing Research IDEO*. Retrieved from <https://www.designkit.org/>.
- De Sardan, J-P. O. (2005). *Anthropology and Development, Understanding Contemporary Social Change*. Bloomsbury Publishing.
- Ladner, S. (2014). *Practical Ethnography, A Guide to Doing Ethnography in the Private Sector*, Routledge, UK
- Michael J. Metts & Andy Welfle (2020) *Writing is designing*. Rosenfeld Media.
- Matera, V. (2015). *La scrittura etnografica*. Eleuthera.
- Rogers, R. (2013). *Digital Methods*. Cambridge University Press.

Communicating complexity and the Cloud-Cockoo-Land. Addressing functions of imaginaries in science communication

Andreas Metzner-Szigeth¹ (0000-0001-9100-4231)

¹Free University of Bozen-Bolzano, andreas.metzner-szigeth@unibz.it

Abstract. Tables, graphics and IMAGES – e.g. representations of small but complex macro-molecules in ‘gestalt’ of the Watson-Crick Double Helix or of even more immaterial objects like bits and bytes sliding down a curtain of strings as green drops – play an important role in SCIENCE COMMUNICATION. This applies to processes of communication between sciences and the public as well as to those between or within scientific disciplines. The function of IMAGINARIES as associative complexes is to simultaneously shape and limit our understanding of scientific findings. The idea of gene expression within the relationship of DNA and entire organisms is an example here. Another is that of data mining with regard to the retrieval of information from networks of signal transmission. IMAGINATION, finally, points to personal and collective resources that enable creative minds to figure out how to recognize unknown phenomena or such not yet conceived nor determined in distinct structures. Albert Einstein who wrote about a dream in which he was riding on top of a sun beam during the time he was struggling to elaborate his theory of relativity, is an example here. How can we detect and observe the generative dynamics unfolding within the interplay of images, imaginaries and imagination in science communication? What are suitable ways of analyzing and understanding its patterns and movements? Which kind of opportunities do we have to make good use from our insights? Taking up these issues my contribution will be trefold: First, there will be presented an overview about structure and contents of an anthology that I am publishing as responsible editor with Casa Editrice Leo S. Olschki, Florence. Second, there will be introduced essential parts of my paper about Exploring the Interplay of Images, Imaginaries and Imagination in Science Communication that represents the lead chapter of the book, outlining an approach. Third, there will be discussed how the Interplay of Images, Imaginaries and Imagination in Science Communication can refer, resonate and enrich COmmunicating Complexity as the core topic of the conference.

Keywords. Creative minds / Generative dynamics / Science-society interplay

1. Launching the boat

If you ever make the experience of launching a new acquired boat, you will remember the words that I will share with you now. The words, spontaneously evoking an

imaginary, are a verbal expression of the mixture of doubt and hope that was flashing through my mind in this critical moment: “Will it sink or sail?”. This said, we are already ‘in medias res’, since the Latin standard phrase for initialising lectures (or writings) includes an interchange of currency: between ‘the things’ we are ‘in midst of’ and the matters they signify.

Be it simplifying of complex issues or simplifying of complex thoughts: Normally we neglect to pay attention to the fact that the act of simplifying is quite more than reducing or structuring complexity. Since it cannot be done by applying some algorithm, we have reason to assume that we, ourselves, are the ‘creative minds’ with the ability to do so. Well, then let’s be proud to be humans, not machines, also while assimilating the following piece of text. At first glance it may seem to offer nothing else than a demonstration. A demonstration of the exhausting but joyful business of juggling around objects, respectively topics. But you are invited to have a closer look and make up your mind whether this technique might be offering great advantages, also for the purpose of explaining complicated correlations and their dynamics. This task will be ‘exercised’ (by the way noted, a rather German term, actually more worthy of a philosopher than of a military) using the example of science communication. Even its sober circumference is full of ‘generative dynamics’, full of allegorical imaginaries and suggestive narratives, enriching and mobilizing the ‘science-society interplay’.

2. Publishing about – zand with – ‘Scientia atque Usus’

Initially, the anthology I will present you now was intended to publish the proceedings of two sessions – focusing on inter – and transdisciplinary contributions – of the homonymous open panel “On the Interplay of Images, Imaginaries and Imagination in Science Communication” within the International Conference on “Locating and Timing Matters: Significance and Agency of STS in Emerging Worlds” jointly organized by the European Association for Science and Technology Studies (EASST) and the Society for Social Studies of Sciences (4S), in Prague, Czech Republic, from August 18-21, 2020.¹ Nevertheless, the book was from the beginning planned to include several further invited papers to make it a round, more complete thing, also because of its links to the ongoing research project on “Studying, Portraying and ASSessing examples of good scientific practice in interdisciplinary work – An explorative study about collaborations of sciences and humanities with particular reference to contributions of design and arts” (SPASS)². Then it turned out that inviting other contributions was

¹ The conference was an online convention due to the Coronavirus pandemic. Please look at <<https://www.easst4s2020prague.org/>> for the program, abstracts and the structure of our panel.

² For a quick overview, cf. SPASS – Studying, Portraying and Assessing, in Gamper, Johann; et al. (eds.) Research Report 2019, Bozen-Bolzano (Free University of Bozen-Bolzano) 2020, p. 58, <https://issuu.com/unibz/docs/unibz_research_report_2019>.

easier than expected and finally they became more significant, also since original panel presentations had not been delivered as finalized papers.

Organizing the long process and editing the anthology became a satisfying experience as much as it succeeded in providing a volume for a particular series published by Casa Editrice Leo S. Olschki S.R.L. in Florence, Italy. 'Scientia atque Usus'-series is characterized by an innovative approach toward publishing original work in the area of science with and for society³.

The book will be available soon with the following bibliographic data: Metzner-Szigeth, A. (Ed.) (2022a). *On the Interplay of Images, Imaginaries and Imagination in Science Communication*. Florence: Leo S. Olschki Publishers (Scientia atque Usus, vol. 3), (in print). All 28 contributions of the anthology are either already inter-disciplinary, trans-disciplinary or cross-professional or if they follow more disciplinary methodologies, are at least striving to include more general concepts. Regarding the system of academic disciplines, the selection of text contributions covers an extensive range. It covers topics, approaches and knowledge claims from social sciences and humanities, as well as from natural sciences and engineering, and even from medicine, design and the arts.

3. Exploring interplaying imaginaries and realms

Some kind of imagined component seems to be essential for processes of cognition, communication and consciousness (Mitchell 2013). Taking this into account, we are confronted with the task to address this virtual moment right from the beginning of our considerations. Therefore, a coherent determination of the different meanings we want to attribute to the terms 'images', 'imaginaries' and 'imagination' is required.

- 'Images' are items outside of the human brain. They share the quality of being able to stimulate or even to animate their visual perception as particular parts. Thereby they are emphasized from and hauled out of the context of the entire visual field of the beholder⁴. Viewed from the

³ Please look at <<https://en.olschki.it/catalogo/collana/saus>> for further details about intention, structure and content.

⁴ Additionally it should be noted that with images which are intentionally created as images (e.g. drawings by an artist or graphics by a designer) this essential effect may be strongly supported by using framings. Framings, nonetheless, are much more than those wooden structures, typically in a gold or silver colour, which all paintings we look at in museums or art galleries are surrounded with. The term 'framings' refers to a general model introduced by Erving Goffman (1986). It quickly became a core concept of symbolic interactionism, prominently represented by G. H. Mead. Originally coined to describe meanings, interpretations and definitions of situations shared by actors or contested among them (not to speak of the observers that may have the same pre-understandings as the actors or rather other ones for defining a situation) 'framings' became a widely used concept, particularly in sociology and social psychology, cultural studies and media and communication research

perspective of the individual human subject they are something brought in. Images flow from the outer world into the inner world of consciousness when they are perceived and recognized.

- 'Imaginarities' are items inside of the human brain. Their common feature is the requirement of a memory from where they emerge and are noticed with our 'inner eyes'⁵. They are (viewed from the perspective of the individual human subject) something brought out. Imaginarities are fed into the outer world when expressed while communicating with others.
- 'Imaginations' are better to apprehend as processes instead of items. Their decisive feature is a stronger link to the movement of our consciousness when constructing something in our mind than to the resulting products: new ideas, contents or relations between phenomena. Instead of simply adding things together as with other cognitive functions imaginations can do more. They have the power to create novelties and to bring something completely new into the world by recombining elements that formerly were not connected or even seemed to have nothing in common.

So, let's try to find some suitable examples:

- 'Images': Identifying a figure, an object or a scene at first glance seems to be a difficult task when looking at a 'Wimmelbild'⁶ (a sort of hidden picture puzzle). This format is characterized by full-spread drawings, sometimes across gatefold pages, depicting scenes of humans, animals, and objects in excessive detail. Apart from their recent career in children's books as an invitation to train the ability of identifying and discovering details, this particular format was originally invented and

(Dillon 2014). The approach of constructivism, in all its varieties, profits a lot from adopting 'framings' as an analytic and explanatory concept.

⁵ Since the 'inner eye' is a quite common expression, frequently used in everyday conversation as well as in scientific discourse, we often forget to critically reflect on its metaphorical character. Metaphors have the advantage of being intuitively understandable and trying to grasp the nature of a more unknown or unclear phenomenon in comparison to more known or obvious phenomenon. The 'inner eye' uses that mechanism to designate a phenomenon that shares some aspects with visual perception by comparing it with the performance of the proper eye as a sensory organ. Nevertheless, you could also talk about an 'inner cinema' or make use of other metaphors or speak vaguely about 'inner perception'. But the phenomenon has particular aspects of its own, first and foremost referring to the fact that the visual impression that we 'see' with our 'inner eyes' is generated by the brain and not perceived by any other sensory organ, and therefore needs to be taken as something more than a derived form of a well-known sense (compare Butler 2013, who treats this topic, especially in her chapter about 'Poking Out the Inner Eye', pp. 16-40).

⁶ If needed, simply refer to Wikipedia <<https://de.wikipedia.org/wiki/Wimmelbild>> to get an idea about this term.

realized in paintings by Hieronymus Bosch and Pieter Brueghel the Elder. The point here is: the outer world (natural and/or artificial) we perceive is always very complex, full of elements which we either distinguish easily or with varying degrees of difficulty. The evolutionary answer to that overwhelming complexity was by no means to develop sensory mechanisms for ‘reducing complexity’ by a certain algorithm, but ‘Gestalt’-perception that allows to structure complexity into a meaningful order. Against this background, images can be understood as artifacts that – from the very first cave art in the Paleolithic until today’s multitude of forms and techniques – are intentionally produced in correspondence to our ability to identify meaningful particular sections in the entire field of our perception.

- ‘Imaginaries’: What kind of object is a ‘Cloud-Cuckoo Land’⁷? Clearly, when painted, it is an image. When talked about, it is a story. When built, it is a structural model. But how to describe its original form, its ‘proto’-existence? It is a mental construction that includes visual impressions and interpretative features, that shows the ability to pass from one mind into other minds, and that is constantly open towards variations in form, content and shape. This openness towards variations is characteristic for imaginaries, since they are not only psychic phenomena dependent on conscious and/or subconscious processes, that is dependent on a state of mind in which they are refurbished. As such they are also social phenomena, appearing in society as soon as they are expressed in oral, written or visual communication.
- ‘Imaginations’: For an example we can refer to Umberto Eco here. In his famous book *The Name of the Rose* (1995, p. 201) he has his narrator, Adso of Melk (the Benedictine novice accompanying William of Baskerville, the Franciscan monk) explain how a surprising novelty (here: a ‘golden mountain’) is born by creatively relating two common, but distinct ideas (here: a ‘mountain’ and ‘gold’) by simply expressing the following insight: “This, in fact, is the power of the imagination, which, combining the memory of gold with that of the mountain, can compose the idea of a golden mountain”.

3.1 About epistemic and poietic functions

Let us continue with the flow of our considerations regarding Umberto Eco, the famous Italian novelist and well-known professor of linguistics, who reflected deeply on boundaries between science and non-science, literature, art, hermetic respectively esoteric knowledge, journalism and further practices. According to him “there is

⁷ Here again, if you need further explanation regarding this term, please refer to Wikipedia <https://en.wikipedia.org/wiki/Cloud_cuckoo_land>.

something artistic in a scientific discovery and there is something scientific in that which the naïve call ‘brilliant intuitions of the artist’” (Eco 1990, p. 159).

Now, with Eco’s great insight about the ‘brilliant intuition’ in mind, we are ready to conclude, at least preliminary, our exploration asking for the epistemic functions of ‘images’, ‘imaginaries’ and ‘imagination’. According to Zittoun et al. (2021, p. 1) ‘imagination’ may be defined “as the process by which we temporarily leave the here-and-now of current experiences, to explore and play with the past, the future, and alternative spheres of experience”.

But beyond the ‘epistemic’ functions there is need to also address the ‘poietic’ functions. If I would be asked to put my insight associated with these functions into a concise written statement I would present the following thesis: Imagination has a somewhat intrinsic power to transcend the virtuality of the imagined towards its realization. However, systematically I would prefer to introduce these creative and productive functions together with Zittoun et al. (2021, p. 2) while representing the following twofold thesis:

- imagination plays a core role in the realization of individual and societal development;
- imagination contributes essentially to the construction of individual and collective realities.

The cultural dynamics of imagination (in its connection with imaginaries and images) unfolds in some strange dynamics involving phenomena dealt with by individual and social psychology as well as by micro- and macro-sociological approaches towards social change that are centered in actors and/or institutions. Frequently, imagination was (and still is) a victim of a misunderstanding. It seems to depict something unreal, dealing with the impossible, and therefore being concerned with illusions only. Consequently, according to Zittoun et al. (2021, p. 4) this term became often qualified as infantile, escapist, unproductive and primitive, if not even associated with regressive states and mental disorders. Then again, there is a strong tendency of modern societies to ‘prize imagination as an attribute of the creative individual’ as Sheila Jasanoff (2015, 5f.) puts it in *Future Imperfect: Science, Technology, and the Imaginations of Modernity*. Imagination, favorably understood, is “the faculty that allows the extraordinary person to see beyond the limits of constraining reality and to make or do things that are out of the ordinary” (ibid.).

Indeed, making the impossible possible is a challenging task, because the inertia of the status quo needs to be overcome in our own consciousness, in dealing with our contemporary fellow humans, and in the reality we are living in. Doing so, requires reconfiguring the boundary between the domain of the possible and the domain of the impossible through imagination. In this context Zittoun et al. (2021, p. 4) point out that most social movements and political revolutions “began with an impossible idea, and then, as the imagination became shared, the plausibility increased, the impossible became possible and, sometimes, even actual (e.g., the welfare state)”. Consequently,

transformations of the boundary between that what is believed to be impossible and that what is acknowledged to be possible can – if a critical mass of believers of novel opportunities is transgressed – really alter the existing state of affairs (ibid.).

But let's come back to the just presented quote of Sheila Jasanoff to finish this thread. Subsequently she states: "We rightly celebrate the seer, the visionary, the transformative political thinker. But imagination also operates at an intersubjective level, uniting members of a social community in shared perceptions of futures that should or should not be realized" (Jasanoff 2015, p. 5f.).

Finally, in search of a systematic approach needed for unlocking this complex of ideas and matter, and needed also for the modes and ways to set them in motion, transforming them into manifesting futures, I would like to refer to the concept of 'co-production'. It comprises a two-way dynamic model based on the premise that "the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it" (Jasanoff 2004, 2f.). Framed like this, we can recognize that scientific knowledge is crucial since it offers a double standard: "It both, embeds and is embedded in social practices, identities, norms, conventions, discourses, instruments and institutions – in short, in all the building blocks of what we term the social" (ibid.). Similarly crucial is technology, our human-built material environment, that also embeds and is embedded in social practice thereby opening up for lasting transformational processes, as described (among others) by Theodore Schatzki (2019) in *Social Change in a Material World*.

3.2 Science communication, practice and society

According to an insight expressed by a famous quote ascribed to Isaac Newton, all scientists are like 'dwarfs standing on the shoulders of giants', and, being there, 'they can see farther than these themselves'.⁸ The narrative, as illustrated in the following graphics, is in itself an example for the great power of imaginaries in science communication. Furthermore, narrative and imaginary give us an idea about an essential characteristic of scientific practice in its intertwinement with science communication.

⁸ Please refer to Robert K. Merton's *On the shoulders of giants: a Shandean postscript* (1998, originally published in 1965) for the putative authors of this quote, the origins of this parable, and some discursive exploration of its meanings and implications in and for the scientific community.



Fig. 1. Illustration of the aphorism of dwarfs on the shoulder of giants (from an medieval encyclopedic manuscript containing medical and allegorical paintings, provided by the Library of Congress, Washington, DC, LCCN permalink <<https://lccn.loc.gov/50041709>>) [place here: Riesen-118x300.jpg].

Scientific progress is a cumulative, recursive and iterative process of building-up on the achievements of forgoing generations while generating novel scientific knowledge. Along with this description focusing on the importance of interactive work for collective achievements some colleagues view even the aforementioned figure of the 'giant' not so much as a metaphorical expression for the overarching importance of famous scientists, like e.g. Galileo, Newton, Darwin or Einstein. Instead, they suggest to interpret even the 'giant' as a figure composed by a number of dwarfs (as in the case of Thomas Hobbes's *Leviathan*),⁹ thereby appreciating all the work done by less famous contributors.

⁹ See Bredekamp (2020) for details and context of this visual metaphor.

Science communication is an integral part of scientific practice.¹⁰ Following this line of argumentation I would like to focus (y)our attention now on one point only, namely the interplay between images, imaginaries and imagination, its forms, functions and consequences. Moreover, this point is discussed only with regard to its importance for the dynamics of science communication. However, science communication is understood in its broadest sense here. That is, including processes of communication between scientists of one and the same scientific discipline as well as between representatives of different scientific communities, even if they are very distant to one another. Prime examples for the latter are communications passing the gap between sciences and humanities or, according to the concept introduced by C.P. Snow in 1959 bridging *The Two Cultures* (1998). Consequently, science communication is not at all introduced in the limited but publicly predominantly understood sense of communicative processes between scientists and citizens only, respectively between sciences and the general public.

A common, quite simple assumption about the relationship between experts and citizens characterizing the field of science communication – whilst structuring the relationship between science and the public – is that the existence of some cascade or slope between the people who acquired the knowledge (by studying and researching) and others, that need to be informed about consequences they should know about. This ‘model of the knowledgeable and the ignorant’, as I would put it, is a quite persistent ‘imaginary’ – despite its lack of evidence. Additionally, it is often recognized that the peculiarities of the academic jargon and even more, the ‘Chinese-like’ strangeness of disciplinary languages constitutes the most important factor preventing successful science communication.

According to this communicating becomes ‘imagined’ and ‘realized’ as ‘transporting’ contents or as ‘mediating’ information. The metaphor and allegory of this ‘imaginary’ is parcels filled with content (scientific knowledge) by scientists – eventually supported by specialized professional science communicators taking care of an attractive packaging. The parcels are then consigned to citizens who receive their content like parcels with consumer goods sent by Amazon or eBay and delivered by UPS or DHL.

In order to move forward in our considerations about the interplay of images, imaginaries and imagination in science communication we should now clarify the meaning of the term ‘interplay’. An interplay between several (or at least two) components indicates much more than elements having a relationship or elements being embedded in a state of interdependency or similar ideas following the common definition of interplay as signifying and designating ‘the way in which two or more things have an effect on each other’. The term ‘interplay’ also goes beyond a more dynamical understanding of elements that interfere or even interact with one another, whereby these elements are mutually influenced or even reshaped.

¹⁰ For some reinforcement of this thesis compare Latour (1986). He identifies graphs and images as decisive components of scientific practice and his study about Visualization and Cognition – Thinking with Eyes and Hands substantiates this thesis with many examples.

Why? Well, the term transcends the dual scheme of static versus dynamic framings. It has an active role. ‘Interplaying elements’ are partners that stimulate each other to have joy and to thrive. They perform a kind of shared activity – like children (or adults) playing together, inventing games that allow them to regulate how to interact with one another by creating unprecedented novel patterns of reciprocal ‘behavior’, respectively social inter-‘action’ (as in 1938 anthropologically described by Johan Huizinga in *Homo Ludens*).

Consequently, – as for the epistemic function of the interplay – we can ascertain that leisure-time and playfulness may open channels that allow us to receive inspirations we would miss otherwise. Scientific practice, without this enrichment, would be quite a boring experience lacking the ability to creatively perform and to generate inspired outcomes. With concern to the mediating function of the interplay we can assume that the success of science communication will remain rather limited as long as images, imaginaries and imagination are merely used as visual tools for improving the transport of scientific content to the public. Instead, acknowledging non-scientists as equally enabled partners in the game is the condition ‘sine-qua-non’ for enjoying and exploiting all possibilities opening up when really genuinely interplaying.¹¹

4. Connecting with communicating complexity

The interplay of images, imaginaries and imagination is meaningful and makes sense. Taking into account its mediating, epistemic and poietic functions we have enough reason to conclude that its results are of utmost importance for the interplay of science and society thereby generating outcomes with an impact on perspective, performance and pace as components of the ‘autopoiesis’ of modern societies.¹²

¹¹ The discursive dynamics of the ‘Anthropocene’ – since its proposition as concept two decades ago (Steffen et al. 2011; Ellis 2018) – is an example par excellence in this context. The power of its ‘imaginary’ has stimulated a wide range of intense debates in diverse sectors and contexts, inter-disciplinary, trans-disciplinary, inter-sectorial and in the general public. Donna Haraway’s *Staying with the Trouble Making Kin in the Chthulucene* (2016) is only one prominent example here. All this debate, manifesting a veritable ‘snowball effect’, is supporting processes of science-related awareness-raising about the state and future of our planet as well as controversial discussions about its pros and cons. Questions like, whether the phrase ‘Anthropocene imaginary’ should be understood as a revelation of its ideological content or as a disclosure of its critical implications, were and are consequently encouraging these debates even more.

¹² At this point I decided to re-employ the expression and concept of ‘autopoiesis’ as introduced by Humberto Maturana and Francisco Varela (1980), also considering strengths and weaknesses of its use in the systems theory of Niklas Luhmann (1995). This is done in a thoughtful way, as described in my essays on *Constructions of Environmental Issues in Scientific and Public Discourse* (Metzner 1998) and *Contradictory Approaches? – On Realism and Constructivism in the Social Sciences Research on Risk, Technology and the Environment* (Metzner-Szigeth 2009).

Admittedly, the ensemble of its mediating, epistemic and poietic function – taken for itself – is not sufficient to explain the intensity and reach of human cognition of the world in relation to our capacities to shape the conditions we live in by creating outcomes of all kind: insights, ideas, inventions, objects, mechanisms, procedures, installations and systems. However, the interplay is an essential phenomenon of our abilities to gain insights, collect knowledge and progressively build on them while forming a necessary - and may be even a decisive - part of our abilities to do so and implement these abilities in different modes and forms of practice (Schatzki 2019; Hui et al. 2017; Shove et al. 2012).

