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# Towards a new design culture of scientific production – Innovating the formats of scientific publication of design

Eleonora Lupo<sup>\*a</sup>, Beatrice Gobbo<sup>a</sup>, Emilio Lonardo<sup>a</sup>

<sup>a</sup> Politecnico di Milano

\*eleonora.lupo@polimi.it

**Abstract** | In Italy, the normative system of evaluation of the quality of scientific production and publication of design research is becoming articulated and complex. Moreover, the cultural dominance of western and Anglo-Saxon centred vision and standards need to be complemented by a plurality of approaches and narratives on design. Many trends are permeating internationally the design field, and in particular, the ones related to digital transformation. In this respect, one of the contemporary challenges that design research is undergoing is to reach an authoritative, high impact and effective scientific production. Starting from a collection of cases and practices from different disciplines which thoroughly summarizes the state-of-the-art, this paper, describes an ongoing research project aimed at innovating the design cultures of scientific production and publications, presenting the exploration of them according to a proposal of an innovative publication lifecycle. Finally, it proposes an envision of a format of scientific publication in design.

**KEYWORDS | SCIENTIFIC PRODUCTION, PUBLICATION LIFECYCLE, PUBLICATION FORMATS, COMPOSING, ECOSYSTEM**

# 1. Introduction

## 1.1 Background

The topic of academic publication which, although in a different way, has always played a central role in the different historical periods of scientific divulgation, today is going through a moment of profound change. Publication is central to the making of science. Epistemologically, it is a critical step in the making of publicly accepted knowledge; sociologically, publication has become the measure by which researchers are evaluated for tenures, promotions, and grants (Fyfe, 2000). Most of the features we associate with the modern scientific journal – including originality of research, self-authorship, refereeing procedures, and standardized rhetoric and structure – were nineteenth-century developments, while big profits, the use of English as the international language of science, and the emergence of professional bodies for managing editors and publishers are largely twentieth-century phenomena (Baldwin, 2018; Moxham & Fyfe, 2018). Until the mid-nineteenth century, original research could be first published in a wide variety of places. Reports of new research findings might sit alongside book reviews and letters to the editor in a magazine devoted to natural philosophy or amid discussions of philology, antiquarianism, and moral philosophy in learned journals (Peiffer, et al., 2013). By 1790, at least a thousand scientific and technical journals had been established (Kronick, 1976). Around a quarter of these were the transactions of learned academies and societies, but the majority were independent, set up by printers, booksellers, or editors with the hope of turning a profit from the learned and/or public culture of science. As before, most of the new periodicals were short-lived. But by the end of the eighteenth century, a handful of editors demonstrated that, with the right commercial skills and a good network of contacts, an independent journal could be successful (Fyfe, 2000). Recent attempts to estimate the number of academic (not just scientific) journals globally suggest that there may be around a quarter of a million – but in 2010 perhaps only 24,000 of these were scholarly peer-reviewed journals (Larsen & Von Ins, 2010). The proliferation of scientific journals has reflected the emergence of new specialisms, the establishment of new societies, the growing number of researchers seeking to build careers, and the global expansion of the scientific enterprise in the late nineteenth and twentieth centuries, but the expansion of scientific research had placed strains on these publishing programs, with more research papers meaning more expense. Elsevier and Pergamon Press took advantage of the post-war boom in science funding – including library budgets – to increase circulations of their journals and to raise the prices charged to institutional subscribers (Fyfe, 2000).

In recent years the body of design research develops and expands, and it is interesting to examine the publication patterns of institutions and researchers publishing in the field of Design. Particularly, the scientific publication in the field of Design reflects some factors related to the recent valorisation of the disciplines, but also the richness of approaches,

fields and applications combined with a proactive and often innovative attitude that design is used to propose in terms of content and visualizations.

## 1.2 Relevance

The digital transformation is also permeating the field of academic publication in design on a global level: the concept of *phygital* (the interaction between the physical and digital world) blurs its boundaries and research areas, introducing new ways of intervention. In this context, the scientific production and diffusion of design, especially in the international sphere, are taking on new forms and objectives, becoming increasingly unstructured, broad and, thanks to the digital environment, rhizomatic, with the related strengths (e.g. accessibility) and weaknesses (e.g. reliability).

For example, with the *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities* (2003) the open access paradigm has acquired great importance.

Paradoxically, the Article Processing Charge (APC) system of peer reviewed scientific journals (WOS, SCOPUS), increasingly recognized as a quality criterion, remains the responsibility of the authors. Meanwhile, especially in Italy, the regulatory system for the evaluation of scientific production is becoming more and more complex, due to procedures often conflicting at different institutional levels (university criteria, VQR, ASN), in a framework of actors (ANVUR, SSD scientific boards) equally varied.

These conditions have a considerable impact on the circulation of high-quality scientific production and limit the possibility of innovating its methods and formats; one of the challenges is to enable new spaces for experimentation in order to achieve authoritative, high-impact and effective communication, pursued with a multiscale strategy, which guarantees scientific productivity and extended impact (e.g. the third mission), while maintaining rigour and authority.

The European Community's Future of Scholarly Publishing and Scholarly Communication report written in January 2019, proposes a vision for the future of scholarly communication; it examines the current system and its main actors. It considers the roles of researchers, research institutions, funders and policymakers, publishers and other service providers, as well as citizens and puts forward recommendations addressed to each of them. In structuring the context of reference recalls that the whole of the scholarly communication exists to offer researchers the possibility of participating in a distributed system of knowledge that approximates H. G. Wells' vision of a "world brain", also remembering how, starting in the '80s, the whole research ecosystem has invested the metrics with great power: overall, researchers, funders, and university assessments have come to rely too much on the evaluation function of scholarly communication as structured by the JIF.