The performance and outcome of the interplay is visible and vital in and for individual processes as well as in and for the operations of the compound system of academic disciplines itself. Furthermore, they are also important for the whole of society since perceiving and using the stimuli and forces of the interplay is not limited to members of the academia, the so-called ‘scientific community’. Economic and political functions are affected among others, since the acceptance (or rejection) of proposals to follow certain investment strategies or developmental paths are strategic decisions which are not only highly dependent on scientific knowledge and the modes and ways of mediating this knowledge to decision-makers in all sectors of social life: They are – above all – dependent on the professional capacities of all humans working in this fields and on their trained aptitude to make constructive use of the interplay in their own particular practice.

Any exploration of completely unknown or not sufficiently known territories needs to be extended in all directions. Similarly, while exploring the interplay of images, imaginaries and imagination in science communication, we can conclude that there is a need to expand our examination into a wide range of fields: philosophy, sociology, neurobiology and psychology, literature and cultural science, anthropology, and last – but not least – design and art.

5. Looking ahead

Coming back to my introductory story about the moment of launching a boat allows me to spin the read thread a little further. Once everything is done, there arises the question: “Which course should be set?” Besides of enjoying my new hobby I would like to invite colleagues and friends to do some exiting work. Don’t worry, not on board, or even worse, at the shipyard. What I have in mind is to explore the interplay of images, imaginaries and imagination with the purpose to reveal its generative dynamics in four fields: 1.) organizational cultures and leadership styles, 2.) futures studies and scenario techniques, 3.) digital communication and virtual reality, and 4.) sustainability science and transition perspectives (please refer to Metzner-Szigeth 2022b, and get in touch with me if you are interested).

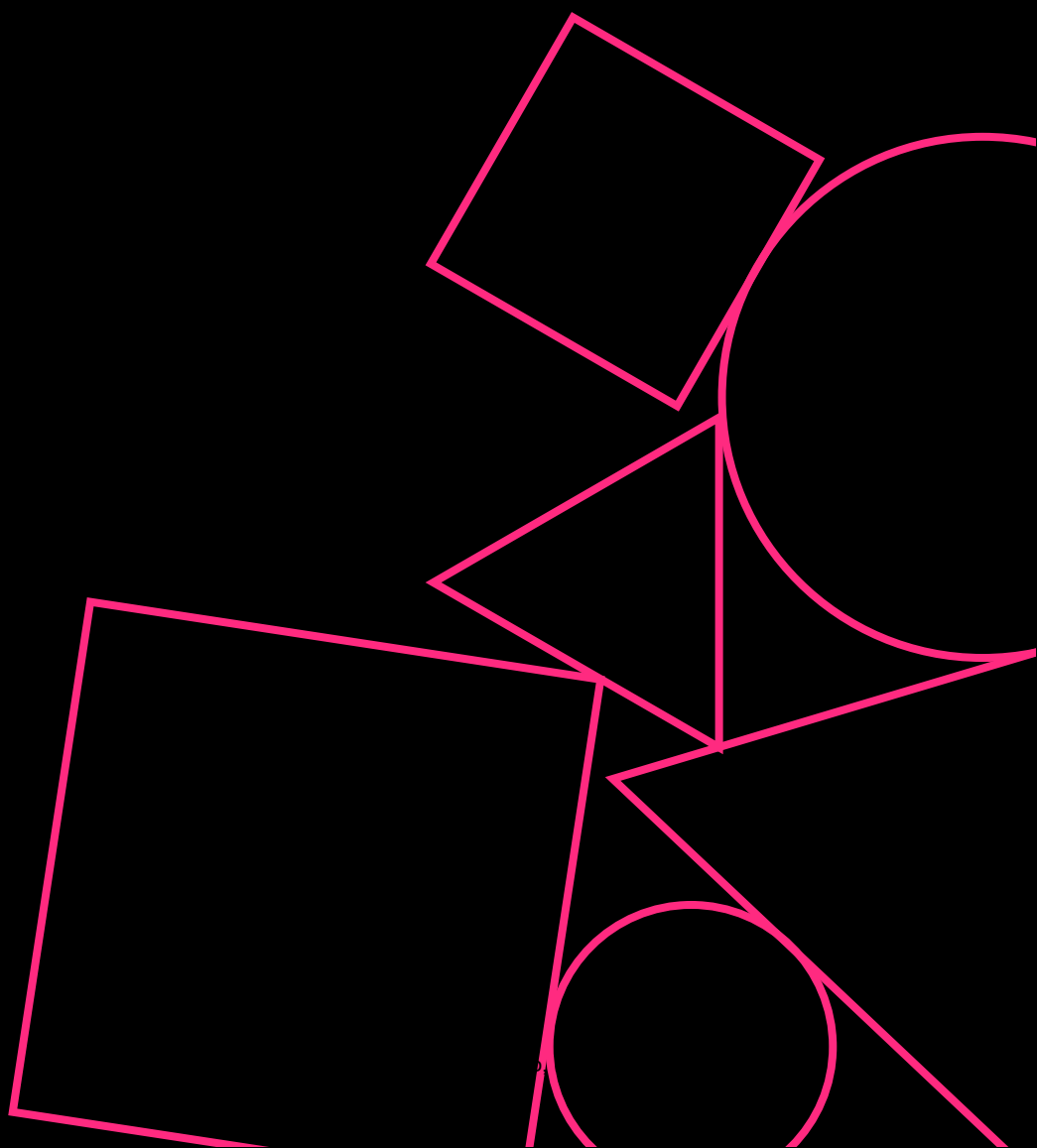
References

- Bredenkamp, H. (2020). *Leviathan: Body politic as visual strategy in the work of Thomas Hobbes*. De Gruyter.
- Butler, J. (2013). Poking Out the Inner Eye - Rethinking Introspection. In Butler, J., *A Pluralist Approach to the First-Person Perspective*, 16-40. Palgrave Macmillan. Retrieved from 10.10.1057/9781137280381_3.
- Dillon, M. (2014). *Introduction to Sociological Theory: Theorists, Concepts, and Their Applicability in the Twenty-First Century*. Wiley (particularly chapter 8, Symbolic Interactionism, 273-299).
- Eco, U. (1990). *The Limits of Interpretation*. Indiana University Press [I limiti dell'interpretazione. Bompiani, 1990].
- Eco, U. (1995). *The Name of the Rose*. Houghton Mifflin Harcourt.
- Ellis, E. C. (2018). *Anthropocene: A Very Short Introduction*. Oxford University Press. Retrieved from 10.1093/actrade/9780198792987.001.0001.
- Goffman, E. (1986). *Frame Analysis - An Essay on the Organization of Experience*. Northwestern University Press.
- Haraway, D. J. (2016). *Staying with the Trouble - Making Kin in the Chthulucene*. Duke University Press.
- Hui, A., Schatzki, T., Shove, E. (Eds.) (2017). *The nexus of practices: Connections, constellations, practitioners*. Routledge.
- Huizinga, J. (2014). *Homo Ludens: A Study of the Play-Element in Culture*. Beacon Press (1st ed. in Dutch, 1938).
- Jasanoff, S. (2015). Future Imperfect: Science, Technology, and the Imaginations of Modernity. In Jasanoff, S., and Kim, S.-H.(Eds.), *Dreamscapes of Modernity – Sociotechnical Imaginaries and the Fabrication of Power*. University of Chicago Press, 1-33. Retrieved from 10.7208/chicago/9780226276663.003.0001.
- Jasanoff, S. (2004). *States of Knowledge: The Co-Production of Science and Social Order*. Routledge.
- Latour, B. (1986). Visualization and Cognition - Thinking with Eyes and Hands. *Knowledge and Society*, 6, 1-40.
- Luhmann, N. (1995). *Social Systems*. Stanford University Press, 1995 (1st ed. in German 1984).
- Maturana, H. R., Varela, F. (1980). *Autopoiesis and Cognition - The Realization of the Living*. Springer. Retrieved from 10.1007/978-94-009-8947-4.
- Merton, R. K. (1998). *On the shoulders of giants: a Shandean postscript*. University of Chicago Press (1st ed. 1965).
- Metzner-Szigeth, A. (1998). *Constructions of Environmental Issues in Scientific and Public Discourse*. In Müller, F., and Leupelt M. (Eds.), *Eco Targets, Goal Functions and Orientors*. Springer, 171-192.
- Metzner-Szigeth, A. (2009). Contradictory Approaches? – On Realism and Constructivism in the Social Sciences Research on Risk, Technology and the Environment. *Futures - The Journal of Policy, Planning and Futures Studies*, 41(2), 156-170. Retrieved from 10.1016/j.futures.2008.09.017
- Metzner-Szigeth, A. (Ed.) (2022a). *On the Interplay of Images, Imaginaries and Imagination in Science Communication*. Leo S. Olschki Publishers (Scientia atque Usus, vol. 3), (in print).
- Metzner-Szigeth, A. (2022b). Studying the Role of Visual Imaginary in Science Communication - Introduction to the Volume. In A. Metzner-Szigeth (Ed.), *On the Interplay of Images, Imaginaries and Imagination in Science Communication*. Leo S. Olschki Publishers (Scientia atque Usus), (in print), chapter 01.

- Mitchell, R. W. (2013). The Comparative Study of Imagination. In M. Taylor (Ed.), *The Oxford Handbook of the Development of Imagination*, 468-486. Oxford University Press, (citation pages according to printout from Oxford Handbooks Online as 1-32). Retrieved from 10.1093/oxfordhb/9780195395761.013.0030.
- Schatzki, T. (2019). *Social Change in a Material World*. Routledge.
- Shove, E., Pantzar, M., Watson, M. (2012). *The dynamics of social practice: Everyday life and how it changes*. Sage.
- Snow, C. P. (1998). *The Two Cultures*. Cambridge University Press (original edition 1959).
- Steffen, W., Grinevald, J., Crutzen, P., McNeill, J. (2011). The Anthropocene – Conceptual and Historical Perspectives. *Philosophical Transactions of the Royal Society A*, 369(13), 842-867.
- Zittoun, T., Hawlina, H., Gillespie, A. (2021), Imagination, in V.P. Glăveanu (Ed.), *The Palgrave Encyclopedia of the Possible*. Palgrave Macmillan. Retrieved from 10.1007/978-3-319-98390-5_68-1.



2. Junior track



Service Blueprint System.

A collaborative tool for process visualization

Jacopo Sironi¹

¹oblo.design, jacopo@oblo.design

Abstract. Service blueprint is a model for visualising complex processes and systems involved in the delivery of a service. It is a versatile tool to support different stages of analysis, design and implementation of a service, but is limited in readability and visual synthesis. The aim of Service Blueprint System project is to provide designers and other experts involved in the design activities the methodological and graphical tools to build and use service blueprints to support their work. In particular, SBS consists of a guide and a design system, which enable designers to build, share and collaborate on the definition of a service more effectively, thanks to the service blueprint. The goal is to drive users in the development of visualisations, guiding them in their design choices at each stage of the mapping activity, from the definition of objectives to the final delivery. The guide consists of a series of design queries, associated with examples and possible solutions. The queries are divided into stages and cover aspects of strategy, visualisation and interaction with the service blueprint. The design system makes it possible to generate dynamic views from a basic visualisation, adapting the quality and granularity of the information to the needs of the stakeholders involved or the objectives of the activity in progress.

Keywords. Information design / Service visualization / Service blueprint / Design system / Participatory design

1. Introduction

A process is a sequence of actions, performed in order to reach a goal. An example of a process could be the act of connecting a device to a wifi network. It consists of three tasks: find the network from the device, fill the password and connect.

Every step of this simple process is made possible by systems or collateral sub-processes like the functioning of the router, the payments to internet provider, eccetera. Each of these micro-processes is assigned to a single operator or stakeholder that is responsible for a specific goal (for instance that the router is installed correctly). Moreover every operation completed affects the following ones and the related touchpoints.

This example highlights that what can be experienced as an easy interaction from the perspective of the user hides several layers of additional processes. Potentially the

representation and understanding of all these layers can involve a high level of complexity that is extremely onerous to manage.

1.1 Visualization as a tool to make processes tangible

Services are by definition immaterial products: they can't be owned or exchanged, so the design practice recurs to devices that make services tangible¹. In this sense all the forms of representations: storyboards, customer journeys, system maps, eccetera are gimmicks to define the service at different levels.

In some cases none of the people involved has a clear understanding of how the whole system works, so the map becomes essential to merge the knowledge of the experts in the team. In this way the map is a collector of information and a representation of the entire process, a common ground for everyone to discuss and start building with a "collaborative practice" (McColl-Kennedy et al. in Holmlid, 2018).

Visualisation is also a tool for the designer to spot fail points, communicate new implementations, define streams of work and facilitate the operations on the process in general.

2. The service blueprint

Service blueprint is the most efficient visual model to share the functioning of a service. This is because its structure displays information about the "relationships between different service components [...] that are directly tied to touchpoints in a specific customer journey" (S. Gibbons, 2017).

A feature that makes it an ideal tool for collaboration is its visual layout. The actors are listed in a series of layers, showing a specific flow of operations with relative duration, touchpoints and order. Lastly, the blueprint is a modular system and can support various types of information and granularity, depending on the context and needs.

2.1 Objectives: to analyze a system and to co-design a strategy

Service blueprint has two main aims: to analyse the system and to design the implementation of a strategy. These goals can be reached in collaborative environments supported by maps and visualisation.

To analyse means to detail operational flows for each actor or department, understanding how they affect the final experience and where are bottlenecks or opportunities of innovation. This can be easily done defining the proper granularity and phases and collecting information to fill the blocks from the people involved.

¹ P. Kotler (1987): 'A service is any act or performance that one party can offer to another that is essentially intangible and does not result in ownership of anything.'

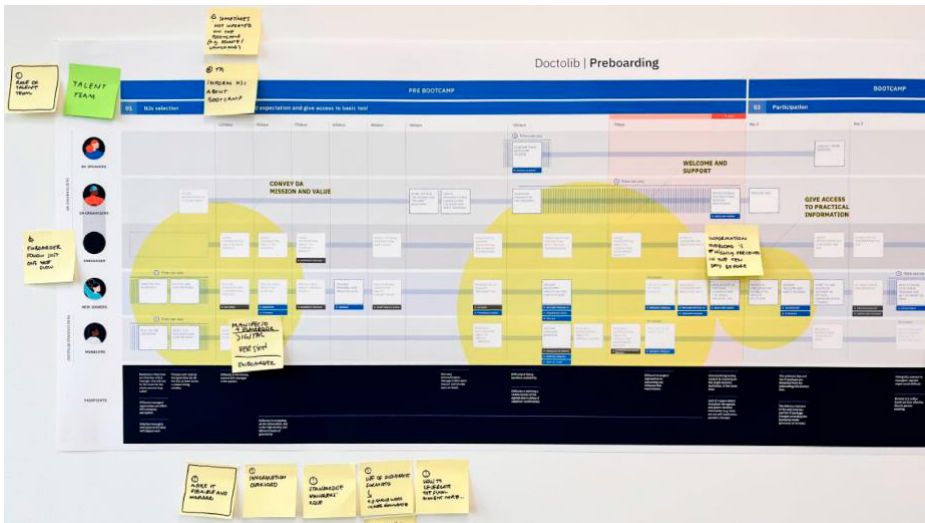


Fig. 1. Oblo, Doctolib Preboarding, blueprint used in a co-design session to analyse a process of onboarding, 2021.

In this context it is appropriate to add reference for further documentation, comments and notes for evaluation on the blueprint.

To design implementation means to highlight the tasks every actor or department needs to perform in order to execute a concept or a strategy. To do this is convenient to start at a high-level, listing macro-objectives, responsibilities and expected duration; then create an additional more detailed version including success metrics and further instructions.

2.2 The focus of visualization

Starting from the assumption that maps are intended as representation of shared knowledge, in most of the cases it is impossible they can fit all the complexity of information in a single view. Every project phase, activity or team requires a specific focus to work on and the layout of the visualisation needs to be adapted. Furthermore it's essential that every stakeholder involved can work on a version of the map that highlights the most relevant aspects for their interest. For example, a manager could be more focused on an overview of the process, while a developer could focus on a granular view that shows every single interaction between the user and the system. So, to meet the requirements of each activity, the blueprint needs to be adjusted in different versions, prioritizing the most relevant information for the contextual scope and for the interests of people involved.

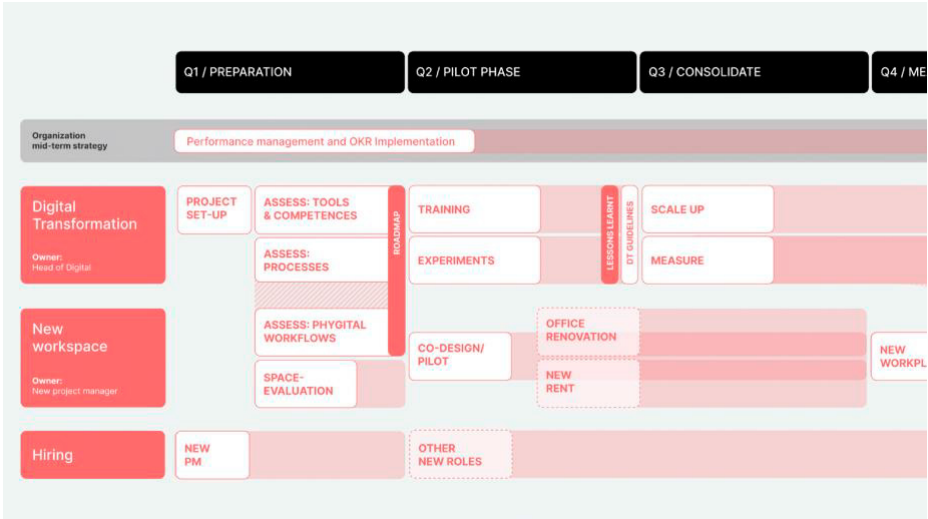


Fig. 2. Oblo, MSF Roadmap, a blueprint illustrating the strategy for the digital transformation of an NGO - overview, 2022.

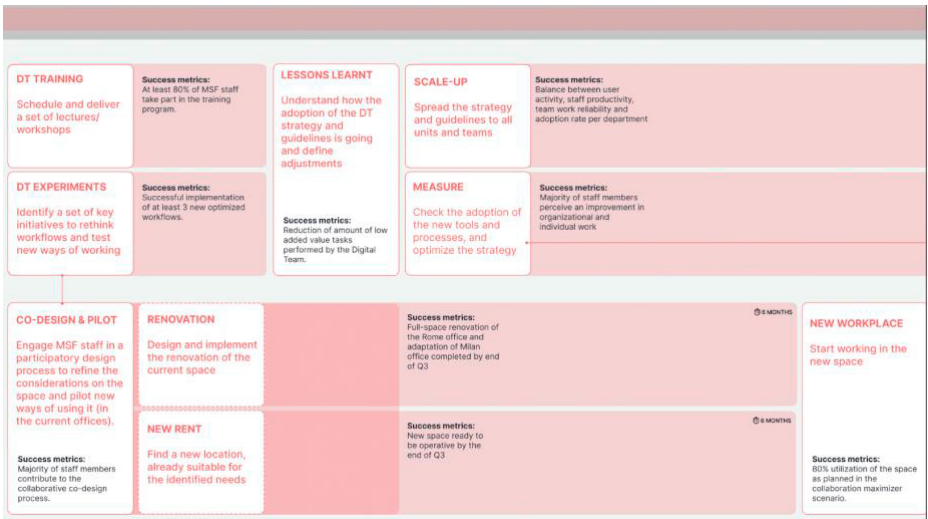


Fig. 3. Oblo, MSF Roadmap, a blueprint illustrating the strategy for the digital transformation of an NGO - high detail view, 2022.

3. Blueprints as dynamic layouts

In this sense service blueprint is not a fixed template that needs to be filled, but a system of perspectives that show different sides of the service on “a clear picture of what is happening at every level” (B. Summarsono, 2020). In order to reflect these levels on the visualisation the designer is required to consider three dimensions: time, granularity and hierarchy.

1. Time refers to the span of the flow of actions visualised and defines the horizontal extension of visualisation. It can mark the process by months, weeks or single moments.
2. Granularity is the level of detail and the amount of information every block contains. An action can be described with a single keyword or with a deep explanation with text, hyperlinks and technical documentation.
3. Hierarchy is the vertical order of actor’s swimlanes. The level on top, that normally is reserved to the user’s swimlane, affects the connections in the layers below and has a primary role in the visualisation.

The digital tools for visualisation like Figma² have unlocked the opportunity to generate these maps with a systemic approach. Instead of creating a single version and printing it on a big scale, the features of Figma: “variable components”³ and “prototype”⁴ allow one to choose the correct visual module among different variants and interact with the visualisation shifting dimensions (time, granularity, hierarchy) to the desired perspective.

3.1 Service Blueprint System

In this context has been developed the project *Service Blueprint System*⁵: a system of resources providing designers and non-experts, visual assets and a workflow to build service blueprints.

Service Blueprint System combines two tools: a methodology for the workflow and a design system for the visualisation.

The methodology is a series of design queries to drive the visualisation process through all the project phases and suggest possible solutions. This outcome has been adopted to stress the idea that the blueprint is not a template but the result of a series of design choices, from the support of the map (print, digital board, interactive interface) to the level of information displayed.

² <https://www.figma.com/>

³ <https://help.figma.com/hc/en-us/articles/360056440594-Create-and-use-variants>

⁴ <https://www.figma.com/prototyping/>

⁵ <https://www.serviceblueprintsystem.com>



Fig. 4. SBS design system, visual blocks for timeline, actors, touchpoints, and actions, 2021 (Property of the author).

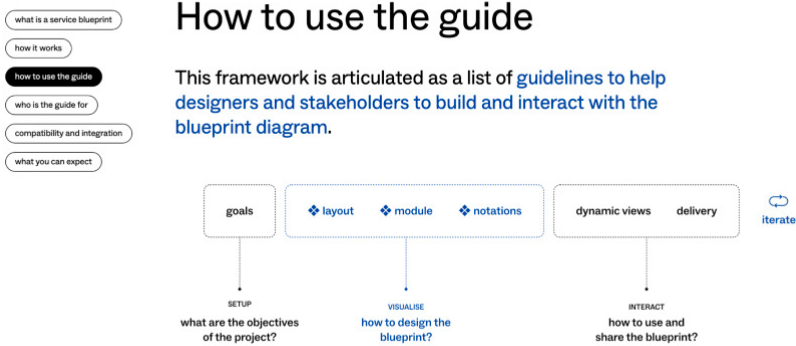


Fig. 5. SBS guide, introduction and conceptual structure of the framework, 2021 (Property of the author).

The design system⁶ includes all the essential assets to visualise processes (timeline, blocks for actions, customer journey, labels for touchpoints, eccetera) in different variants, to adapt on various levels of granularity. The benefits of the design system is the speed of the workflow and the modular approach to visualisation.

⁶ <https://www.serviceblueprintsystem.com/resources/resources>

4. Final takeaways

This tool and the research that has been made lead to new opportunities of development. A relevant issue discovered is the great requirement of resources (in terms of time and effort) needed to map a process in detail. To simplify the work on the map it is convenient to use libraries of assets or layouts that can be reused.

Another area for innovation is the interaction with a map in digital environments. The current approach is to navigate static visualisations, but a dynamic interaction that adapts the level of information automatically could improve the legibility and highlight relevant information.

Lastly is needed a tool to combine ease of use, in order to involve non-experts and visualisation capabilities.

References

- Bitner, M. J., Ostrom, A. L., & Morgan, F. N. (2008). Service Blueprinting: A Practical Technique for Service Innovation", in *California Management Review*, 50.
- Canella, A. (2021). The Map Trap, published on *Medium*. Retrieved from <https://medium.com/service-design-in/the-map-trap-17776b1904f2>.
- Gibbons, S. (2017). *Service Blueprints: Definition*. Retrieved from Nielsen Norman Group at <https://www.nngroup.com/articles/service-blueprints-definition/>.
- Kalbach, J. (2021). *Mapping experiences: a complete guide to customer alignment through journeys, blueprints, and diagrams*. O'Reilly.
- Kotler, P. (2018), *Marketing management*. Pearson.
- Shostack, G. L. (1982). How to Design a Service in *European Journal of Marketing*, 16.
- Shostack, G. L. (1987). Service Positioning through Structural Change in *Journal of Marketing*, 51. Sage Publications.
- Stickdorn, M., & Schneider J. (2011). *This Is Service Design Thinking: Basics, Tools, Cases*. O'Reilly.
- Sumarsono, B. (2020). *The power of visualizing process* published on *UX Planet*: Retrieved from <https://uxplanet.org/the-power-of-visualizing-process-8f7c7f7a91be>.
- Tassi, R. (2019). *#Service designer: un progettista alle prese con sistemi complessi*. FrancoAngeli.
- Wreiner T. et al. (2009). Exploring Service Blueprints for Multiple Actors: A Case Study of Car Parking Services in *First Nordic Conference on Service Design and Service Innovation*.

Behave.

Mapping the commitment of higher education towards the sustainable development goals

Sofia Cretaio¹ (0000-0002-0934-3136)

¹Polytechnic University of Turin, sofia.cretaio@polito.it

Abstract. University campuses are wide and complex entities in which flows of people, activities, and spaces continuously interconnect, defining the campus' identity and giving life to scenarios in continuous transformation. Every tangible and intangible element of this system of relations contributes to the social, environmental, and economic impacts of the campus and its surroundings. In such a complex context, where different actors engage at different levels, it is crucial to understand how universities are approaching and contributing to the achievement of the Sustainable Development Goals (SDGs). These goals should be seen as an opportunity and not as a drag; hence the need to develop a visualization tool to map the campus' sustainability and the community's perception of it. A mapping approach could support the identification of gaps, the discovery and enhancement of already existing good practices, and the interpretation of new paths, for a more effective contribution to the 2030 Agenda.

Keywords. Higher Education / Data Visualization / Interactive platform / SDGs

1. Introduction

In 2015 the United Nations introduced the *Sustainable Development Goals* (SDGs), 17 universal points created to improve the current cultural, economic, and social system. Even if the SDGs propose a universal language, globally valid, it is necessary to visualize how to achieve these objectives, what actions need to be taken and the effects they will have.

Among all the actors who are called to take part in the SDGs mission, Higher Education Institutions are one of the most important. University campuses are not only containers of knowledge: they are social microcosms that promote community engagement, and relationships with external stakeholders, with a strong impact on the social, productive, and economic world. Being able to map — with a data-driven approach — how the contribution to the SDGs occurs daily is the aim of a design concept, born within the activities of the co-funded project *Change the Climate* by the Erasmus + Program of the European Union, which goal is to improve the contribution of Latin American universities through the integration of strategies for more sustainable education.

2. Data-driven design for a sustainable approach

The actions of social, geographical, and economic environments can be translated into a huge amount of quanti-qualitative data, useful to read the trends of the current society. Without a context, data itself would not have any meaning: the environment — considered as natural, industrial, or individual — can be seen as the circumstance of visual artifacts regarding for instance climate, healthcare, energy production and consumption (Stabellini et al., 2017). Representing this type of data can be an opportunity to discover and interpret everyday behaviors inside an individual's life but also inside organizations. Data visualization is therefore a useful medium to support human perceptions, remember information and recognize patterns (Dur, 2014). In addition, data language — made up of dots, lines, and graphs — is universal and readable by a broader range of users.

3. Higher Education and the commitment to the SDGs

Sustainability topics in universities were introduced around twenty years ago, but only recently campuses have started to realize how necessary it is to radically change their knowledge and communication systems on these topics (Poza et al., 2021).

The role of universities as nodes of global networks able to spread stronger values is among the reasons why sustainability can be a turning point to raise their social mission, together with the students, as representatives of a community in which is fundamental to adopt more innovative behaviors (Sonetti et al., 2020). In this context, SDGs act as a support to integrate sustainable development, but only if efficiently managed: in the actual state of the art, SDGs are often used as a branding tool to promote the 'green' identity of the university, or they are managed as a separate entity from the study plans, under the shape of workshops or extracurricular activities.

4. Mapping sustainable behaviors

Among the many tools that are gradually becoming a prerequisite for private and public organizations to communicate sustainable approaches, there is the practice of Sustainability Reporting (SR), a document that collects information about the values, mission, and performances carried out by the author for a transparent disclosure. It's a yearly report, static or dynamic, made of texts, photos, maps, graphs or tables where future objectives and strategies can also be presented inside.

In the context of University SR, most of the examples are static resources with an unbalanced use of visual representations: in the *2019 Sustainability Report* by the Polytechnic of Turin, data visualization is at the core of the structure, allowing users to visually understand the commitment towards teaching, research, and third mission [Fig. 1]. In other cases, the output of the report is mainly textual, and the use of data

Behave. Mapping the commitment of higher education

visualization is reduced to few bar charts and category numbers (e.g., the *Gloucestershire Sustainability Report 2020-2021*).

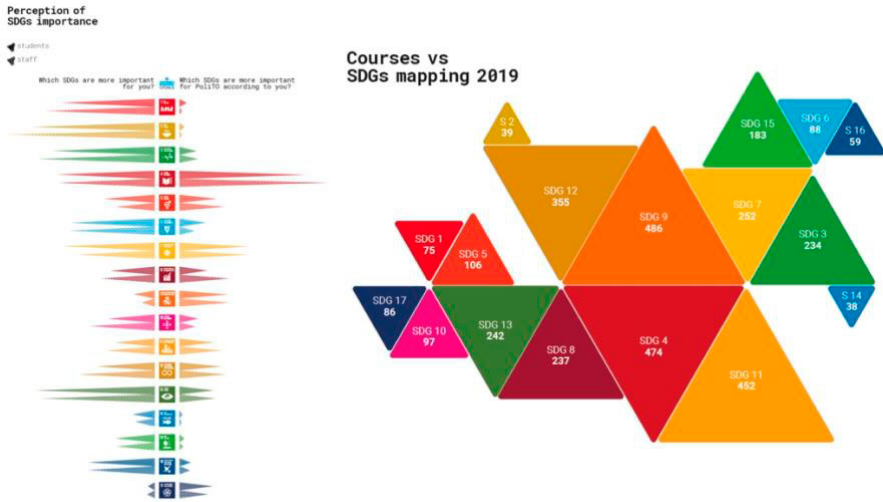


Fig. 1. Polytechnic University of Turin, 2019 Sustainability Report, examples of visual representations (campus-sostenibile.polito.it).

Examples of more data-viz oriented SR can be found in dynamic web tools and dashboards. The latter offered cues of further investigation thanks to the UNDP document *SDG Dashboard: The role of information tools in the implementation of the 2030 Agenda* (2017) which makes a distinction between Information and Development Dashboard: the former is a visual display of important information into a single screen, to be briefly monitored; the latter addresses a broader set of issues which require whole-of-government coordination with a broader set of institutions and stakeholders.

The different approaches and gaps that emerged from the state of the art allowed to settle the boundaries for the development of a tool focused on reaching a *Performing Analysis* of university campuses: information should be displayed to monitor and track their impact and enable public scrutiny from partners and other stakeholders [Fig. 2]. This approach requires the use of technical and scientific language to inform the reader and activate a comparing process. Furthermore, the use of a digital interface allows more user interactivity, by giving the possibility to carry out new actions and introducing unexpected perspectives on the use of content (Mauri & Ciuccarelli, 2014).

5. Behaving through data

The state of the art and the identification of the general guidelines assessed the base for the development of the platform Behave: a digital interface designed to allow universities to explore data and compare them according to different parameters. Particular attention was given to the explorative process that goes beyond the SDGs classification; being halfway through the process of achieving the 17 SDGs — scheduled to last until 2030 — it is fundamental to design actions and good practices that are not strictly bound to them. A long-term vision requires thinking of alternative representations, that can coexist with the actual scenario and potentially impact future visions. With this consideration, a double-reading layer was created: each SDG and its targets has been analyzed, identifying seven areas where campuses' sustainable commitment could impact their achievement [Fig. 3 – on the left]. The contribution to these areas comes from the action taken by the campuses that can be identified into 14 content categories. These can be then enclosed in six macro-topics that summarize the campus field of action [Fig. 3 – on the right] and that will represent This classification helps in the creation of a *functional* interface, able to show the information clearly. Starting from the homepage, users become aware of what the platform has to offer, discover the joining campuses, and directly reach their pages, to *explore* the data [Fig. 4]. This is the main section of the tool, where all the data can be visualized, compared, and analyzed [Fig. 5] with a process of data aggregation that follows a 'subtractive' approach (Ciuccarelli & Ricci, 2009): users can see all the data but have the possibility to filter them according to entities, perspectives, or additional filters.

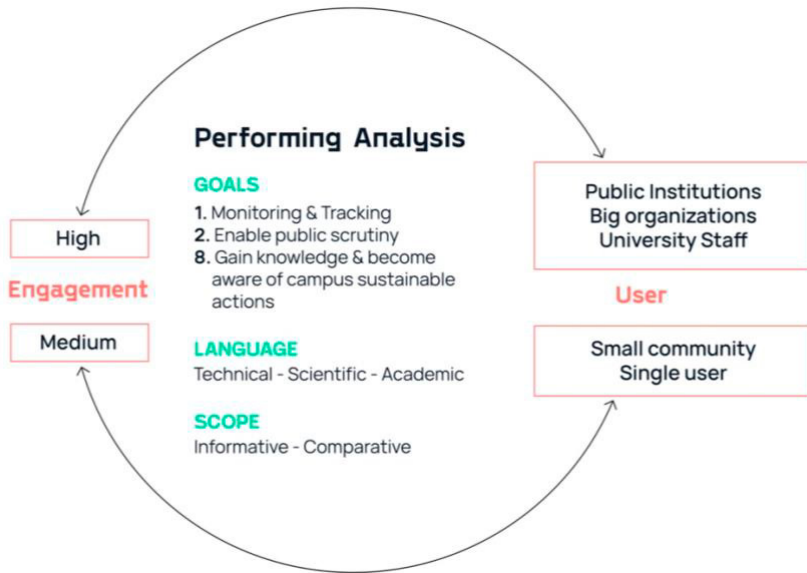


Fig. 2. Tool development: guidelines.

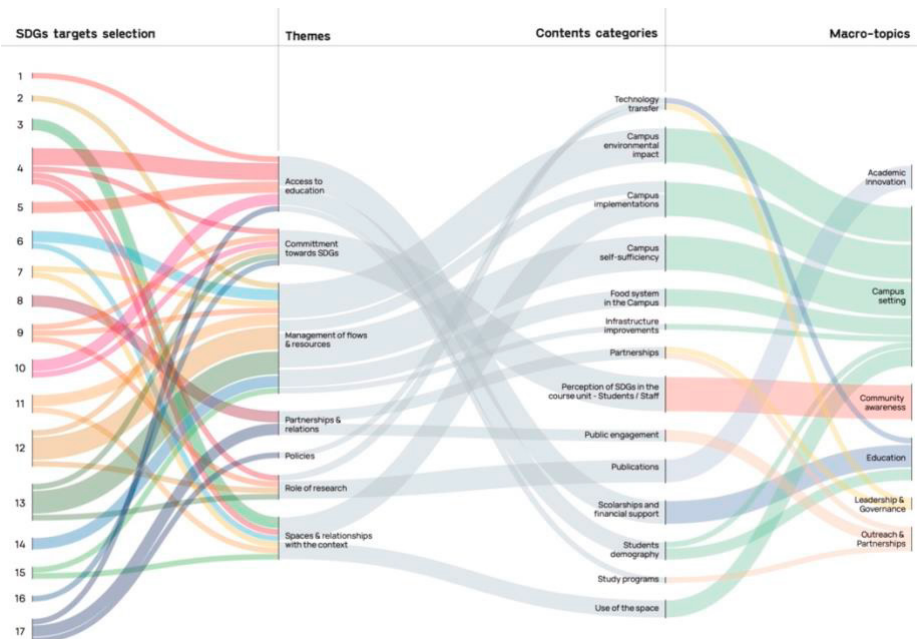


Fig. 3. From SDGs to specific contents: explorative process behind the tool.

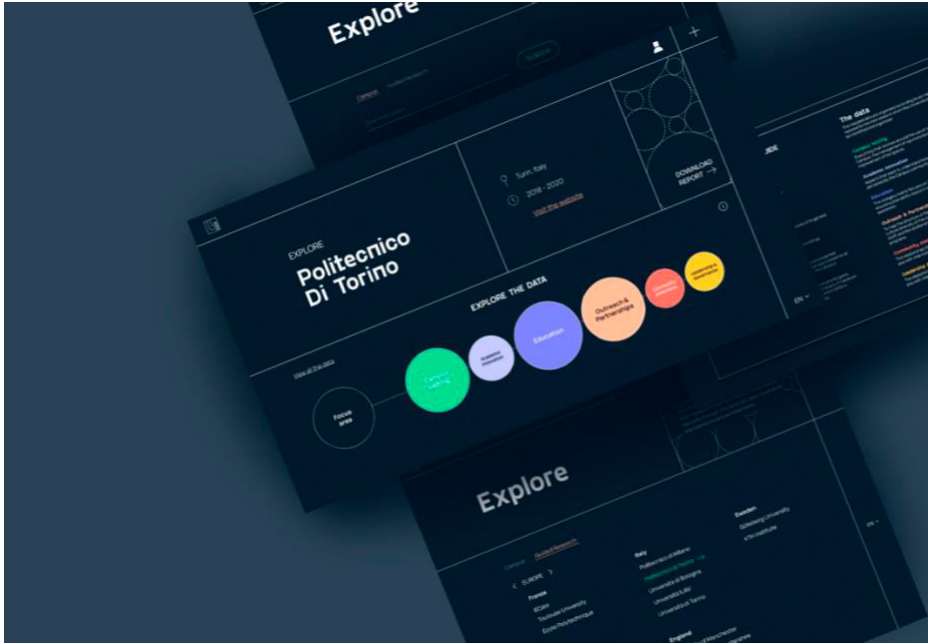


Fig. 4. Behave platform. Explore section, campus overview and general information.

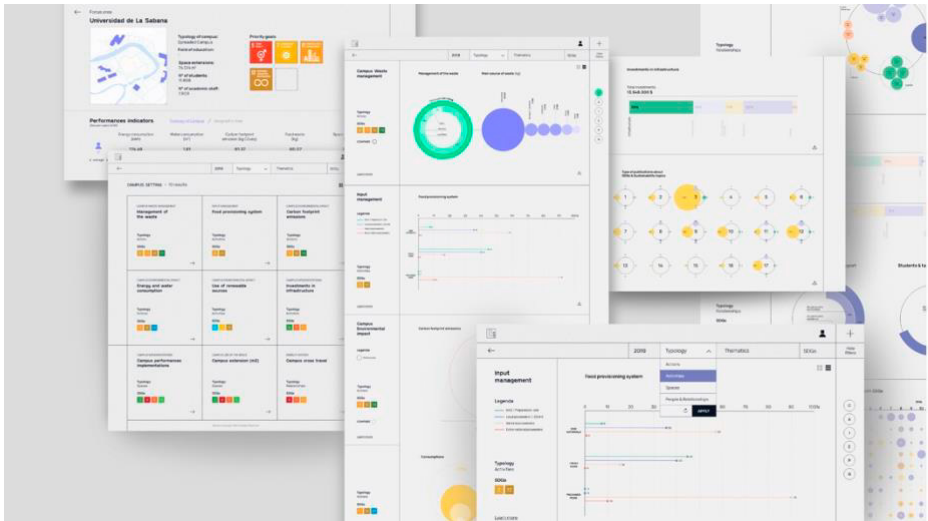


Fig. 5. Behave platform. Explore section, data visualization collection.

In Behave, the entities to be visualized are the six macro-topics that offer a brief overview of the investigated areas; the perspective of the analysis is the possibility to consider the actions, activities, spaces, or relationships in the campus; the additional filters are the 17 SDGs or their correspondent themes [Fig. 6]. In this way, users

Behave. Mapping the commitment of higher education

navigate the information depending on their needs and their knowledge: public institutions, policymakers, partners, or members of the university staff are the main stakeholders to whom the platform is addressed; however, even students or research groups may have an interest in this type of data. Therefore, the exploration phase must be suitable for all those users who are not necessarily used to interpreting complexity.

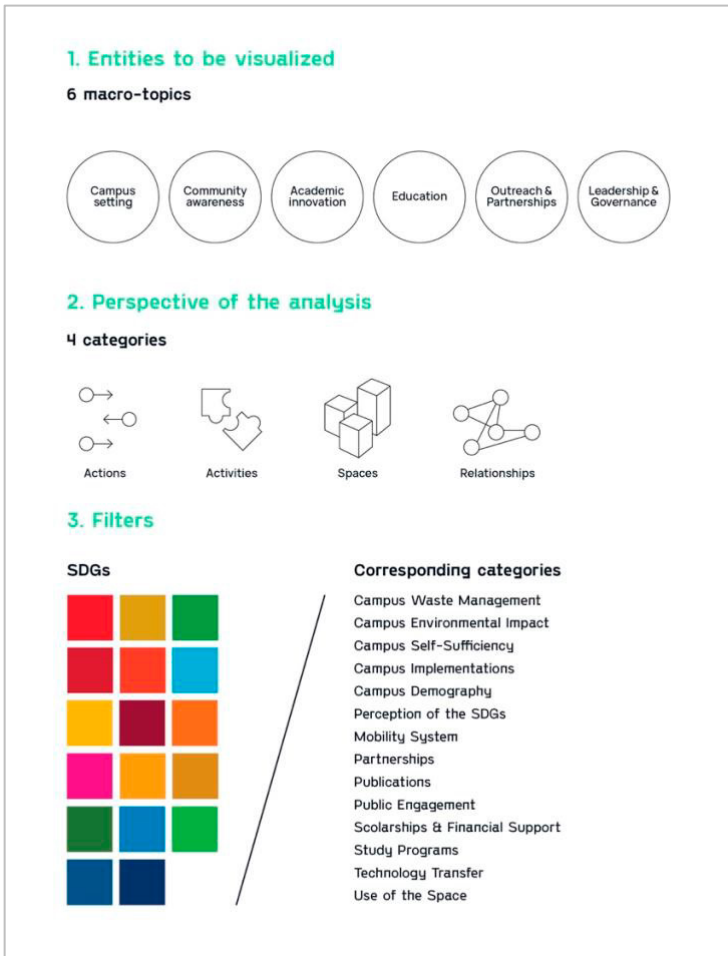


Fig. 6. Behave platform. Data aggregation process: entities, perspectives, and filters.

Additional sections complete the platform by giving the possibility to download a static report of the data or to deepen the SDGs knowledge. The overall result is an alternative to the annual reports published by campuses, with a greater supply of data, unified among the various members and offering greater user involvement.

6. Conclusions

The development of *Behave* revolved around data visualization as an approach to acquire more awareness of the actions that academic institutions carry on every day. The biggest challenge for visual artifacts is to find a way to untangle and represent complexity. Data visualization is a language whose duty is not to influence the user toward specific choices, and not even to suggest a final solution; visualizations must push towards an individual's critical analysis, provoking the rise of new questions. *Behave* is the result of a project phase supported by preliminary research and it reached a first prototype that needs to be tested properly. The visualizations were developed from an effective collection of data from some university campuses in Latin America, but some implementations can be foreseen in the future; both in terms of platform functionality and data analysis, understanding how to integrate more qualitative data without making it quantitative. Overall, the tool offers campuses a common and shared space to communicate what makes each of them recognizable; it's a space that could evolve into an open web interface where the Higher Education System can develop new strategies and, at the same time, compare the various results with an open and collaborative approach.

References

- Ciuccarelli, P., Ricci, D. (2009). Design and visualization. Diagrammatic tools for complexity. In Lupo, E. & Campagnaro, C. (Eds.), *International Summer School. Designing Connected Places*, 6-7. Editrice Compositori.
- Dur, B. U. (2014). Data Visualization and Infographics in Visual Communication Design Education at the Age of Information in *Journal of Arts and Humanities*, 5 (12).
- Mauri, M., & Ciuccarelli, P. (2014). Il ruolo dell'Information Visualization nella progettazione di interfacce per archivi digitali eterogenei. In F. Ciotti (Ed.), *Digital Humanities: progetti italiani ed esperienze di convergenza multidisciplinare*, (16). Sapienza Università Editrice.
- Poza, E., Merello, P., Barberá, A., & Celani, A. (2021). Universities' Reporting on SDGs: Using THE Impact Rankings to Model and Measure Their Contribution to Sustainability. *Sustainability*, 13 (4), 2038. Retrieved from 10.3390/su13042038.
- Sonetti, G., Bariooglio, C., & Campobenedetto, D. (2020). Education for Sustainability in Practice: A Review of Current Strategies within Italian Universities. *Sustainability*, 12 (13), 5246. Retrieved from 10.3390/su12135246.
- Stabellini, B., Remondino, C. L., Tamborrini, P. (2017). Data Visualization Collection. How graphical representation can inspect and communicate sustainability through Systemic Design in *The Design Journal*, 20:su1, S1673-S1681. Retrieved from 0.1080/14606925.2017.1352690.
- United Nations Development Programme (2017). *SDG Dashboards: The role of information tools in the implementation of the 2030 Agenda*.

IN*VISIBLE.

Gender discrimination of women in the Austrian design industry

Christine Poplavski¹ (0000-0002-1188-6340),
Johanna Wicht² (0000-0002-8731-5982)

^{1,2}University of Applied Sciences Salzburg
christine.poplavski@gmx.de, johanna.wicht@gmx.at

Abstract. IN*VISIBLE is an exhibition dedicated to daily forms of gender discrimination of women in the Austrian design industry. The dark side of the creative industry is increasingly becoming the focus of public attention. Whether sexism scandals, the gender pay gap or the lack of representation of minorities – the industry needs a reality check. That is why the exhibition IN*VISIBLE takes stock of injustices and holds up a mirror to the industry. Within the exhibition, data and facts are made tangible. The key question of the project: "How does discrimination against designers manifest itself in everyday life?" The status quo was analysed based on studies as well as expert interviews and are made apparent and tangible through exhibits. Since most of the discrimination is everyday discrimination, the exhibition uses everyday objects to make these problems visible. It targets the emotions of the recipients and is thus intended to awaken their own motivation to help shape the industry. Daily objects can be discovered – a walk through an apartment, figuratively speaking. With the difference that each individual exhibit addresses a gender-specific issue in the design industry. The exhibits are dealing with common killer phrases, the gender pay gap, the struggle women face getting into high paying positions as well as a proper balance of work and life.

Keywords. Gender discrimination / Invisibility / Women / Design / Austria

1. Introduction

The project IN*VISIBLE is an exhibition that was created during the master degree in Communication Design at the University of Applied Sciences in Salzburg supervised by Viktoria Kirjuchina. The research question and main topic of the exhibition was to portray how discrimination against designers manifest itself in everyday life – focusing on designers in the field of communication and media design.

Current developments like *Ladies, Wine and Design* founded by Jessica Walsh or the project *Ad Girls Club* brought this topic to our attention. Both raise awareness in their own way about grievances in the creative industry.

The title *IN*VISIBLE* works as an animated logo revealing at times the word *VISIBLE* and *INVISIBLE*. The words are separated by an asterisk, which in the German language is used for gender-sensitive language. With this we wanted to emphasize the focus on female and other underrepresented designers and their struggles in everyday work life that often remain invisible.



*VISIBLE INVISIBLE

Fig. 1. *IN*VISIBLE*, stills of logo animation, 2022 (Property of the author).

2. Exhibiting tangible data

The exhibition was designed to present the topic of gender inequity in an understandable and impactful way. The data was primarily derived from a study by *KMU Forschung Austria* as well as by conducting interviews with designers in different positions and stages of their careers.

2.1 Research

The Austrian study found that about three quarters of the designers surveyed are self-employed. The Austrian design industry is characterised by a micro and small business structure and a combination of different forms of activity. Furthermore, designers generally have a very high level of education as around two thirds hold a degree from

a university or a university of applied sciences. When looking at the key business figures, gender-specific differences are noticeable. More than half of the men (52 %) are to be found in higher turnover categories from €75,000, while this is only true for 19 % of the women. In addition, an analysis of turnover by different age groups shows that the proportion of respondents in higher turnover categories increases with age, but not nearly to the same extent among female designers as among their male colleagues. Looking at median earnings by gender, female designers were only able to earn half the average total earnings of their male counterparts (€50,000) in 2019, with a median of €25,000. (Enichlmair et. al., 2021, p. 2-5)

The findings of the interviews provided a more personal insight into the designers' workday. The interviewees' concerns revolved mostly around topics such as the gender pay gap, the difficulty for women to get into high paying positions, the feeling of not being taken seriously or not being able to sustain a proper balance of work and life.

2.2 Visual effects of the (in)visible

In parallel to researching data, a key element of our concept phase was design research. In the design research the most prevalent question was to find out how information can be experienced and furthermore how it can be impactful for the viewers. A huge inspiration and a good example for creating these experiences is the work of Domestic Data Streamers. Their website states that "the world couldn't be understood without numbers, but it wouldn't be understood with numbers alone. We believe that any meaningful interchange of information between people needs to carry emotions, experiences to create knowledge or change." (Domestic Data Streamers, n.d.)

In some cases, the data from the study shows the status quo of the designers' situation e.g., when looking at the gender wage gap. What remains invisible are the underlying structural problems that lead to inequity. Therefore, the aim of the exhibition was to find visual and tangible effects to make the invisible visible. In doing so, the exhibition communicates not only the data but also what impact the numbers have on designers. Reviewing all the pieces of information, we concluded that the majority of gender inequity revolves around the topic of everyday discrimination. To further illustrate this, the findings were translated into everyday objects, which is discussed in more detail in chapter 3.

The exhibition design focuses on a bold typographic language. With the particular interest on emphasizing women and other underrepresented designers, the typeface is used to represent this intent as it is a "visual voice, an extension of its creators' bodies." (Rohde, 2020, p. 7) Therefore, the typeface *Ambiant Sans* by the type designer Laura Csocsan was chosen and is used throughout the project.



Fig. 2. IN*VISIBLE, title on acrylic glass, 2022 (Property of the author).

3. Exhibits

In the following chapter the exhibition pieces are presented in more detail.

3.1 *Mood Killer*

This exhibit is dedicated to experiences of power play in work environments. It is based on the use of killer phrases. These are used in discussions to shut down the counterpart, end the conversation, or shift the topic to a trivial matter. They are especially inappropriate in the work environment, as they not only put the other person in an uncomfortable situation, but also create a condescending hierarchy within the conversation. The exhibit *Mood Killer* ridicules killer phrases by debunking this form of dominance. With the premise of moving such power plays to where there would be potential preferences for dominance: the bedroom. This implies that power games and dominance only belong where they happen consensually.

Therefore, six examples of such killer phrases were taken from the workplace and transformed into objects that could potentially be found in the bedroom. ^[15] These objects were labelled with a killer argument as follows:

Eye mask

Especially within the discourse of gender inequity, people tend to use the killer phrase, "I don't see a problem there." This was embroidered on an eye mask to show how the person is turning a blind eye to the problem.



Fig. 3. IN*VISIBLE, Mood Killer Eye Mask, 2022 (Property of the author).

Clock

Regarding the statistical distribution of working hours, it is noticeable that many women work part-time. One justification in this debate is that "women just prefer to work part-time."



Fig. 4. IN*VISIBLE, Mood Killer Clock, 2022 (Property of the author).

Earplugs

A common strategy to avoid difficult questions in discussions is *whataboutism*, where people like to point out that there are currently more pressing issues and refuse to engage further in this matter, hence turning a deaf ear to these issues.



Fig. 5. IN*VISIBLE, Mood Killer Earplugs, 2022 (Property of the author).

Mouth Gag

The following statement is represented by a mouth gag to symbolise being tongue-tied.

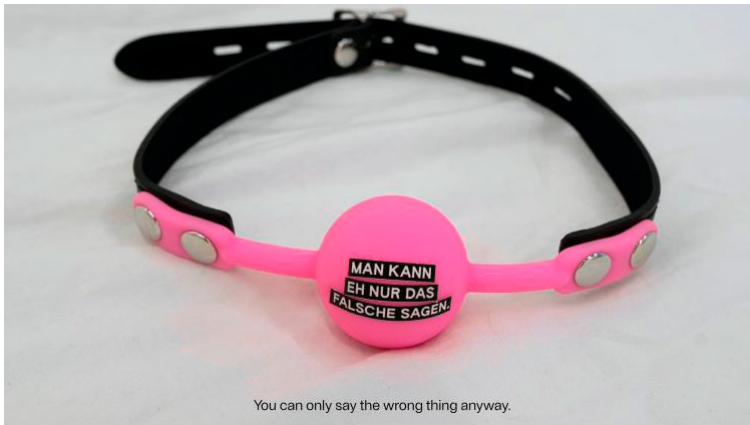


Fig. 6. IN*VISIBLE, Mood Killer Mouth Gag, 2022 (Property of the author).

Handcuffs

The response to an interview request about the current situation in the design industry was, that "as an agency head, you can't do it right." In this case, the person is trying to act as the victim.

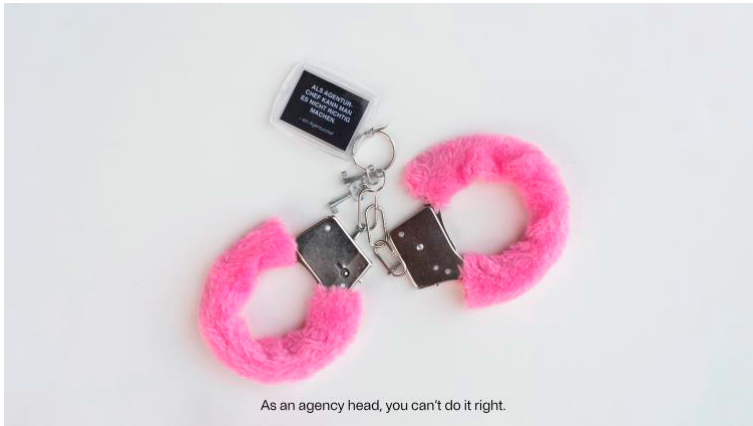


Fig 7. IN*VISIBLE, Mood Killer Handcuffs, 2022 (Property of the author).

Condom

Especially young women are often confronted with assumptions about family planning by their employer.



Fig 8. IN*VISIBLE, Mood Killer Condom, 2022 (Property of the author).

3.2 Big Flex

As discussed above, the study shows that while 52% of all self-employed male designers achieve turnovers of €75,000 or more, this only applies to 19 % of women. (Enichlmair et. al., 2021, p. 4)

For a tangible visualization, the terms *men* and *women* were printed on a resistance band. The font style of *men* is regular while *women* is set in ultra-condensed, decreasing the readability in the normal state of the rubber band. Only by applying strength and by stretching the band the word *women* becomes visible. However, the word *men* grows even larger and appears more dominant. This shows that women must exert more force to keep up with their male counterparts, and even then, they remain a minority in higher paying positions.



Fig 9. IN*VISIBLE, Big Flex, 2022 (Property of the author).

3.3 Sauerei (engl. mess)

The study shows that in 2019, self-employed male designers earned an average total income of €50,000, while their female colleagues earned only half of that (€25,000). (Enichlmair et. al., 2021, p. 5)

For this a piggy bank made of glass was placed in a glass cylinder both are half filled with glycerine. Since glycerine has the same refractive index as glass, there is no change in the direction of light which creates an optical illusion, where the piggy bank seems invisible. ("List of refractive indices," 2022)



Fig. 10. IN*VISIBLE, *Sauerei*, 2022 (Property of the author).

3.4 Raise the bar

The last exhibit deals with the current trend of maintaining a healthy work-life balance and invites the audience to reflect on their own behaviour.

The exhibit consists of a barbell and weights. The left side of the bar represents how much time is spend on work while the right side shows how much time is invested in out of work activities. There are four categories of weights: career, household chores, care work and leisure time. The weight is chosen according to the amount of time that is spend on each activity. Next, the weights are distributed on either the *work* or the *life* side of the bar. Lastly, the participants can review whether the weight distribution is balanced evenly or not.



Fig 11. IN*VISIBLE, *Raise the Bar*, 2022 (Property of the author).

4. Conclusions

In summary, the project IN*VISIBLE transformed data from studies and interviews about gender discrimination in the design industry into a tangible experience.

Our approach was to draw attention to the current problems of the design industry and to trigger the desire for change and improvement. Through tangible data, the topics of gender pay gap, power hierarchy and work-life balance were explored to initiate the viewers' reflection on the industry and their actions.

Injustice and inequity are found in all sectors of the economy. That is why, in the long run the approach of IN*VISIBLE could be extended to many similar issues in different work environments and thus increasing the visibility of women and other underrepresented individuals.

The goal of the exhibition was not only to make women and their daily challenges visible, but also to show that the structural problems behind them are deeply manifested within our society and therefore remain invisible.

References

- Domestic Data Streamers. (n.d.). *The studio behind the info-experiences*. Retrieved from October 19, 2022 <https://domesticstreamers.com/about/>.
- Enichlmair, C., Hosner, D. & Petzlberger, K. (2021). *Die wirtschaftliche Situation und Bedeutung von Design in Österreich*. KMU Forschung.
- List of refractive indices. (2022, August 28). In *Wikipedia*. Retrieved from https://en.wikipedia.org/w/index.php?title=List_of_refractive_indices&oldid=1107192412.
- Rohde, C. (2020). *Skincare for Unruly Bodies*. Retrieved from October 19, 2022, https://sandberg.nl/media/document/original/thesis_rohde.pdf.

The Layers of Ads

Sabina Bauer¹

¹University of Applied Sciences Salzburg, sabina.bauer@online.de

Abstract. As part of the design exhibition *Behind the Veil – about the non-shown in design*, which is about the unveiling of mental images, *The Layers of Ads* explores poster advertising in a new way and allows the visitors to participate in it. The project aims to give an answer to the question of how advertising works. To do so, it is separated into three parts: The definition of the layers, the visualization of the layers and the creative design exercise.

Keywords. Advertising / Exhibition / Mental image / Pictograms / Creative design exercise

1. Introduction

How does advertising work? We look at an image – and a completely different one automatically appears in our head: The mental image.

However, this happens so quickly that we do not even recognize of what led to our mental visualization. Often, even the designers are not aware of the reasons for their decisions.

The paper presents the project *The Layers of Ads* that is part of the group exhibition *Behind the Veil – about the non-shown in design*. The exhibition was created together by seven students of the communication design master class at the University of Applied Sciences Salzburg under the direction of Dr. Shiro Inoue and FH Prof. Viktoria Kirjuchina. The aim was to find a mechanism to create mental images in the visitors. The projects should ask them the question “What did you see in your mind’s eye?” to make them aware of it.

The Layers of Ads focuses on poster advertising that uses the combination of two similar shapes of objects and is used frequently.

It aims to visualize the different components contained in such an ad, that are normally only perceived unconsciously. This is how the way advertising works is revealed.

2. Methodology

For the research and development of the project, the main questions were: How does this kind of poster advertising function? Which steps are necessary as a designer to create such an ad? And which parts of the ad are responsible for the creation of the mental image in the viewer's mind?

The project consists of three parts: The definition of the layers, the visualization of the layers and the creative design exercise.

Since the definition of the layers acts as a necessary base for the other parts, it will be discussed in more detail. To do so, about 100 of these posters were collected, observed and analysed. Afterwards, a decomposition of the advertising in individual components is carried out to see which of the are necessary or decisive for their effect. The visualization serves to illustrate the core elements of the previously described layers in a spatial way.

The creative design exercise functions as interactive part of the project and makes it more tangible. As a result of it, the visitors gain a deeper understanding of the mechanism and the structure of ads. This allows a reduction of complexity and proofs that the mechanism works.

3. The Layers

Since the creation of mental images normally happens within way to fast to perceive them, we are mostly unaware of them and especially of their formation process. That's why, a detailed analyzation of the posters is necessary to obtain the awareness of all thought steps.

For the analyzation of the posters, attention was paid to all visible components, the first impression and the mental image. Afterwards a reconstruction of the thought steps went through was accomplished, to see what is important for the creating of the mental image in the mind.

To ensure that the mechanism works in general in this way, some of the posters were shown to a few testers.

3.1 Analyzation of an example

For the explanation of the definition of the components, an advertising of the *Danger in the Water* campaign from *Less Plastic* (Fig. 1) serves as an example.

The advertising depicts three plastic knives swimming in the sea so that only the tips of them are visible above the water surface. The company logo and the message

“More than 100.000 marine animals lose their lives to plastic each year” is placed in the lower right corner.

It turned out that the first impression, while looking at the plastic knife tips, are shark fins.

This leads to the visual imagination of dangerous sharks in the ocean. But the real danger is plastic floating in the ocean, polluting it and being eaten by marine life – including sharks. It poisons them, causing them illness or death.

By sorting these results, four different types of components that are crucial to the impact of advertising could be identified. This led to the conclusion of a separation into four layers (Fig. 2).

3.2 Definition of the Layers

The most obvious one is the *Picture*. It is the central object, that is depicted. In the example, it is the tips of the plastic knives.

The *Image* is an object, whose shape reminds of the *Picture*. This shape matching creates a relation from the *Picture* to the *Image*. Furthermore, it is also the first association of the viewer while looking at the advertising. In this case, it is the shark fins.

Together the *Picture* and the *Image* layer function as visual metaphors. The visual metaphors are the core elements in the ad.

In order to guarantee the establishment of the connection between *Picture* and *Image* for the viewer, *Context* is required. It can be the logo, slogan or message of the identity but also the background or environment in which the *Picture* is placed. This function is performed by the logo of *Less Plastic*, the text “More than 100.000 marine animals lose their lives to plastic each year” and the sea.

The *Mental Image* is the connection of the other three layers. It is not depicted and only visible in the viewer’s mind. It is everything that you imagine visually while looking at the ad. In the example, it is the chain of thought about sea pollution etc.

3.3 Different versions of picture and image

Among the analysed advertisements, it was possible to distinguish two different ways in which the connection between the *Picture* and the *Image* layer takes place.

In the first version, only the *Picture* is shown. The *Image* is the first association in combination with the given *Context*, as the knife tip as shark fin in the previous example (Fig. 1).

However, the second version is a visual combination of the *Picture* and the *Image* layer. That means, that one shape functions as part of the other, as in the advertisement of *Tabasco*, where the bottle is part of the fire extinguisher.

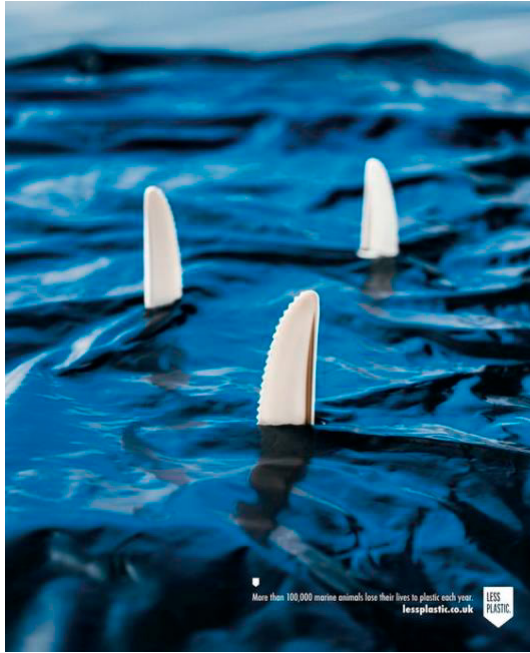


Fig. 1. Project Worldwide for Less Plastic, Danger in the Water, Campaign about plastic pollution, Less Plastic, 2018. (<https://www.adsoftheworld.com/campaigns/danger-in-the-water-forks>).

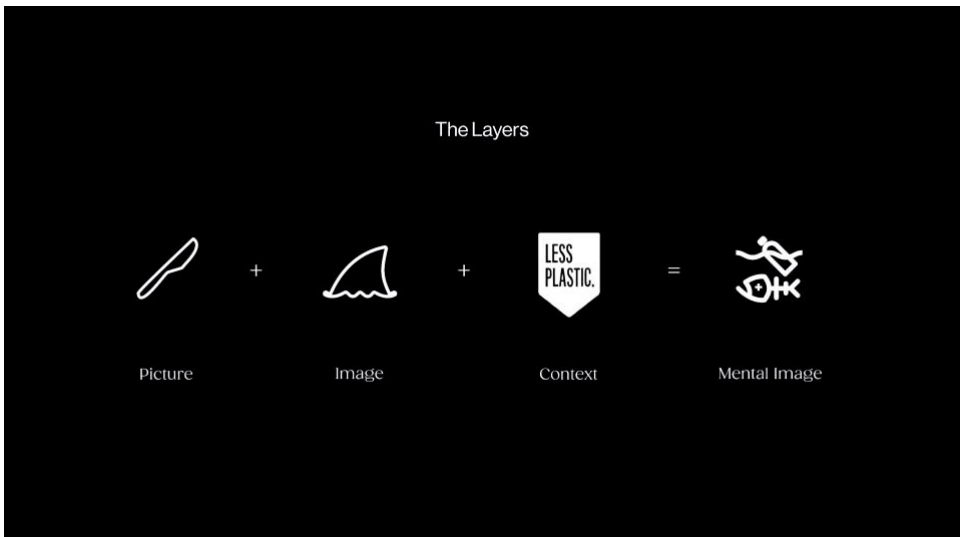


Fig. 2. Sabina Bauer, The Layers, Depiction of the individual layers of an advertisement using the example of Danger in the Water from Less Plastic, 2022.

4. The exhibition structure

The final exhibition (Fig. 4) consists of two parts: The visualization of the layers and the creative design exercise.

4.1 The visualization

In the first part, the mechanism is shown and explained. For the visualization of the layers, the focus is placed on the demonstration of the matching shapes of *Picture* and *Image* as the core elements of the advertisement. To do so, advertising posters were examined and their *Picture* and *Image* element separated into two physical layers.

The aim was an as simple as possible presentation of the matching shapes. For this, the *Picture* layer of each ad is presented as pictogram. On the other hand, the *Image* layer of each ad is displayed as a photo.

Since the brain first perceives the *Picture* and secondly the *Image*, the *Image* layer is also revealed in the second step, when the viewer switches it on. For this purpose, augmented reality is used and realized through the *Artivive* app (Fig. 5). A device with the app is provided, through which the collection of pictograms can be scanned. This allows the *Image* layer to be projected over the *Picture* layer, so that the combination of the two layers is recreated in the viewer's mind. This is where the *Mental Image* is finally created.

4.2 The creative design exercise

In the creative design exercise, the visitors are asked to build such a mechanism themselves.

To do this, they are guided through three steps. A particular pictogram is given and should be used to create a shape combination as seen in the first part. A total of ten different pictograms were provided for this purpose. At last, the visitors are also asked to think about a message of their created shape combination, if possible.

The result is a big collection of creative ideas (Fig. 6).



Fig. 4. Sabina Bauer, Exhibition Structure, 2022.

5. Conclusions

In conclusion, it can be said that by looking closely at the individual components of an advertisement, awareness of how it works could be generated.

The use of pictograms for simplification of complex pictures turned out to be advantageous, as they are universal and do not require further explanation. Therefore, everyone is capable of drawing and understanding them.

It was interesting to note that although people who consider themselves as "non-creative" took more time to finish the exercise than people who defined themselves as "creative", the results worked similarly well in both groups.

The diversity of the results from the interactive part, which were created in the exhibition, shows that creative ideas can easily be developed in this way, as well as that the deeper understanding of the individual components can consequently also support designers in their creative process.



Fig. 5. Christoph Platzer, Pictogram Collection, Sabina Bauer, 2022.

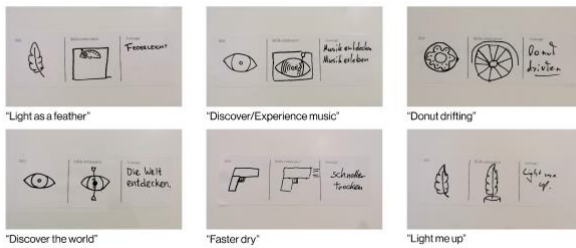


Fig. 6. Sabina Bauer, Creative Design Exercise, Some examples of the visitors' results for the design exercise, 2022.

Genoa Loci Interactive Game

Annapaola Vacanti¹ (0000-0002-7992-8623),
Pietro Crovari² (0000-0002-6436-4431),
Daniele Bonanzinga³

¹University of Genoa, annapaola.vacanti@edu.unige.it
²Polytechnic University of Milan, pietro.crovani@polimi.it
³daniele.bonanzinga@outlook.it

Abstract. Generative design is a valuable tool to engage citizens in interactive activities and allow them to discover hidden treasures in their cities. Such potential has been leveraged by the authors, combining a physical experience with a digital application, designed to collect data during the event Genoa Loci, and ultimately visualize them, producing graphic feedback that could be collected as a prize. Genoa Loci has been organized in February 2020 by TEDxGenova, a non-profit organization devoted to sharing knowledge and valuable ideas within the city of Genoa, Italy. The gamification approach has been extremely valuable in involving both young and adult users in the activity, and ultimately improve the perception that citizens have about a strongly stereotyped area of Genoa. The article describes how the activity was organized and managed via the design of a custom web application and shows the results and the final impact of the experience on the participants.

Keywords. Gamification / Generative design / Phygital experience / Path visualization / Active citizenship

1. TEDxGenova and the Genoese context

Genoa has one of the most extended medieval centres in Europe, about 2 square kilometres densely populated with alleys, called *caruggi* in dialect. Buildings almost touch each other, creating a maze of narrow spaces that elude the possibility of an overall view. Different architectural styles overlap, from the remains of medieval walls to 14th-century mansions to Gothic arcades occupied by contemporary premises and historic stores. Craft activity has strongly characterized the city's history: many workshops are still in operation, and valuable votive shrines donated by the guilds still decorate the numerous crossroads (Leone, 2010).

However, despite the undeniable historical and architectural value of the area, sociological and cultural processes linked to urban, economic, and social transformations have distorted its image; in particular, the Genoese historic centre has long been the victim of a strongly negative prejudice that has fueled stereotypes and collective beliefs based on the urban decay of some areas, indicated as notorious and dangerous

(Leone, 2010). In this context, the goal of the case study hereby presented was to strengthen the sense of belonging of the citizens and let them discover an area that they too often avoid.

Genoa Loci has been organized by the authors as volunteers of TEDxGenova, a non-profit organization born in 2015, devoted to the organization of annual independent conferences in the TED format in Genoa. The goal of TEDx conferences is to share knowledge and valuable ideas at a local level, operating under a license granted by TED itself (Anderson, 2016). In addition, TEDxGenova team often organizes happenings in the city, aimed at reactivating its social fabric and engage citizens in innovative and fun activities.

Genoa Loci is a gamified experience that took place in February 2020. Participants were invited to walk around the historical centre using a web app to get directions on the route to follow, which was solely determined by their answers to a series of questions proposed by such app. The experience aimed to gently push citizens to explore the historical centre, by leveraging the value of data generated by their wanders. By designing a final visual prize (the visualization of the walking path of each participant), it has been possible to positively involve both young and adult users in an activity requiring commitment and dedication (Zichermann & Cunningham, 2011).



Fig. 1. A girl following the web app that gives her directions around the historical centre, February 2020 (Credits: Luca Bobbio).

2. Genoa Loci: methodology

To start playing, participants must go to one of the five access gates to the game area and scan a QR code with their smartphone. The QR code contains a URL that refers to the application, together with an identification code associated with the gate, so that the starting point is known to the system. From that moment on, the application guides players through the alleys, and indicates a path based on their inputs. At each crossroads (3-way intersection + the route travelled to reach it), the application presents the player with a multiple-choice question, drawn from the 15 questions included in the test. Each question offers three possible answers and, depending on the one selected, the application directs the player to a new intersection in which to answer the next question. In this way, the path generated is entirely customized by the player's choices.

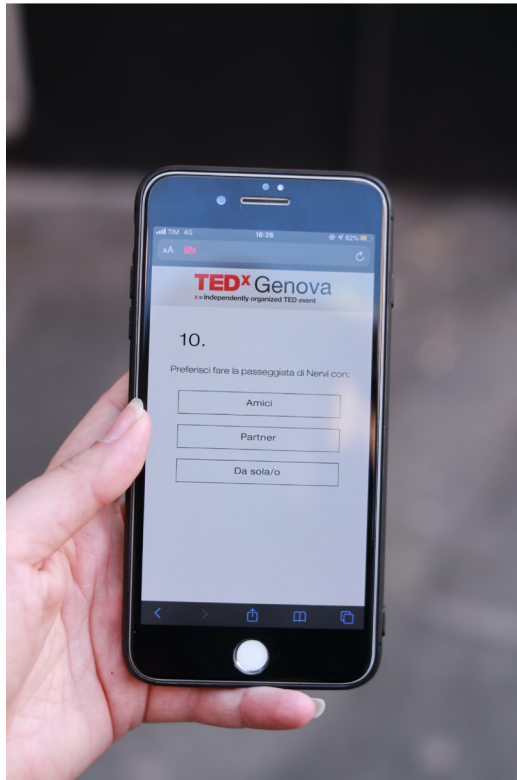


Fig. 2. The UI of Genoa Loci's web application, February 2020 (Credits: Luca Bobbio).

The questions do not have a "correct" answer but are rather structured as a personality test; mainly focused on Genoa and its traditions, the questions record three different traits of the participant, which contribute to the definition of a generative image. The final output of the experience consists in the generation of a unique

illustration, representing the path taken by the player in the game area (Huang et al., 2014); in addition, the answers provided during the test profile the player's personality in the light of three parameters, measured by simple subtraction or addition of scores depending on the selected answer.

The three traits are:

Parameter G: the user's relationship with the city of Genoa.

Parameter S: how much the user is a dreamer / pragmatic.

Parameter T: how innovative / traditional the user is.

Each of these 3 parameters has three possible degrees:

Parameter G: True Genoese / Occasional Genoese / Tourist.

Parameter S: Dreamer / Flexible / Pragmatic.

Parameter T: Visionary / Enthusiastic Innovator / Lover of Tradition.

The results of the G parameter control the background colour of the illustration, the S parameter controls the colour of the path travelled by the player and the T parameter controls the shape of the checkpoints.

3. Genoa Loci: algorithm

Genoa Loci was made possible by modelling the play area using a graph on which the application moves the player. Starting with the road map of the area, all intersections between two or more streets were marked as nodes in the graph, along with the points at which the streets curve, to allow for path reconstruction. The result is a connected graph, in which three pieces of information are associated with each node:

- - An alphanumeric identifier, consisting of either a letter or a number.
- - The degree g of the node, that is, the number of arcs to which the node is connected.
- - The coordinates of the node, expressed in pixels, taking the upper left corner of the map image as (0,0).

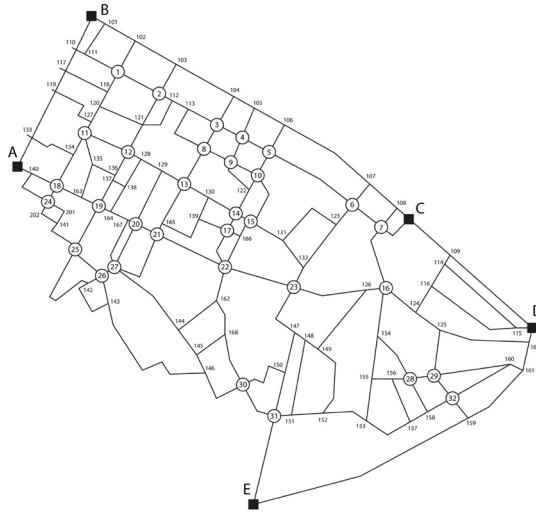


Fig. 3. The map of the game area.

Next, all nodes with degree $g=4$, identified in Fig. 03 with an identifier less than 100, were selected, and a route to another node in the same set, different for each arc, was designed for each of them. The route is specified as a set of codes, representing the nodes that must be traversed to travel it. In this way, each node of degree 4 is connected to 4 other different nodes, themselves of degree 4. These nodes represent the set of possible stages in the game.

The operation of the routing algorithm works as follows: once the player reaches a stage, the game logic takes the 4 outgoing arcs from the node, removes the one from which the player arrives, and assigns one of the answers to the question to each remaining arc. At this point, when the player selects his answer, the game directs him to the path assigned to that arc.

The area where the game was played is characterized by poor network connectivity; therefore, a single page application architecture was chosen to minimize the exchange of information with the server and thus related problems during the activity. For the same reason, directions provided by the device's GPS system were not used (Modsching et al., 2006); instead, ad hoc directions were written for the experience. Once the desired intersection is reached, the user reports it to the application via a dedicated button. To facilitate recognition of the stops, the application refers to them by the street names that generate the intersections.

4. Results and findings

At the end of the activity, the server recorded a total of 211 paths generated, or the number of users who have successfully completed the process of 15 questions.

Considering that 40% of users have played as a couple or as a family, collaborating from the same device to build a single path, we can estimate that about 700 people have walked through the alleys of the historic centre.



Fig. 4. Two players comparing their results, February 2020 (Credits: Luca Bobbio).

The paths obtained through generative graphics take different forms, symbolizing the spatial experiences lived by the participants, sometimes radically different from each other (Pandey, 2014). Looking at the data visualizations, we can see that all paths have at most two "truncated" points, where the line appears broken in either direction; these two points represent the entry point to the web app and the exit point, the place where the 15th question was answered. In cases, however, where one of the two blind spots should not be visible on the map, the player has ended the game at a previously visited down point, making the exit point graphically "invisible". Paths can be divided mainly into two major types: linear or closed. In linear paths, players rarely retraced the same path several times, cutting across the entire length of the game area without incurring any particular "loops." In the closed paths, on the other hand, players answered questions by selecting answers that brought them back to their steps several times, thus generating figures that were wider or narrower depending on the distance to the checkpoints. The illustrations then took on all possible combinations in terms of background color (3 variables), trail color (3 variables) and checkpoint shape (3 variables), thus highlighting at least 27 different personalities in the participants.

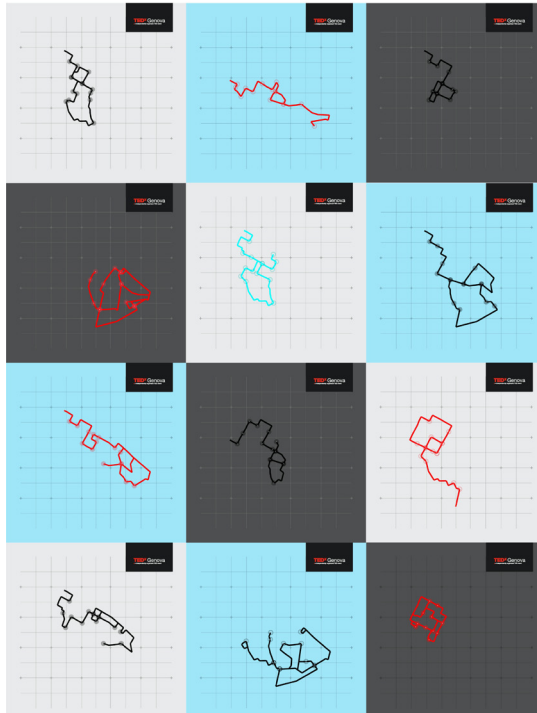


Fig. 5. A sample of the data visualizations generated by the algorithm.

The initiative has produced encouraging results from several points of views (data collected via survey from a sample of 187 respondents). 32% of participants said they were thrilled to be able to compare their journey with that of friends and relatives. As for the relationship with the city, the feedback was even more positive: one in two players (50%) said they were "happy to be able to explore an area of the city that they know little about." And one in three players (32%) said they were happy to be able to "deepen the relationship with their city". But the most significant result from the point of view of the redevelopment of the Genoese historic centre is the following: to the question "after playing at Genoa Loci, did you re-evaluate the alleys you crossed?", more than half of the participants (55%) replied "Yes, positively".

Acknowledgements

The chapters are to be attributed as follows. "TEDxGenova and the Genoese context" to Daniele Bonanzinga; "Genoa Loci: methodology" and "Results and findings" to Annapaola Vacanti; "Genoa Loci: algorithm" to Pietro Crovari.

References

- Anderson, C. (2016). *TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations*. Hachette.
- Huang, D., Tory, M., Aseniero, B. A., Bartram, L., Bateman, S., Carpendale, S., Woodbury, R. (2014). Personal visualization and personal visual analytics. *IEEE Transactions on Visualization and Computer Graphics*, 21 (3), 420-433.
- Leone, M. (2010). La leggenda dei vicoli: analisi documentaria di una rappresentazione sociale del centro antico di Genova. *La leggenda dei vicoli*, 0-0.
- Modsching, M., Kramer, R., & ten Hagen, K. (2006, March). Field trial on GPS Accuracy in a medium size city: The influence of built-up. In *3rd workshop on positioning, navigation and communication*, 209-218.
- Pandey, A. V., Manivannan, A., Nov, O., Satterthwaite, M., & Bertini, E. (2014). The persuasive power of data visualization. *IEEE transactions on visualization and computer graphics*, 20 (12), 2211-2220.
- Zichermann, G., & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. O'Reilly Media, Inc.

Tracing Breakpoints. Interactive human data installation

Jana Christina Rowenski¹ (0000-0002-6912-236X)

¹University of applied Science Salzburg, jc.rowenski@gmail.com

Abstract. Tracing Breakpoints is an interactive installation that deals with self-imposed stereotypes. Through negative experiences with our social environment, roles are imposed on us that we often find difficult to let go and that have a lasting influence on us. The installation is an attempt to make these role models visible using consciously generated mental images. Within the installation, the negative memories can be experienced through tangible data. The project revolves around the question: "What was the most hurtful thing anyone ever said to you?", leading to a confrontation with our negative experiences, the roles they impose on us and the human behind. The experience intends to create sadness and dejection, which dissipates during the confrontation, leading to closure. To make the negative memories and their imposed roles visible, tetrahedrons were used on whose sides the participants wrote: the experience, the associated person, and (if needed) the context of the situation. A black tetrahedron indicates that the experience is still lingering, while a white one indicates that the situation has been completed. The position of the tetrahedron in the vertical represents the age of the participant at the time of the experience. Another cord stopper, the current age of the person. By hanging the tetrahedrons from the ceiling, a tangible and experiential set of data is created, which allows individual experiences to become shared ones and evokes a further examination of one's own life expectations. The project generates engagement with the subject at different levels. In the participants themselves, who deal with their own experiences and images, as well as in the viewers, who see a person behind each tetrahedron.

Keywords. Interactive installation / Stereotypes / Tangible data / Human data / Society

1. Introduction

As designers, we try to manipulate people in a direction we set in order to communicate our intended message to them. Mental images are a tool to anchor these messages sustainably.

1.1 Mental images

As human beings we constantly produce mental images in our minds, which help us to understand the world better. Thereby boundaries of reality are not important, we

can imagine things that we have never seen before in reality (f. ex. pink elephant). We can use this imagination as designers and create voids that are then filled mentally and by placing ourselves in the void and stimulating our imagination, this increases self-identification with the subject and it becomes more tangible, more real.

1.2 Stereotypes

In order to get along in society, we generate stereotypes, often fixed (mental) images of people. They allow us to quickly assess people and therefore with them incoming threats. They are constructed by our society and we whether consciously or unconsciously let them influence our view of our surroundings. But we not only have fixed images of others, but also of ourselves. We have an image of ourselves, just as we believe that others have a certain image of us. We allow stereotypes to be imposed on us by others and often let them limit and influence us in our actions. Key moments in our lives play a major role, especially those experiences that are negative in their nature.

1.3 Approach

The project tracing breakpoints tries to visualize and materialize negative experiences, which often have a lifelong impact on us and influence our behavior. The question "What was the most hurtful thing anyone ever said to you?" serves as a guiding question to condense and collect the negative experiences. The project is intended to gather human data (negative experiences) in a participatory way and make them tangible to outsiders through an installation. The negative memories are tangible through tetrahedrons in a three-dimensional installation. The tetrahedrons represent the experiences and can be included by the participant into the installation. The project leads towards a confrontation with our negative experiences, the roles they impose on us and the human behind. The experience intends to create sadness and dejection, which dissipates during the confrontation and leads to closure.

2. Setup

The goal of the installation was to create a space for the negative experiences, which makes the different aspects visible to outsiders and gives a bigger picture of the effects of our interaction with each other. The installation consists of a description, hanging memory representations in the form of tetrahedrons with hooks strung on ropes, a false ceiling made of a metal grid, a numbered raster of tape (mounted with a distance of 20 cm), as well as aids such as a hanging device (helps to hang the tetrahedrons) and pens for writing (black and white).

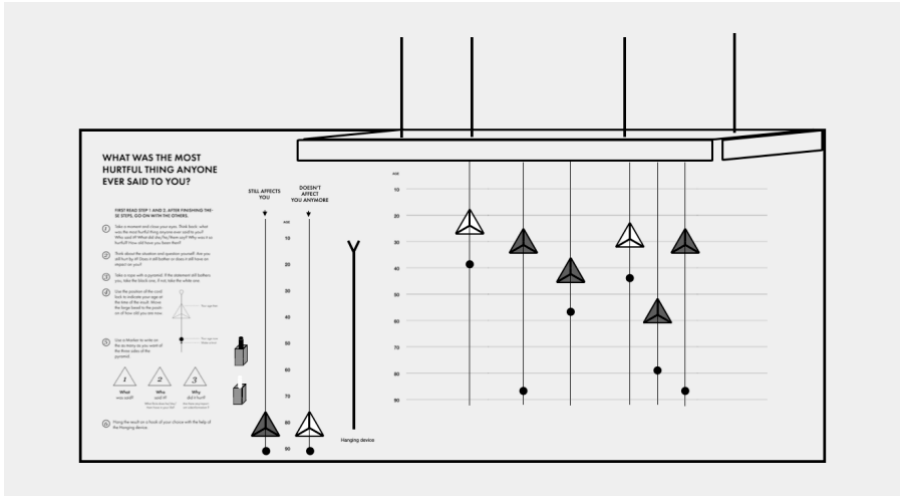


Fig. 1. Tracing Breakpoints, Setup, 2022 (Property of the author).

2.1 Labeling

A description on the left side of the installation guides the participant through the experience. The main question of the installation is displayed as headline. The text below explains to the participants in five steps how they can interactively participate in the installation. Step one and two should be read and performed first, as they support the participant in mentally returning to a negative memory, so that it can be manifested. Steps three through six then explain to the participant how to set up representations of memory (for simplification in the text referred to as pyramids) and finally integrate them into the installation. The numbered grid (0-90) indicates the age in years.

2.2 Collected data

Different data sets help to make the memories understandable and tangible for outsiders. First, the memory itself, "what was said" is questioned. Furthermore, it is important for the comprehensibility of the emotional scope, from whom (which person) the statement originates. In this way, an emotional relationship can already be made clear, depending on the social relationship between the persons. Thirdly, the context of the situation is particularly interesting. This is optional, since not every memory depends on it. Others, however, cannot do without it, since only together with the context the entire memory can be understood by outside viewers. The context can be, for example, an emotional state or a previous decision. To measure the severity of the influence on people personally, it was asked whether the memory was still lingering or not. In order to put the memories and their scope into a larger

picture, the current age of the participant is asked, as well as the age the participant was during the time of the memory. In summary, the following data of recollection are relevant:

- What was said?
- Who said it?
- Why does it hurt? (What is the context of the situation?)
- Does the experience still has an effect on the participant.
- The age of the participant at the time of the memory.
- The current age of the participant.

2.3 Representational elements

In order to make the collected data sets tangible, they are represented by different elements. A tetrahedron threaded on a rope with two cord stoppers represents the memory and the participant. "What", "Who" and "context" are represented by a three-sided tetrahedron made of cardboard. The color of the tetrahedron indicates whether the memory is still lingering. White represents that the experience has been processed, black that the experience still has an impact. The age of the participant at the time of the event is represented by the position of the tetrahedron on the rope. To anchor the tetrahedron in place, a cord stopper is used as an aid (disappears under the tetrahedron). To indicate the current age of the participant, a second cord stopper is used, which is anchored at the corresponding height. The cord itself is as long as the numbered raster. To represent the current age of the participant, a second cord stopper is used, which is anchored at the corresponding height. The cord itself is as long as the numbered grid. It re-presents the length of a life of 90 years and serves as an indicator of time to visualize the temporal action. At the beginning of the rope there is a hook, which allows to hang the rope on the false ceiling (metal grid).



Fig. 2. Tracing Breakpoints, Representational Elements, 2022 (Property of the author).

3. Procedure

At the beginning of the participation in the installation, the participant reads the explanatory text of the installation. They were asked: "What was the worst thing someone ever said to you? In an additional text the participant is mentally led back into the situation to manifest it. Who said it? What did she/he/them say? Why was it so hurtful? How old have you been then? Are you still hurt by it? Does it still bother, or does it still have an impact on you?"

- After the first two steps have been completed, the participant is asked textually to decide between a black or white tetrahedron. The white indicating the processing of the experience, the black one that it is still lingering. In step four, the participant adjusts the tetrahedron. To do this, they move the upper cord stopper vertically to the position that indicates their age at the time of the memory with the help of the scale attached to the wall. Thus, the tetrahedron also hangs at this position and marks the age

(the cord stopper is below the tetrahedron). The second cord stopper is then moved to the place corresponding to the participant's current age. In the fifth step, the participant fills in as many sides of the tetrahedron as they can:

- 1. Side: What was said?
- 2. Side: Who said it?
- 3. Side: Why did it hurt? /What is the context of the situation?

In the last step, the participant hangs his individual tetrahedron on the grid in a place of his choice. A hanging device makes it easier to reach the ceiling.



Fig. 3. Tracing Breakpoint, Participation, 2022. Picture by Christoph Platzer (Property of the author).

4. Outcome and conclusion

The result of the installation is a collection of traumatic memories. Behind each tetrahedron is a person you can almost see in your mind's eye. It creates a push of coping with their traumatizing experiences.

The way the project was handled was very different. For some participants it was difficult to find a specific event in their past that fit the theme, others could immediately remember a suitable moment. The results and memories also varied extremely. They range from childhood memories to recently experienced situations. People close to us, such as family members or partners, are often the triggers, but also casual acquaintances or teachers.

The vertical placement of the tetrahedrons was particularly interesting, as most of them indicated that the worst experiences were already made at a young age. So it shows again how much the early years of our lives already shape us and are still relevant in old age. But the results may also be due to the fact, that the installation was part of a student project and therefore the average age of the participants was very young.

Viewers looking at the installation from the outside were fascinated by the three-dimensionality. They immediately went actively into the installation, through the ropes and turned the tetrahedrons around to read the data on them.

The Installation *tracing breakpoints* shows that everything we say has an impact and we should be a little more careful with our surrounding people because we never know what statement will be a *breakpoint* for them.



Fig. 4. Jana Rowenski, Tracing Breakpoints, Installation Detail, 2022. Picture by Christoph Platzer (Property of the author).



Fig. 5. Tracing Breakpoints, Installation Tracing Breakpoints, 2022 (Property of the author).

Humanizing dance: unveiling the invisible and dance your data

¹Chiara Tuttolani

¹La Sapienza University of Rome, chiara.tuttolani@gmail.com

Abstract. Every day, we produce data. Beyond the numbers, however, all our stories are a collection of small data (Lupi, 2017). The paper presents Information design as a tool to read a choreography. It tries to explore in which ways design could translate dance in a new graphic language. Humanising dance is an invitation to go beyond movement and reveal invisible features. The research explores the human side of dance in order to understand and visualise it. The project begins with the analysis of the choreography of Lucrezia Gabrieli, and the research process has been developed through four phases: choreography analysis, data sampling, data analysis and data visualisation. The project is based on a methodology to understand the complexity of dance. Due to this, the audience can focus on invisible details thanks to the infographics. On the other hand, the visualisation process could also be a useful tool for dancers and choreographers who need to analyse their work in more detail. Humanizing Dance is the result of a thesis project, but it is still an open research area for which several applications are possible.

Keywords. Infographic / Data visualisation / Dance / Alphabet / Data Set

1. Introduction

Unveiling the invisible is the aim of *Humanizing Dance*, my master's degree thesis project. The research is based on a dynamic and interdisciplinary dialogue between information design and dance. They are apparently separated domains, but, there are some common points between dance and data visualisation. Firstly, they convey, and they visualize stories and information. Data visualisation does it obviously, but dance too because choreography means visualizing and giving shapes to stories, information and emotions through the body of the dancers. Furthermore, they are both the results of choices: every element of a visualization is carefully chosen, and this is the same for dance. (Fragapane, 2017). Every movement, positions, stasis moments, gestures, scenography means something.

The information design is the discipline that aims to sets four tasks: presenting, comparing, organising, and relating data (Cairo, 2016). Information design is declined in two complementary parts: data visualization and infographics. The first one is an operational part which presents data with a technical-analytical depth. On the other hand, infographic is a descriptive value to that data based on visual language

generated to be as accessible as possible (Cristallo, 2022). More specifically, data visualisation is the tool to interpret and analyse a choreographic performance. Both disciplines need to open their fields of applications and embrace new experimentations: visual data need to encourage a new kind of data set (Ciuccarelli, 2014), and dance needs to test new ways to reach a wider audience.

2. Methodology

Firstly, the project explores the human side of dance. The movement is just its visible feature. Of course, it is fundamental, but many invisible features catch our eyes, although we do not realise it. The experiments of Merce Cunningham analyse the movement of dancers through specific software. Due to this method, he was capable of manipulating the data themselves which subsequently became the starting point for the creation of his choreographies (Cunningham, 1998). In this scientific approach, what is missing is visualization, beyond the visible, which allows revealing other elements that make us understand the complexity that lies behind a choreographic sequence.

There are a lot of stories about the Information design and one of them is to focus on *small data* (Lupi, 2017) which, as well as big data, are able to provide us important information on a particular research topic. With this assumption, data visualization meets emerging dance. The project begins with the analysis of the choreography *Stretching One's Arms Again* by Lucrezia Gabrieli with Lucrezia Gabrieli and Sofia Magnani as dancers. The research process has been developed through four phases: choreography analysis, data sampling, data analysis and data visualization.

Firstly, the performance analysed is divided into five main moments: the presentation of the characters, the exploration of the space, the relationship, the consolidation and the awareness of the others.

On the other hand, the second phase is a moment of data collection and definition of the data set. It starts with an experimental workshop between dancers and designer: white sheets are spread on the ground, and it becomes the stage for the dancers. They perform the choreography on the sheets and the data collection begins during their stasis. We collect data manually so we are very close with data, and we can understand better their relationship and their patterns.

The data collection includes: the direction of the eyes and the direction of the body, which often are not the same and for this reason provide further information. Furthermore, significant metadata (emotions, words, etc...) were added to each point. It is an empirical, physical and analogical activity. The dancers wanted to participate in the data collection, and they had the opportunity to learn about their own data.

In the third phase of the project the whole experience is transferred into digital. A new graphic language is laid out and it starts from the study of notational systems developed in the past. For instance, the Labanotation in the early 1900s or the Beauchamp-Feuillet notation, developed in the early 1700s (Hutchinson, 2011). These visual representations were arisen from technical and functional needs: they helped

the choreographers and dancers to memorise and convey the movements. The analysis of them influenced the research in terms of understanding the graphic alphabet, their relations and patterns. Moreover, there other case studies: for instance, Merce Cunningham noted down the steps in a small notebook, keeping separate track of the way in which feet, legs, arms, torso, and head were to move. Once he set these steps on the dancers, they would in turn record them for study in their own in similar notebooks: there were no overlaps in any of these idiosyncratic notations. Also, the work of Wassily Kandinsky, however, is a key study. I was inspired by his way of composing works of art in order to compose the infographics of the choreography sections of my project. The study of all these methodologies is the starting point for the final visualizations. Thus, the new graphic representation can be regarded as an expression of a visual language (Yuri Von Engelhardt, 2022). The project of the new alphabet opens doors to the last phase: the five sections of the choreography are visualized with five infographics. In each of them there are all the data set collected: the direction of the observation, the direction of the body and all the annotations.



Fig. 1. Dancers on the sheets with data collection at the end of the experimental workshop.

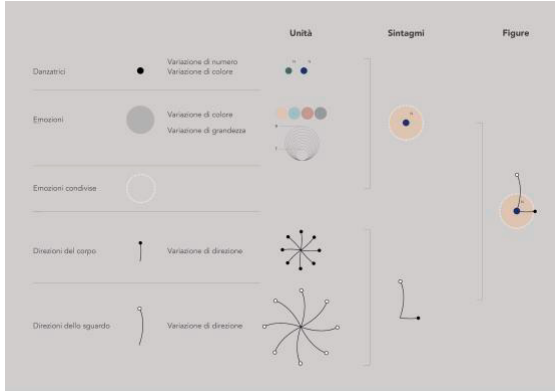


Fig. 2. The construction of the new graphic language.

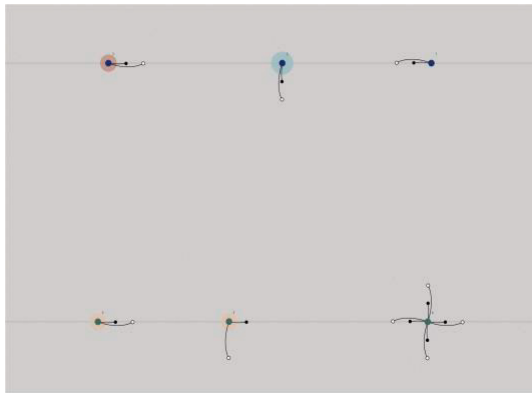


Fig. 3. Infographic of the first part of choreography: the presentation of the characters.

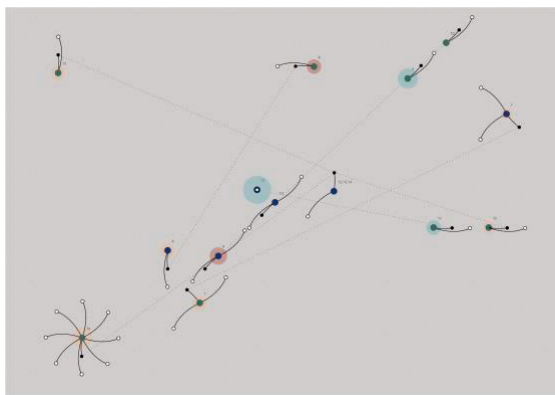


Fig. 4. Infographic of the second part of choreography: the exploration of the space.

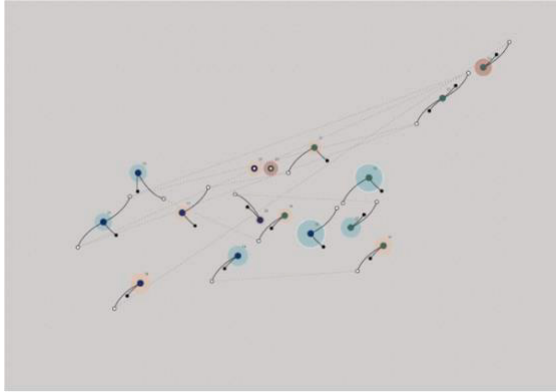


Fig. 5. Infographic of the third part of choreography: the relationship.

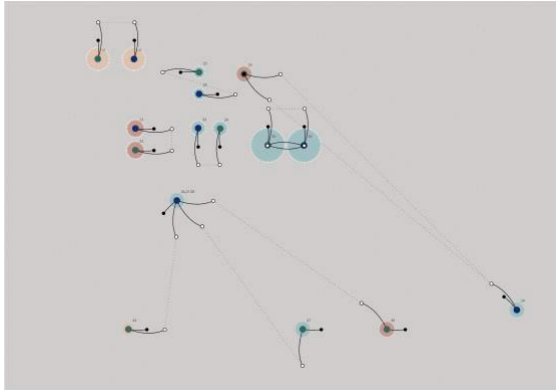


Fig. 6. Infographic of the fourth part of choreography: the consolidation.

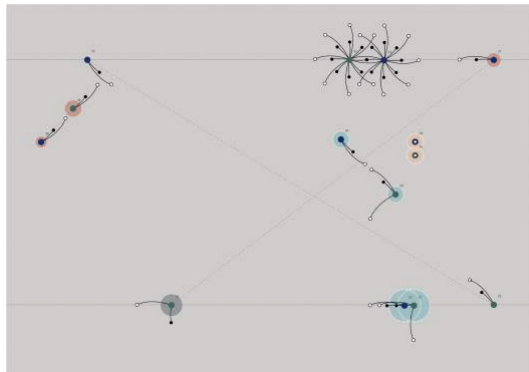


Fig. 7. Infographic of the fifth part of choreography: the awareness of the others.

3. Results

The ability of the Information Design is to reveal the invisible and talk about other relationships that do not immediately come to light (Cairo, 2006). In fact, in the infographics, the relationship between the dancers is clearly visible. These data were not intentionally sampled, but these connections revealed by the infographics tell us something new about the choreography. And therefore, there is a second level of reading: the relationships between the characters, the relationships with space and their changes over time. In this way they reach a deeper understanding. The choreography, therefore, is finally translated into an image, through the language of information design.

The main output of the project is designing a new method where the data visualization is the tool to interpret and analyze a choreographic performance. Both the general public and the dancers/choreographers are the target of this research. One of the goals of the project is to look for a new way to better understand the choreography through the language of data visualization. Keeping in mind this aim, the five infographics related to the five sections of *Stretching One's Arms Again*, are translated into a poster in which there are all the meta data collecting.

This graphic product may be useful to the public to better understand the performance. This operation reveals something more than a choreographic action, and this is the reason why the graphic display could also support a live performance. In this case, the audience could focus on *invisible* details thanks to projected infographics.

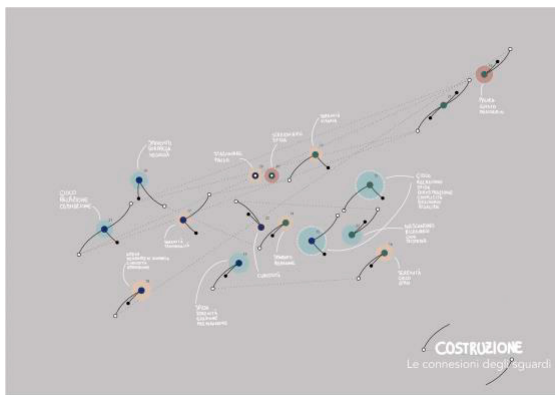


Fig. 8. An example of poster (third infographic).



Fig. 9. An example of live performance with dance and data.

On the other hand, the dancers and choreographers could have the chance to analyze their own sequences. This could increase their ability to interpret a choreographic sequence. Furthermore, this method could be the starting point of a new work: a new choreography made from data.

The initial goal of the project was to study a methodology to understand the complexity of dance and all the other elements beyond movements. On the other hand, the visualization process could also be a useful tool for dancers and choreographers who need to analyse their work in more detail. On 7th May 2022, during the *Open Mad*, in the *Murate District* of Florence, a workshop was held with the dancer Lucrezia Gabrieli. During an improvisation performance lead by the artist, the audience actively participates in the construction of the data. They collect data in each stasis of the dancer. In this way, viewers can extrapolate data relating to the directions of her eyes and body. In this way, the audience could read additional data, through the visualization on their sheets. This is just an experimentation of a project that is still open and in the process of being defined.

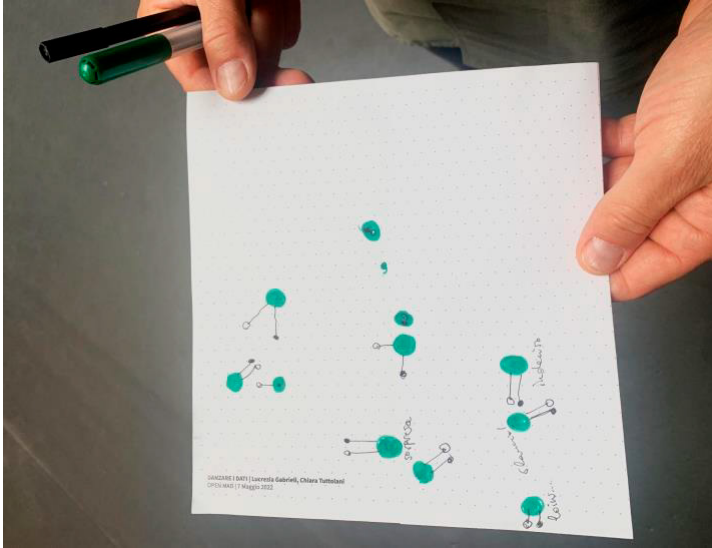


Fig. 10. Data collecting made by hand during *Open Mad*, Florence.

4. Conclusions

The experiment merged separated fields such as information design and Dance. Humanizing Dance is an interdisciplinary dialogue between these two disciplines, and it is the result of a thesis project. The main goal of the project was studying a methodology to understand the complexity of dance and all the other elements beyond movements. On the other hand, the visualization process could also be a useful tool for dancers and choreographers who need to analyse their work. The title Humanizing Dance highlights this main subject: there could be new ways to unveil the intimacy of dance and the audience, dancers and choreographers are the target of this research. Moreover, it is a dynamic, empirical approach and this research is still open because several applications are possible.

References

- Al-Obeidyne, J. (2021). *Touch. A dance Mag*. Crayolab Ltd.
- Berlangieri, M. G. (2019). *Performing space*. Bordeaux.
- Bertin J., (2011). *Semiology of Graphics. Diagrams, networks, maps*. Esri Press.
- Cairo, A. (2013). *L'arte funzionale. Infografica e visualizzazione delle informazioni*. Pearson.
- Cairo, A. (2016). *L'arte del vero. Dati, grafici e mappe per la comunicazione*. Pearson.
- D'Amico, D. F. (2020). *Datapoiesis: La Trasparenza nella performance poetica dei dati*. Elephant Castle.
- Escobar, V. M. (2021). *Theater as Data*. University of Michigan Press.

- Hutchinson, G.A. (2011). *Lebanotation: the system of analysing and recording movement*. Routledge.
- La Lettura, (2014). *Le mappe del sapere. Visual data di arti, nuovi linguaggi, diritti. L'infografica ridisegna le conoscenze*. Rizzoli.
- Lima, M., (2011). *Visual Complexity - Mapping patterns of information*. Princeton Architectural Press.
- Lupi, G., Posavec, S. (2016). *Dear Data*. Princeton Architectural Press.
- Lupi, G., Posavec, S. (2019). *Osserva, Raccogli, Disegna – Un diario visivo*. Corraini Edizioni.
- Manovich, L. (2008). *Info Aesthetics*. Bloomsbury Academic.
- Marabotto, P. (2012). *Wasilij Kandinkij – Il tratto tratto dal ritratto è diventato astratto*. Edizioni Lapis.
- Mc Candless, D. (2014). *Information is Beautiful*. William Collins.
- McCandless, D. (2014). *Knowledge is Beautiful*. William Collins.
- Morselli, V. (2007). *L'essere scenico*. Ephemeria editrice.
- Rendgen, S. (2012). *Information Graphics*. Taschen.
- Sieni, V. (2021). *Progettare scalzi*. Maschietto Editore.
- Watt, S. T. (2017). *Atlante delle emozioni umane*. UTET libri.

Versolid. Analysis and visualisation of human language's poetic dimension

Lucía Fernández Panadero¹

¹ Faculty of Fine Arts, Complutense University of Madrid, fdz.luciaa@gmail.com

Abstract. Our speech is becoming hurried, homogeneous and superficial as the result of a reality in which fast consumption, immediate communication and lack of analysis have become common issues. Knowing that human language is our primary organ for thinking, its degradation implies a problem of knowledge. This paper presents an investigation of human minds and the way we produce and internalise meaning, trying to highlight the role of our poetic dimension to face the current tendency of language towards automatism. For this purpose, Versolid has been developed, a visual representation system that brings the expressive possibilities of poetic language closer to the public.

Keywords. Language / Meaning / Thinking / Poetics / Visualisation

1. Introduction

The increasing speed of our lifestyles, trying to adapt to immediate communication, fast consumption and globalization, is directly affecting the way we use language. Our common speech is becoming hurried, superficial and homogenous to match the pace at which we receive ever-increasing amounts of information.

Human language “serves primarily as the organ of thought, as a means of reflection; and only derivatively for the purposes of social communication” (Chomsky, 1978). As it is through language that we relate and understand the world, its degradation implies a problem of knowledge as an impoverishment of the capacity to know, to extend intelligence.

Being linked to thought gives human language its essential characteristic. The Cartesians called it the *creative aspect of language*, meaning it can literally create endless meanings from a limited number of linguistic elements. As a result, it manages to adapt and respond to any situation or scenario, even if they have to do with what is not visible or perceptible by the senses, as emotions or imagination.

This is proof that humans, unlike other species, have the capacity to deal with abstract concepts and ideas, which is intimately linked to the idea of *poetics*. This way, the poetic dimension of language becomes “the quality that comes closest to its creative essence” (Schlegel, 1801), as it is in poetic language that words are no longer indexes

of reality but generate new and infinite meanings. Therefore, we will say that the richness of human language lies in its poetic dimension¹.

This paper presents an investigation that seeks to highlight, in a context where neither deepness nor analysis is the standard, the expressive possibilities of a non-linear use of language. To this end, we propose an exploration through infographics of ways in which poetic language allows us to deepen the content, and so escape from the current tendency of language towards automatism.

2. From linguistics to visuality

Looking back at historical examples, there have been multiple approaches to the creativity of language from the field of visual communication.

Starting from the Futurist's words in freedom that served as a graphic extension of its ideological discourse or the Dadaist revolution against reason and logic, which ended up giving meaning to nothingness. Up to the Surrealist images, which reflected, in fact, how human minds work and produce meaning. Or even more contemporary expressions such as Visual or Concrete Poetry, by materializing the connections between apparently separated concepts, and so creating new ones.

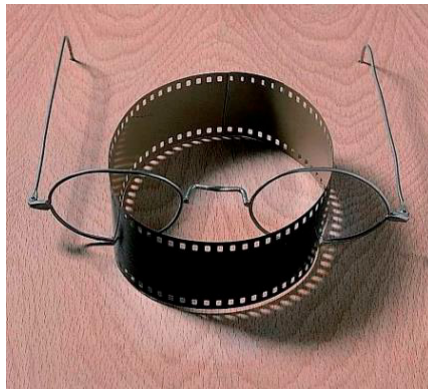


Fig 1. Joan Brossa, *Cinema*, 1988. Object Poem. (Fundació Joan Brossa).

¹ It is needed to distinguish between poetry and poetic function. The poetic function or dimension of language is understood in a broader sense, as just explained, as an immeasurable and exclusive facet of the human mind. The term poetry is commonly used to refer to a particular literary genre. It should be noted that the use of verse, as a formal resource, always implies a poetic function. However, it is neither exclusive to the lyric genre, nor is poetry restricted to its use. We can find verses in fields such as advertising as well as poetry written in prose; both examples of the presence of the poetic dimension of language but only the latter one belonging to the literary genre.

It seems that the most abstract (poetic) facets of language encourage an approach via non-verbal means of expression. In this context, some more recent cases are closer to the strategy followed in this project: graphic transcription of language.

Just to mention a few, such as Stefanie Posavec's visualisations for her project *Writing Without Words* draw the linguistic data of a novel in order to analyse its style and structure. As well as the graphic system created by the Grammatikon team visually explains through symbols how German grammar works, making it easier to learn. Somewhat *à la Bologna*, the rebranding project for the Italian city, is also an analogous experience, as it encodes writing through typical signs of the city, generating a new and unique graphic image for each word, which will describe the city textually and visually. Likewise, the experimental scores of Llorenç Barber or John Cage employ alternative notation systems to manifest the more conceptual layers of the music.

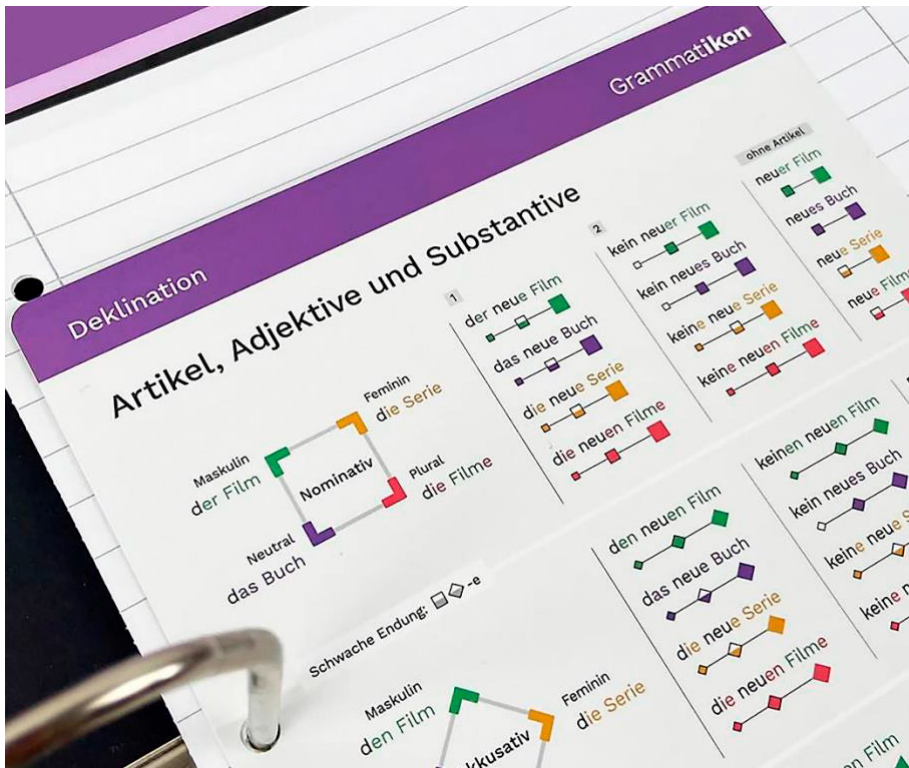


Fig. 2. Bárbara Ávila Vissirini, *Eine graphische Grammatik für Deutsch als Fremdsprache*, 2021. Visual grammar book for learning German. (Grammatikon).

What all these cases have in common is taking quantifiable aspects that, if treated as visual attributes, offer a broader interpretation of a text or an idea.

3. Visualising poetry

In this scenario, graphic resources have been used to study the ways in which the poetic dimension of human language manifests itself. A visual representation system, Versolid, has been designed to appreciate how poetry generates meaning.

The design process has been developed through three main phases. Preliminary research on Spanish versification, on which the system is based, revealed the special application of certain linguistic phenomena when using poetic language —such as synonymy, polysemy, rhythms, rhetorical figures, use of pauses—. As the “expressive potential of poetic language lies in its own form” (Jakobson, 1981), the visualisations are meant to explore how these phenomena work.

In order to elaborate a solid system, a corpus of Spanish poems from different periods, styles and authors was selected and formally analysed following the phenomena previously studied. Based on the extracted data —punctuation marks, grammatical choice, the number of syllables, and phonetic repetitions—, an exhaustive experimentation process began. Carrying out this phase manually was crucial. Dozens of sketches allowed not only a better understanding of those poetic phenomena but also finding the best way to represent their consequences graphically.

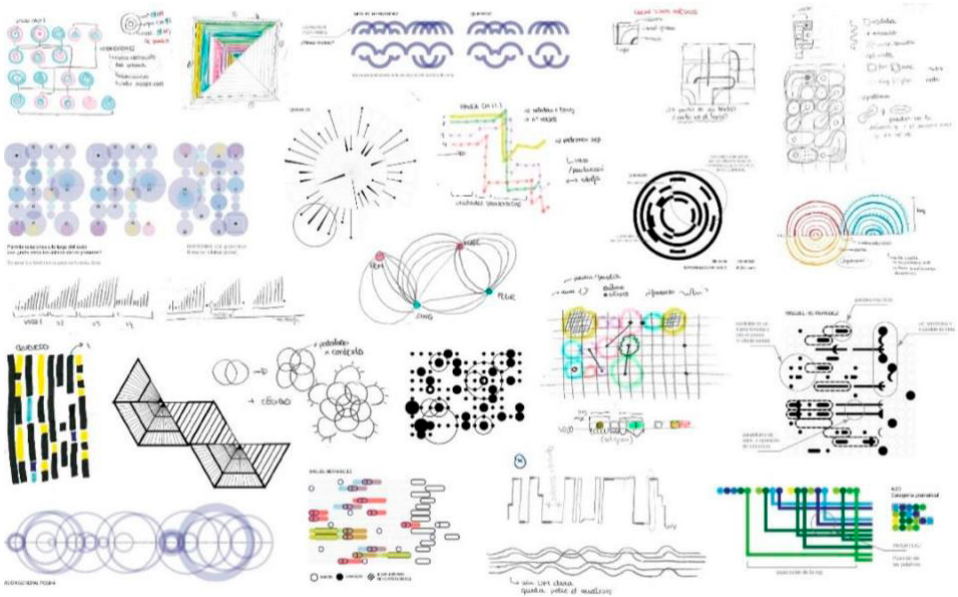


Fig. 3. Extracts from the graphic experimentation process.

Finally, the results were filtered and tested. The outcome is Versolid, a visual representation system that brings together four different infographic methods which provide a new reading experience of the poem.

Every method creates a base grid using a minimum unit of measurement (syllables, letters or words), on which the visual parameters —legends— will be applied according to the poem. In this way, its linguistic data are transformed into shapes, colours, and sizes... allowing us to analyse some key aspects of how non-textual meaning is produced in poetry. Each method is associated to one of the four poetic phenomena finally selected: the use of pauses, accent distribution, grammatical choice and sound repetition (rhyme).

The accent is the soul of Spanish versification. Versolid (Fig. 4) displays its regular patterns and variations highlighting the focus points of the poem. In addition, it allows analysis based on the metrical structure, which is also represented visually and takes part in the perception of the poem sense (harmony, balance, frustration.).

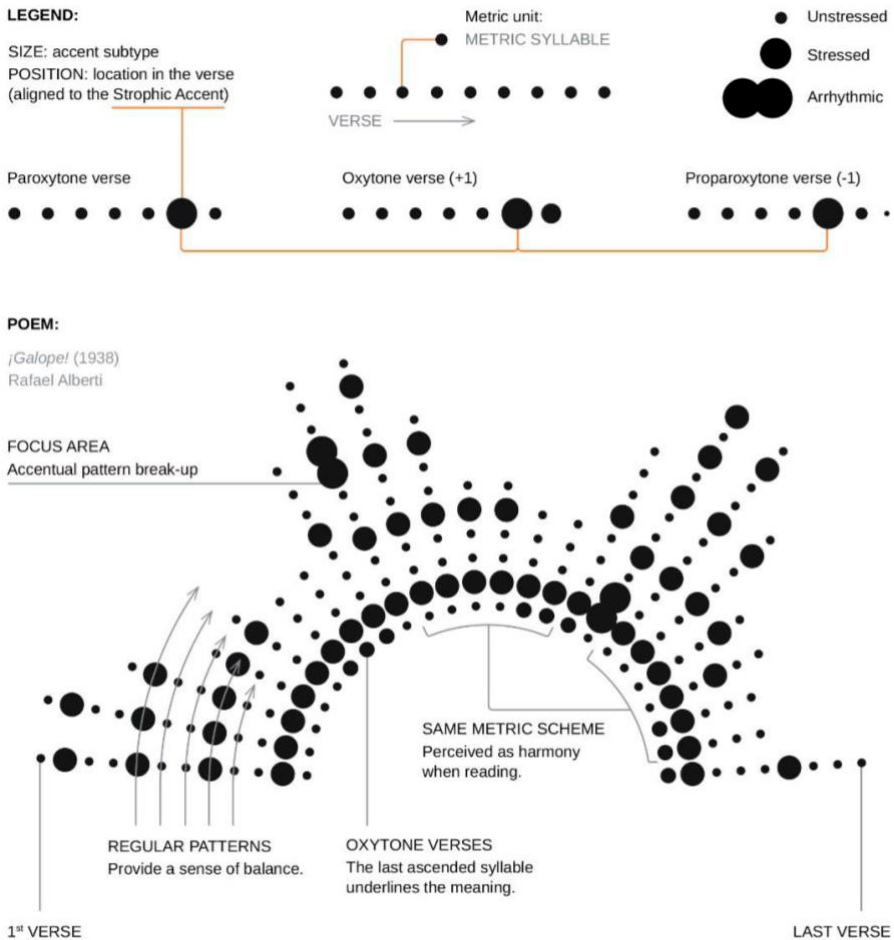


Fig. 4. Versolid's graphic method for analysing poems according to accent.

Pauses are one of the key resources in poetry when it comes to structuring the content. Through their data, Versolid (Fig. 5) reveals the semantic units of the poem and makes it possible to distinguish graphically pauses subtypes. In this way, it becomes easier to analyze their effects on the poem rhythm.

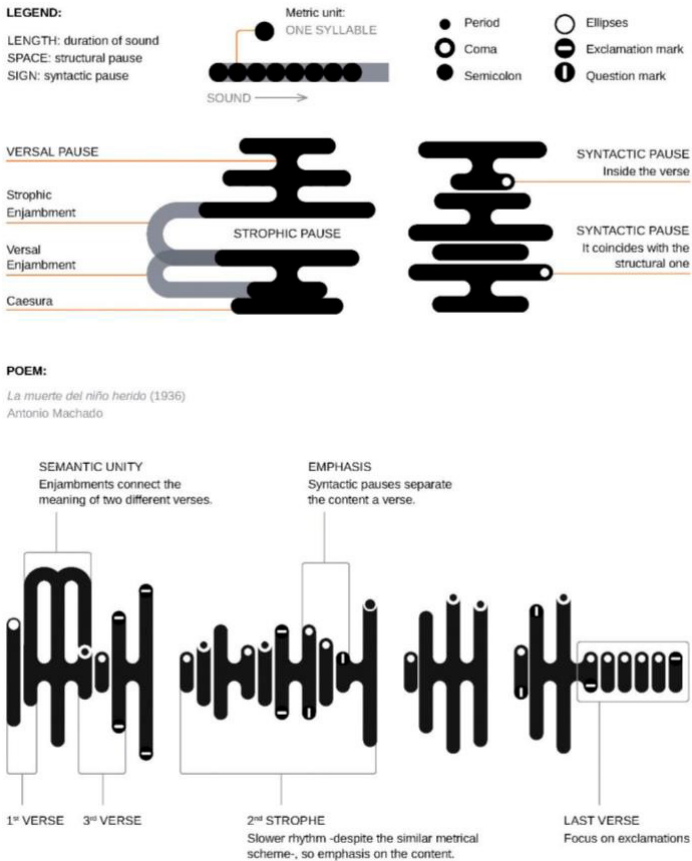
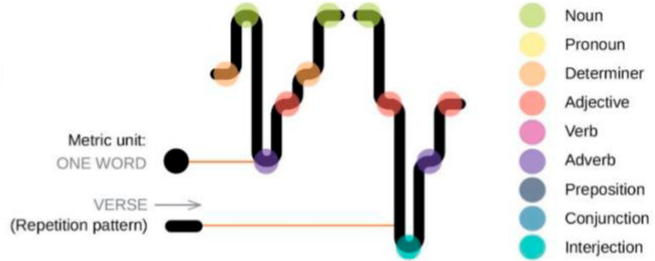


Fig. 5. Versolid's graphic method for analysing poems according to pauses.

The grammatical category choice is another of the resources analyzed by Versolid (Fig. 6). It shows its distribution along the poem, thus we can easily see duplicated syntactic configurations, which make non-textual connections between different parts of the poem. Certain rhetorical figures are also visible, and it allows to extract connotations according to category predominancies.

LEGEND:

DOTS: Words
 STROKES: Verses
 COLOUR: Grammatical category



POEM:

Epifanía en la boca (2018)
 Raquel Lanseros

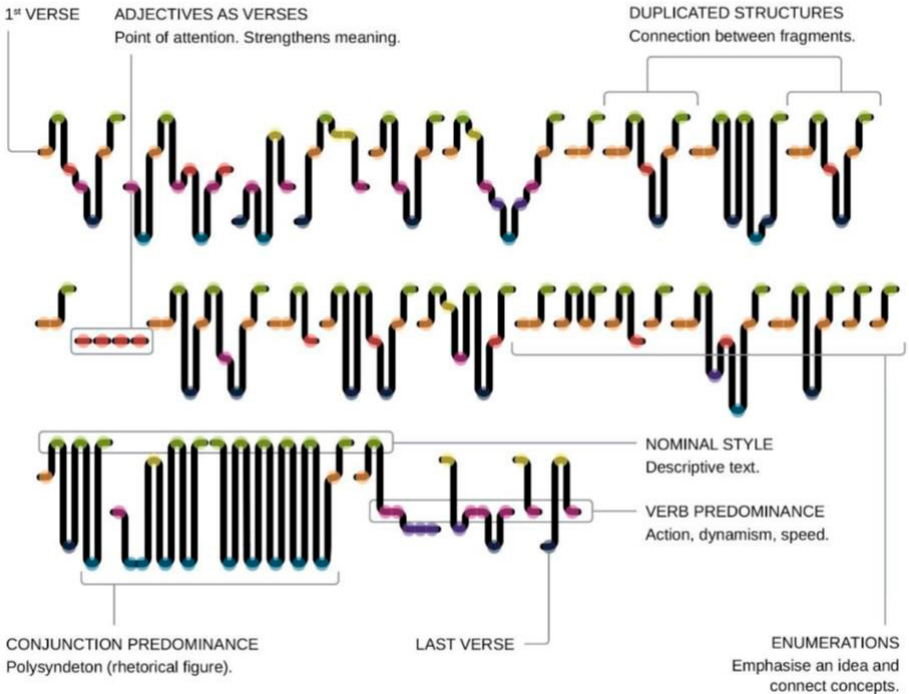


Fig. 6. Versolid's graphic method for analysing poems according to grammatical choice.

Finally, the repetition of sounds throughout the sequence, is pointed out by frequency, verse position and the number of phonetic units that are repeated (Fig. 7). That allows us to analyse rhyme, which identifies the semantic structure of the poem; to notice the emphasis on a specific concept or idea, and to observe the repetition of certain sounds inside the verse, that causes a related perception of the content (Jakobson, 1981).

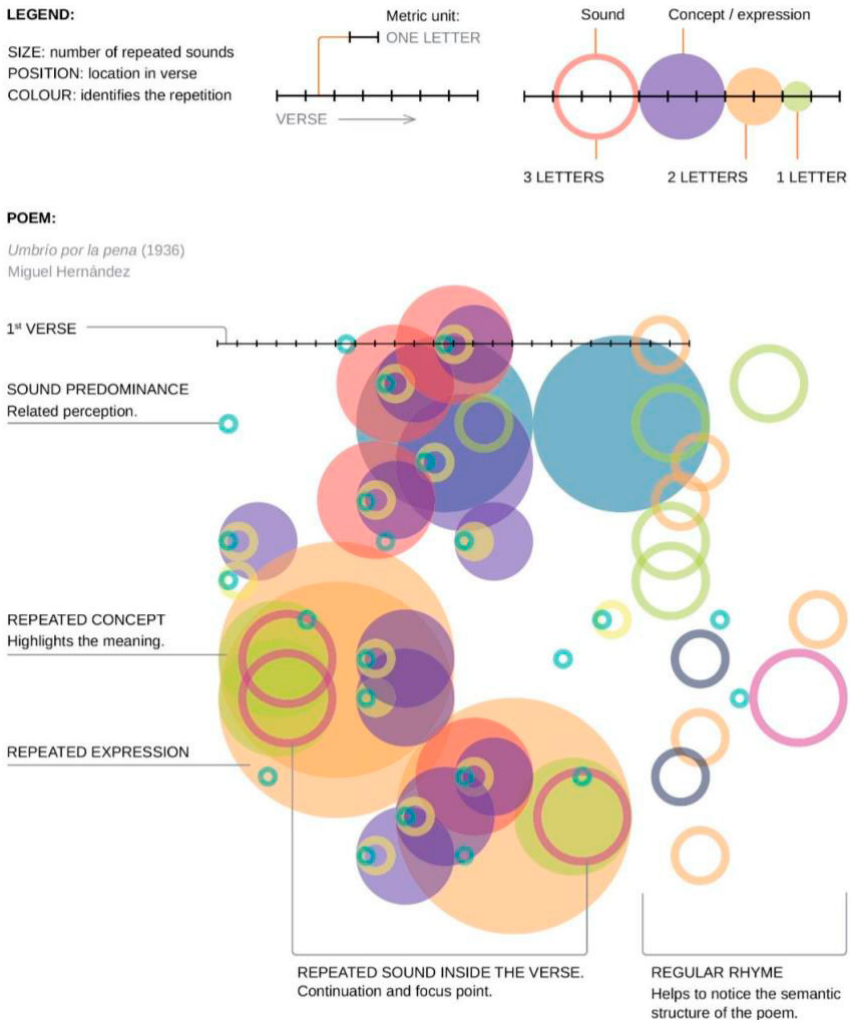


Fig. 7. Versolid's graphic method for analysing poems according to rhyme.

By these means, Versolid manages to literally make visible the non-textual information generated by these phenomena, which turns poetry into a resource to avoid the current tendency of language.

Moreover, Versolid allows a deeper analysis by comparing different poems passed through the same filter.

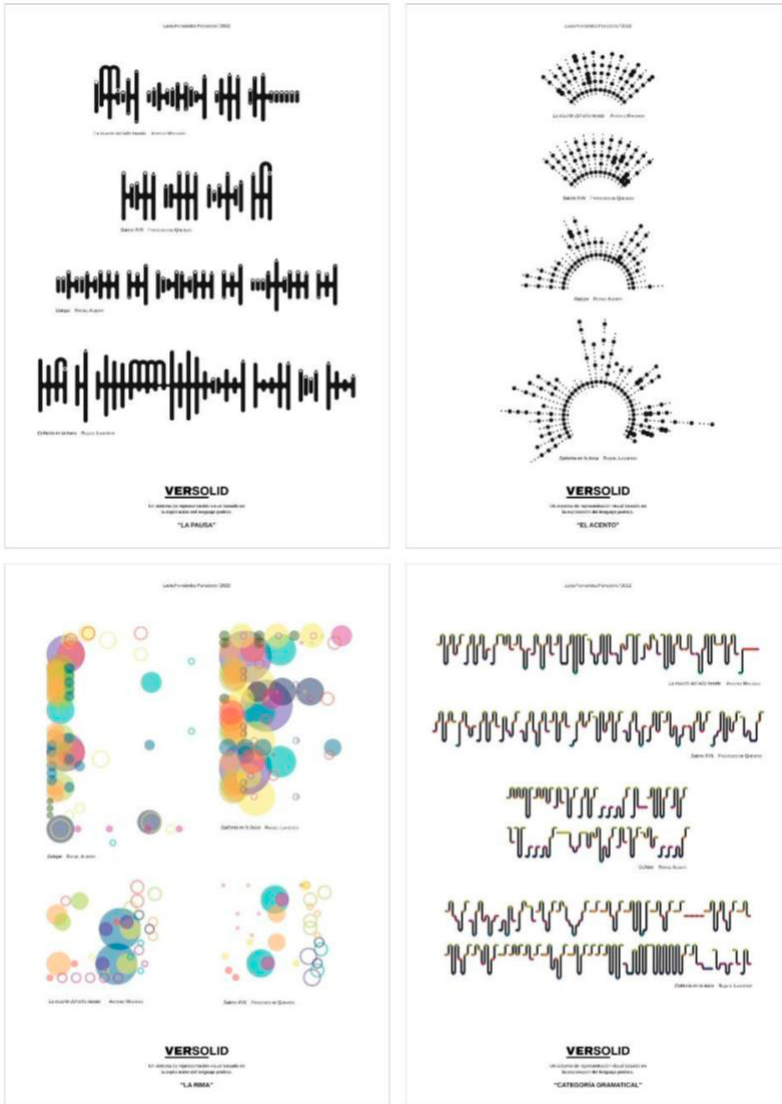


Fig. 8. Comparison of four different poems – Antonio Machado, Rafael Alberti, Raquel Lanseros y Francisco de Quevedo – filtered by each of the four Versolid methods.

4. Conclusions

Versolid is not only a system created to translate certain linguistic parameters into visual attributes. On the one hand, the opportunity to zoom out the words to read the poem from a different perspective discloses information that would stay hidden in a linear interpretation of the text. On the other hand, it is a method that helps us to discover new aspects and possibilities of human language, bringing us closer to the richness of its poetic essence, as the main feature to face the ongoing automatism of language —and consequently, of thought—.

It is noteworthy that this project does not reduce the poetic dimension of language to the use of the four phenomena selected to materialize the proposal. There are many other intrinsic aspects of poetic language that are likely to be incorporated into the system in the future. As well as others that may not suit Versolid's methodology. This fact would mostly confirm the theoretical assumptions of this research: poetry is an infinite and immeasurable dimension of the human mind.

What this project does emphasize is the usefulness of visual language to facilitate the understanding of the most complex and wonderful aspects of human language. In this context, Versolid lays the foundation for further exploration of the semantic potential of poetic language.

References

- Chomsky, N. (1978). *Lingüística cartesiana* (3.ed.). Gredos.
- Darebný, J. & Vázquez Touriño, D. (2016). *E-manual de Métrica española*. Masarykova univerzita.
- Foucault, M. & Monge, F. (2004). *Esto no es una pipa* (1.ed.). Anagrama.
- Gompertz, W. & Basús, F. C. (2013). *¿Qué estás mirando?: 150 años de arte moderno en un abrir y cerrar de ojos* (9.ed.). Penguin Random House.
- Jakobson, R. (1981). *Lingüística y poética*.
- Montalbetti, M. (2018). *Cajas* (1. ed.). Libros de la Resistencia.
- Perondi, L. (2012). *Sinsemie. Scrittura nello spazio*. Stampa alternativa & Graffiti.
- Sanders Peirce, C. (1976). *La Ciencia de la Semiótica*. (s. f.). Nueva Visión.

anima·mundi.

Making the invisible visible

Alice Di Francescantonio¹ (0000-0002-1128-9642),
Nicolò Sinatra² (0000-0002-5172-0871),
Federica Rossi³ (0000-0003-2766-6286)

^{1,2,3}UNIRSM Design - University of the Republic of San Marino
alice.difrancescantonio@gmail.com, nicolo.sinatra2@gmail.com, federicaerre.fr@gmail.com

Abstract. The paper presents an investigation into the role of design, in making tangible large amounts of data, which testify to the crisis in our ecosystem. Through hotspots placed in public spaces, the quantity and type of insects in transit are detected, as well as acquiring information on air quality, temperature and humidity. The intent is to enhance the entomological biodiversity characteristic of urban public spaces by observing changes in numbers and species over time in relation to climate change and human behaviour. Recorded data are collected in a database, processed, and visually translated in real-time into navigable and interactive infographics that relate and compete with the cities participating in the project.

Keywords. Ecocentrism / Insects / Interaction design / Opensource / Data visualization

1. Introduction

The disappearance of large numbers of species in an unusually short time frame is known as mass extinction (Cowie, R.H., Bouchet, P. and Fontaine, B. (2022), *The Sixth Mass Extinction: fact, fiction or speculation?*) and is the phenomenon we are witnessing today. Specifically, we are facing the sixth time in world history when a disproportionate decline in biodiversity occurs across the planet.

The extinction of a species involves a series of chain reactions, caused by the disappearance of all interactions that species had with the environment, for example the disappearance of pollination, seed dispersal, and predation.

The survival of a few individuals of a species is not sufficient to meet such needs. In this scenario, *anima-mundi*, a project born within the Interaction Design Lab of the University of San Marino, held by Prof. Silvia Gasparotto and Prof. Michele Zannoni, fits in; specifically, it aims to monitor and enhance the entomological biodiversity characteristic of urban public spaces.

2. Approach

This is an ecocentric project that aims to contribute to the conservation of the planet by focusing on the insects that inhabit it. The focus of the project, is the changes in their numbers and species over time, compared with climate change and human habits. Through a preliminary analysis of the characteristics of the individual insect orders that inhabit our planet, the interdependent link between them and the ecosystem emerged. Anima-mundi stands as a collector of data, with the aim of communicating it, to raise awareness of the importance of safeguarding insects.

3. Methodology

The project's target audiences are citizens all over the world: from ordinary people living in cities to researchers, who can use it as a monitoring tool to study and share its measurements through schools and other cultural institutions.

The project consists of insect shelters (hotspots) that can be placed in public spaces: the designated places are ideally green areas, such as a park, a school garden, or a vertical forest. Inside them, a Raspberry Pi 0 board ensures the acquisition of information about what is happening around them. Through sensors, air quality, temperature and humidity are detected, while through a 5/8 Mp Raspicam camera module, images are captured and later sent to an artificial intelligence system, which instead takes care of counting and recognising insects in transit.

To ensure and facilitate the large-scale dissemination of anima-mundi, the autonomous production of the "hotspot" object is envisaged through the sharing of blueprints in open source (Gasparotto, 2020. From 0 to 20: An evolutionary analysis of Open Design and Open Manufacturing. Strategic Design Research Journal), which can be found through a website and can be 3d printed (in ceramic and PLA materials). Anyone is then potentially able to self-produce it, guided by a digital manual, in purchasing and setting up the electronic components and assembling the printed parts. The importance of data collection for anima-mundi is encapsulated in need o compare species behaviors over time.

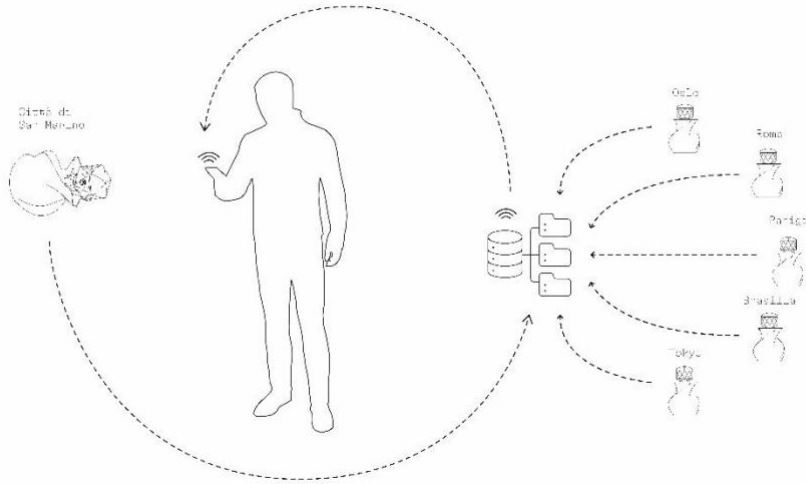


Fig. 1. Scheme of the data transmission system of anima-mundi.



Fig. 2. anima-mundi hotspot, placed on a vertical garden.

4. Making the invisible visible

The website represents a real-time window on the data collected from the different hotspots set in the cities participating in the project. The homepage (Fig. 3) is structured in such a way as to suggest, immediately, that the focus of the project is insects, thanks to clickable icons, from which it is possible to obtain more in-depth information, regarding their peculiarities, such as their physical characteristics, habitats and reference families.

Scrolling down shows a ranking of cities based on the data collected.

Upon logging in, the platform displays daily information derived from the data received: these are reprocessed and translated, by means of predetermined criteria, into short news items. Placed within circular graphical elements that highlight them, the updates are quick to read (e.g., "No pollinator species have yet been observed") but can be expanded upon. Clicking on them shows specifics for each topic and advice on how to contribute (e.g., "Plant in your garden, nectaring plants: golden rod, verbana, yellow alyssum, zinnia.").

It has been investigated how the competitive mechanism of gamification (Hassan, L., & Hamari, J. (2020). *Gameful Civic engagement: A review of the literature on Gamification of e-participation*. Government Information Quarterly), i.e., the application of game logic in a non-gaming context, introduced within the project, can be a means to stimulate and engage people to safeguard the planet.

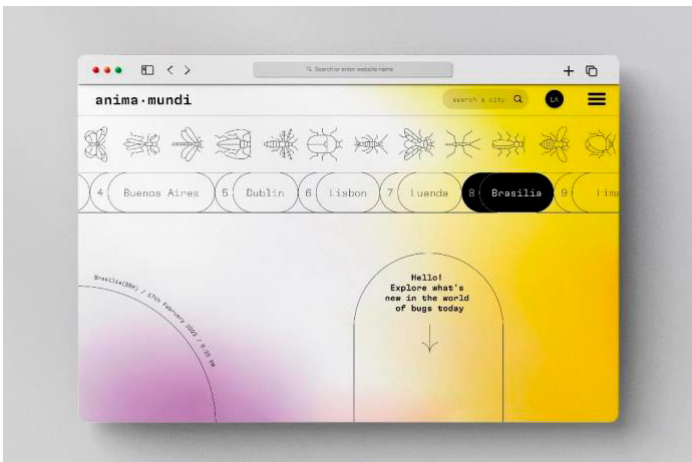


Fig. 3. Screenshot of the homepage of anima-mundi.



Fig. 4. Screenshot of the infographic related to the entire city.

By browsing within the web platform, the data collected can be accessed through infographics. In the first case (Fig. 4), it is possible to observe how the environmental temperature and humidity, relative to an entire city, are closely related to the number of insects present in different time frames (from 24 hours to 365 days). The user can move, via a slider, on the time scale to view intervals relating to the current day, week, month, or entire year. The information is arranged progressively, in a circular pattern, in a clockwise direction; through colors, the fields of analysis are immediately distinguished.

Moreover, through a second filter, it is possible to switch to another, more specific type of visualization (Fig. 5) dedicated to the individual hotspot of reference. In this case, the information shown is more detailed: by choosing to view the day, week, month or year, scanned in turn in horizontal time frames, to the humidity and temperature values, a third is added that returns information on air quality Clustering to synthesize and scattering to reveal. Interactions and animations in the visualization of complex hierarchical data in Atlante Calvino in terms of low, medium or high pollution). The insect data, acquired from the camera, identify specific families and the number of each, recognizable by name and associated icon. The colors of the two infographics are consistent, and, again, guide the reading of the information.

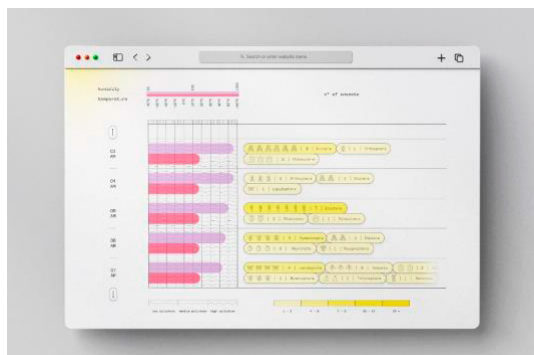


Fig. 5. Screenshot of the infographic related to the single hotspot.

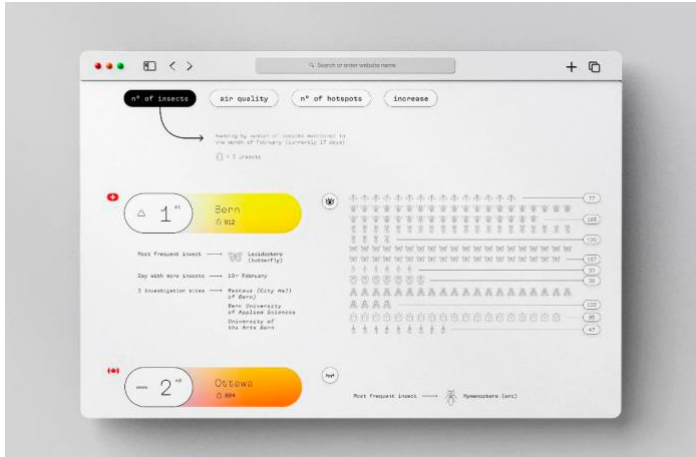


Fig. 6. Screenshot of city ranking.

Finally, (Fig. 6) it is possible to view data on cities, classified according to different parameters: number of insects, air quality, number of hotspots present, and progress recorded over time. Selecting, for example, the filter number of insects for each city shows the ranking position and the total number of insects relative to the current month. Choosing to view the details reveals the most frequent insect type, the day on which the largest number of species was detected, and all investigation sites in the city. Concurrently, on the right column, all insect types and their current count are arranged in an illustrated manner. By clicking on each number, the platform shows the percentage of extinction risk. This detail is significant, as it makes the invisible visible, confronting us with a reality that is hard to accept but not to underestimate.

5. Conclusions

This is a monitoring tool, useful for research to study and share measurements, serving as a bridge between the scientific world and citizens worldwide to make people understand the value of these species, whose role is almost always ignored, at least until their disappearance. In this regard, entomologist Wagner (*Wagner, D. L., Grames, E. M., Forster, M. L., Berenbaum, M. R., & Stopak, D. (2021). Insect decline in the Anthropocene: Death by a thousand cuts. Proceedings of the National Academy of Sciences*), from the University of Connecticut, speaks of a “world of flowerless, silent forests, a world of excrement, dry leaves and putrid carcasses piling up in cities and on roadsides, a collapsing world in which decay, erosion and loss would extend to all ecosystems, moving from predators to plants.” In this scenario, of vital importance is the ability to be able to convey data, in the form of understandable and impactful language, to as many people as possible. The goal is to make them perceive a

condition of imminent urgency associated with the possibility for each perso to take action and intervene.

References

- Cowie, R.H., Bouchet, P. and Fontaine, B. (2022). The Sixth Mass Extinction: fact, fiction or speculation?. *Biol Rev*, 97, 640-663.
- Gasparotto, S. (2020). From 0 to 20: An evolutionary analysis of Open Design and Open Manufacturing. *Strategic Design Research Journal*, 13 (1), 57-71.
- Hassan, L., & Hamari, J. (2020). Gameful Civic engagement: A review of the literature on Gamification of e-participation. *Government Information Quarterly*, 37(3). Retrieved from 101461.
- Nisi, V., Prandi, C., Nunes, N.J. (2020). Towards Eco-Centric Interaction: Urban Playful Interventions in the Anthropocene. In Nijholt, A. (Eds.) *Making Smart Cities More Playable. Gaming Media and Social Effects*. Springer.
- Wagner, D. L., Grames, E. M., Forister, M. L., Berenbaum, M. R., & Stopak, D. (2021). Insect decline in the Anthropocene: Death by a thousand cuts. *Proceedings of the National Academy of Sciences*, 118(2).

The plurality of wayfinding systems

Daniela D'Avanzo¹ (0000-0002-0328-821X)

¹Polytechnic University of Milan, daniela.davanzo@polimi.it

Abstract. In the complexity of our contemporary urban space, wayfinding systems might be considered not only with their primary role of orientation systems but also with the role of information systems for a territory as an instrument to express the cultural diversity of a place. To do that, the wayfinding system should have specific characteristics. This research aims to highlight them, answering the following question: what are those design features of a wayfinding system that can help to communicate the plurality of a place? To address this question, a multiple case study approach has been chosen to analyse and compare some examples of wayfinding projects mainly related to the three following aspects: multilingualism, intended as the capacity to communicate through different languages to express a variety of linguistic and cultural community living in a given territory; the multimodality, seen as the possibility to use more than one media to convey different messages; the participatory process, in which the ordinary people are part of the design process.

Keywords. Wayfinding / Urban Space / Plurality / Communication Design / Projects

1. Introduction

In the existing literature, wayfinding systems have been usually defined as a set of signs helpful for the users to find the way to their destination in an unknown environment (Lynch, 1960; Arthur & Passini, 1992) and, for this research, in an urban public place (Carmona et al., 2003; Gehl, 2011). However, what if we also consider them as informative systems about the place? As a manner to communicate the urban place in its complexity and in its stratification of stories, cultures and time? In order to be successful in this role, wayfinding systems should be the expression of the complexity of the place (Marrone, 2009; Pezzini, 2008; Volli, 2007), conveying not only a singular identity (Remotti, 1996) but bringing to light the multiplicity of subjects living in that place. In embracing this function, wayfinding systems could improve users' sense of belonging to that place (Zingale, 2012), helping the orientation skills and enhancing the liveability of that place (Manzini, 2021). In order to do that, wayfinding systems should have certain characteristics and this research aims to highlight those helping to bring to light the plurality of a place.

2. The features of wayfinding systems

A first review of the literature has helped deepen the existing classifications and characteristics usually linked to wayfinding systems, leading to divide those features into two categories: those related to the physical structure and those related to the message. The first set is the one that most concerns the technical part and includes characteristics related to typography (the font used, the spacing, the arrangement), pictograms and arrows (the expressivity or conventionality of the symbols), colors (contrast, color coding...), maps (diagrams, plans, you-are-here maps...) and other media (use of images, digital technologies). It can also include characteristics related to the shape and the signage setting, including parameters such as size, shape, materials, grouping, location, mounting, and lighting (Calori, 2007; Gibson, 2009; Mollerup, 2005). All these technical features are essential in shaping a common language for wayfinding systems. The repetition of the same characteristics declined for each sign makes them identifiable as part of the same set enhancing the perception of the message. This leads us to the next set of features: those related to the message. This is a more qualitative classification based on the content of the message itself and on the impact that it has on the receiver. It is very much connected with the way of using the technical features and it mainly lists three qualitative characteristics: legibility, comprehensibility and persuasiveness (Mollerup, 2005). This very wide range of features, and more that might be added, is related to any kind of wayfinding system. However, going deeper into some of them, it is possible to see how some specific aspects might be helpful in communicating the plurality of a place. To better understand them, I analysed several wayfinding projects in urban spaces to highlight those elements that better communicate the so-called plurality. Through this case study research, I have pointed out three features helpful to communicate the plurality of a place: (i) multilingualism, intended as the capacity to communicate through different languages to express the variety of the linguistic and cultural community living in a given territory and strictly linked to the typography; (ii) multimediality, seen as the possibility to use more than one media in order to convey different messages and related to the inclusion of different types of content; (iii) participatory process, in which the people are involved in the design process bringing their knowledge and experiences to the project.

3. Case studies

Two case studies will be analysed for each of the three features, to explain them better. The projects chosen to deepen the aspect of multilingualism are the *Cité Internationale Universitaire* in Paris and the *Quartier Européen* in Bruxelles, developed by the same design studio, Integral Ruedi Baur Paris. Concerning the participatory process, the two case studies considered are the *Pôle Molière* in Paris by Malte Martin and *Leer Madrid* by Applied. For the multimediality, the selected case studies are *NYC*

Beach by Pentagram and *Legible London* by Applied. They all tell a different approach to the issue that we will now see in detail.

3.1 Multilingualism

The first case study is the *Cité internationale Universitaire de Paris* (Fig1), a big university campus that brings together hundreds of nationalities. This wayfinding project, part of the area's brand identity, was developed around 2002-2004 by Integral Ruedi Baur Paris, and has its core element in the typography. The font *Newut Plain*, by André Balfinger, is the base on which a set of fifty-seven more characters from selected alphabets from all over the world is added. Each of these glyphs has been chosen based on its formal resemblance with a Latin character so that it can be replaced and read as part of the Latin alphabet (Cité internationale Universitaire, 2022; Integral Ruedi Baur, 2010). This random mix of glyphs from different languages works to communicate the cultural multiplicity that is part of *Cité Internationale*. Although this project might be controversial nowadays because it is based on the shape more than on the content, it was successful when realised. This formal similarity of the glyphs worked in communicating the cultural multiplicity not only in the brand identity but also in the signages, succeeding both in the comprehensibility and in the expression of the plurality.



Fig. 1. Integral Ruedi Baur, Cité internationale universitaire de Paris, 2002-2004. The typeface used and its application in the wayfinding system.

The work of Ruedi Baur around the concept of multilingualism has been carried on through the years in several projects and from different perspectives. One of those interesting for this research is the *Quartier Européen* (Fig2), a typographic installation in a public area of Bruxelles, to talk to people of different nationalities, addressing different themes related to the history of the place. This project, like the previous one, works on typography and the integration of four different languages, representative of the cultural multiplicity of the territory (Quartier Européen, 2022). In this case, the languages are not mixed. They live together in the same graphic space and with the same importance as the people in their public space.



Fig. 2. Integral Ruedi Baur, L'Europe en quartier, les quartiers de l'Europe, 2010. The totem with the four languages used at the same time.

3.2 Participatory process

Regarding the participatory process, the two following projects are relevant for different reasons. The first case study is *Pôle Molière* (Fig3) by the French designer Malte Martin. This project has been developed in the Mureaux neighbourhood, in the Paris periphery, in an area devoted to public services for citizens with different cultural backgrounds. The exciting aspect of this project is the community's involvement. Alongside the wayfinding project's development, a series of workshops has been carried on with the inhabitants, both to make them feel part of the design process and to start a process of reappropriation of the public space. The use of simple shapes and distinctive colors, instead of written language, for the orientation system made the interaction with the space and among the people easier and funny (Cerri, 2020)

In the second chosen case study, *Leer Madrid* by Applied (Fig4), the involvement of the people has a less civic impact but still has an importance in the development of the project itself. The aim of the project is that every group living in the area should benefit from the design of a multi-layered wayfinding system. In doing so, trying to give voice to all of them from the beginning is the first step. Another essential aspect is the naming of the places (Leer Madrid, 2022). A correct nomenclature of the areas should facilitate the perception of the places for the different user groups and enhance the urban area's plurality .



Fig. 3. Malte Martin, Pôle Moliere aux Mereaux, 2010. The totem with the four languages used at the same time.



Fig. 4. Applied, Leer Madrid, ongoing project.



Fig. 5. Pentagram, NYC Beach. Identity and signage for New York City Beaches.

3.3 Multimediality

The case studies chosen to express the concept of multimediality are very different from each other. The first one, NYC Beach by Pentagram (Fig5), expresses the concept of multimediality from an analogic point of view. This wayfinding project was developed after Hurricane Sandy hit New York city and its beaches were severely compromised. A complex project of restoration of the area took place comprising the signage system and environmental graphics. The idea behind the wayfinding project was to show the area as it was before, using pictures taken in the exact spot and from the same perspective of the sign (NYC Beach, 2022). This project gives an insight into the possibility of communicating the plurality of the place as an expression of its evolution through time to enhance a sense of place, using the integration of simple analogical media, such as photography, in the signage system.

The second case study is *Legible London* by Applied (Fig6). This wayfinding system is an integrated system, made of totems and signs spread all over London, that, over the years, has been implemented with digital technologies able to enhance the experience of navigation through the city (Legible London, 2022). Even if this project does not express the concept of plurality, it is a very successful example of an integrated system that could be used to communicate on different levels and in different way place, including its plurality.



Fig. 6. Applied, Legible London. Elements of the wayfinding system
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for the City of London.

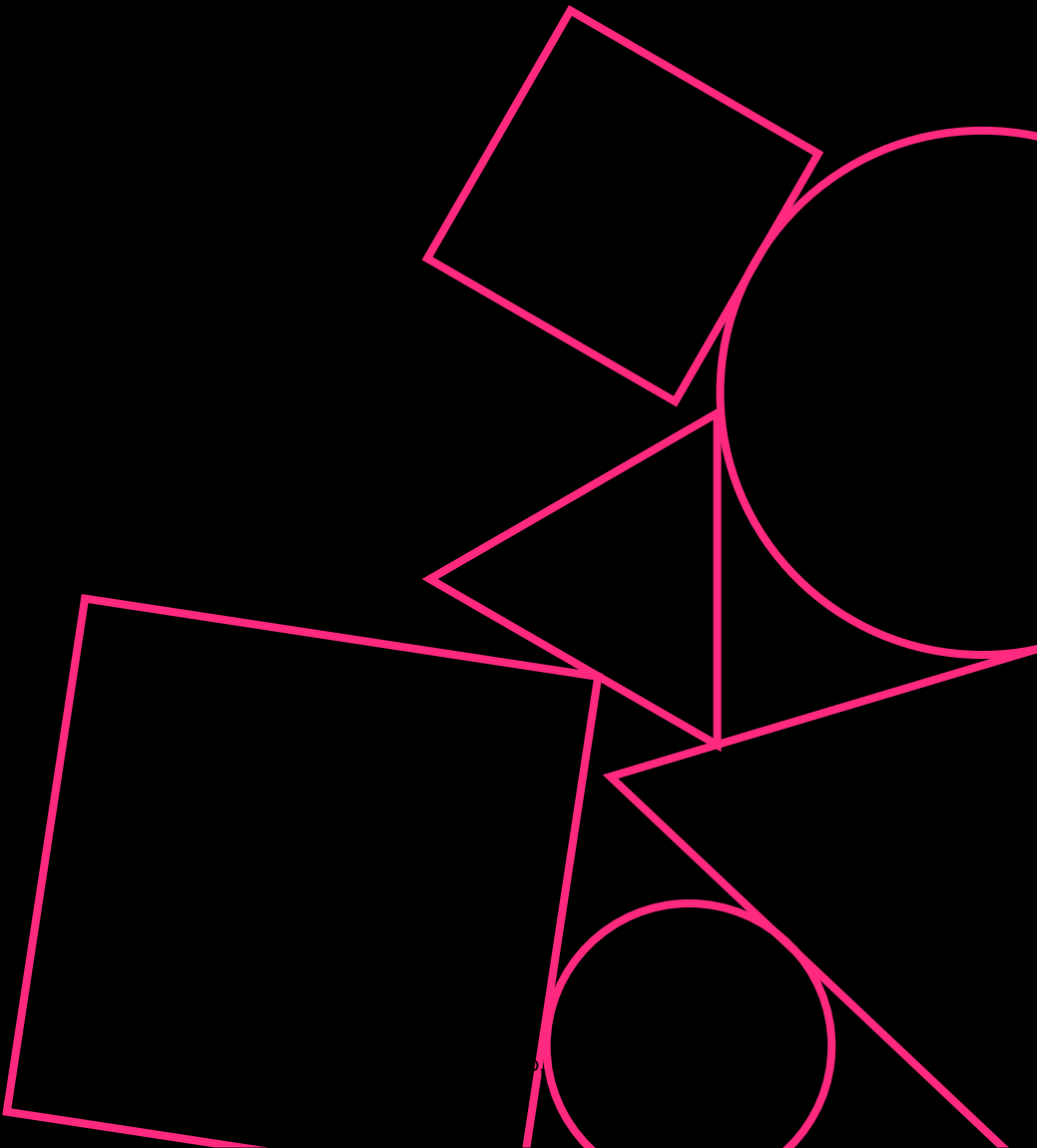
4. Conclusions

This is a first classification of the possible wayfinding systems' features able to communicate the plurality of an urban place. Multilingualism, multimodality and the participatory process are the characteristics that emerged more strongly from the case study analysis, but this set is not fixed yet. Adding more features to this classification offers the chance to further developments of the research

References

- Arthur, P., & Passini, R. (1992). *Wayfinding. People, Signs and Architecture*. McGraw-Hill.
- Baur, R. (2010). *Ruedi Baur Intégral: anticiper, questionner, traduire, irriter, distinguer, orienter, inscrire*. Lars Müller Publishers.
- Calori, C. (2007). *Signage and wayfinding design: a complete guide to creating environmental graphic design systems*. J. Wiley & sons.
- Carmona, M. et al (2003). *Public Places Urban Spaces: The Dimensions of Urban Design*. Princeton Architectural Press.
- Cerri, S. (2020). Segni nello spazio pubblico. Communication design e narrazione dei luoghi. *Rivista. Research for Landscape Architecture*, 18 (1), 126-175.
- Cité internationale Universitaire*. (2022, October 19) Retrieved from www.irb-paris.eu/.
- Gehl, J. (2011). *Life between Buildings: Using Public Space*. Island Press.
- Gibson, D. (2009). *The Wayfinding Handbook: Information Design for Public Places*. Princeton Architectural Press.
- Leer Madrid*. (2022, October 19) Retrieved from www.appliedinformation.group
- Lynch, K. A. (1960). *The Image of the City*. MIT Press.
- Manzini, E. (2021). *Abitare la prossimità. Idee per la città dei 15 minuti*. Egea.
- Marrone, G. (2009). *Dieci tesi per uno studio semiotico della città. Appunti, osservazioni, proposte, E/C*.
- Mollerup, P. (2005). *Wayshowing. A guide to environmental signage. Principles and Practices*. Lars Müller Publishers.
- NYC Beach*. (2022, October 19) Retrieved from www.pentagram.com
- Pezzini, I. (2008). *Nuovi spazi semiotici nella città – Due casi a Roma. La città come testo. Scritture e riscritture urbane*. Aracne.
- Quartier Européen*. (2022, October 19) Retrieved from www.irb-paris.eu
- Remotti, F. (1996). *Contro l'identità*. Laterza.
- Volli, U. (2005). *Per una semiotica della città. Laboratorio di semiotica*. Laterza.
- Zingale, S. (2012). Orientarsi tutti. Il contributo della semiotica per un Wayfinding for All. In Steffan, Isabella T. (Ed.), *Design for All. Il Progetto per tutti. Metodi, strumenti, applicazioni* (Parte prima). Maggioli.

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This volume presents the contributions presented during the last edition of the 2CO International Design Conference in Alghero (8/9.9.2022), in the two conference tracks Full Paper and Junior Track and the sub-topics informative-animation; interactive data visualization; info-graphics; informative environments.

Following a double-blind selection process based on submissions in the form of long abstracts, the contribution's authors presented their papers at the Conference and, after a further selection step by the conference's Scientific Committee, were invited to submit the final contributions that you will find in this volume.

The volume collects various classes of contributions presented during the event: long papers, short papers/junior track, posters, on the conference's four main areas of interest:

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- _interactive data visualization;
- _info-graphics;
- _informative environments.

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