For the UE, researchers and their needs must be put at the heart of scholarly communication of the future. This scholarly communication system must support and facilitate the use of knowledge and understanding for as wide a range of participants as possible, with as wide a

range of purposes as possible, including its integration into new lines of investigation and new forms of education, according to the principles of: *Maximizing Accessibility, Maximizing Usability, Supporting and Expanding range of contribution, Building a distributed and open infrastructure, working for equity, diversity and inclusivity, building community, promoting high-quality research and its integrity, facilitating evaluation, promoting flexibility and innovation, investigate cost-effectiveness* (European Commission, 2019). In this context, the European Community hopes that working partially against this trend new technologies and services now enable researchers to take back some control over some elements of publishing, in particular registration and dissemination. They can, for example, ensure attribution to their own work by posting versions of their outputs on web-based and open access services such as an institutional repository, or a thematic repository such as *arXiv* (Cornell University, 1991). In doing so, they maximise dissemination and accessibility to their own work by themselves.

Universities have always been key actors in scholarly communication in the context of their research and educational missions, so they are both co-operative and competitive and seek to maximise the dissemination and impact of their research but, in the last fifty years, they have partially and gradually disengaged from their roles as publishers. Digital technologies, especially in their free and open form, allow them to design, maintain, evolve and control their own dissemination tools.

In this the design discipline can be a pivotal field for the experimentation and discussion of new scientific publication formats.

A recognized academic community such as the Design one has the responsibility to discuss and innovate the contexts in which scientific dissemination and dissemination are produced and made accessible, and to propose a vision characterized by its recognizable design culture.

### 1.3 Related work

Since it is a work in progress research project, this section does not claim to be exhaustive but simply presents the context outlined in the analysis path, deliberately excluding from this review platforms and events relevant but mainly informative (e.g European Researchers' Night) and technical-instrumental approaches: many resources and tools are available online on how to develop effective dissemination strategies, especially in relation to research findings of projects.

By exploring the digital environment many bottom-up initiatives of dissemination, addressing visual qualities and aesthetic experience can be observed, having a potential of development in term both of novelty and authority with vantages (accessibility, contributiveness...) and sometimes disadvantages (authoritativeness, reliability...).

Among the major changes that have occurred in recent decades in the field of scientific publication, the open access movement has disrupted the way scientific knowledge is

distributed. Due to excessive commercialization and price increases, Open access scholarly journals enable users from throughout the world to access information freely, as these journals can be freely accessed online without any legal, economical, or technical barriers. (Kim, et al., 2018)

The theme of new models and tools for scientific dissemination, in relation to digital transformation, besides being conspicuous on-line at a popular and technical-practical level, is widely debated in literature. As example Tenopir and King on the subject of e-journal propose “new, electronically mediated peer review models” while some scientific fields, such as medicine, reflecting on a scenario in which traditional metrics are flanked by the more recent ones of blog e social media based on the availability of sources and accessibility to dissemination channels on effective digital infrastructures. (e.g. Jama network).

A good reconnaissance is offered to us by Kim, Chung e Lee who outline a scenario according to which new formats of articles include graphical abstracts, interactive PDFs, the application of semantic enhancements, and the utilization of research data, social networking sites, such as *Mendeley* (Elsevier, 2007) and *ResearchGate* (Fickensche, 2008), have become common sites for information exchange; *altmetrics* have been adopted to complement traditional journal metrics and *PubMed Central*, *F1000Research* and *KoreaMed Synapse* have been introduced as innovative full-text scholarly journal distribution systems. With their work they have outlined a number of current trends in scientific publication which analyses new formats of journal articles (e.g. JAMA by American Medical Association and Nature Podcast by Springer Nature), ways of improving semantics in scientific publication, the use of research data and academic social networks (e.g. ResearchGate, Academia) and new distribution systems (e.g. PMC, F1000Research, Frontiers).

In this context, therefore, even the major actors are moving to try to accompany this process of change. In November 2010, Springer announced a new product line – *SpringerBriefs* (Springer, 2011)– for works between 50 and 125 pages in length. *SpringerBriefs* are concise summaries of cutting-edge research and practical applications across a wide spectrum of fields; then the following year, 2011, saw the launch of Princeton Shorts, brief selections taken from previously published influential Princeton University Press books and produced exclusively in e-book format.

In 2012 was the turn of Palgrave Macmillan, that launched *Palgrave Pivot* (Palgrave & Macmillan, 2012), an innovative format for scholarly research offering a new mid-form format for publication.

The discipline of design is relatively young but has rapidly matured in recent decades. This is evidenced by an increase in the number of design journals and dedicated design conferences since the late 1980s, and by an increase in the amount of attention being paid to design in journals from other academic fields like innovation and marketing (Gemser & de Bont, 2016). But as well explained by the authors, a particular criticality also emerges in this area: on the one (Opening Science, 2012) hand there is cultural production that can be valorized in

terms of scientific production, on the other hand there are quality content that cannot be technically valorised, but that builds reputation and identity. It is therefore appropriate to question about the new methods of production and representation of design knowledge and, above all, about overcoming the limits of exclusively textual models of dissemination, which sometimes fail to be flatly effective.

## 1.4 Research questions

The ongoing research project is aimed at innovating the design cultures of scientific production and publication, starting from a structured presentation of a collection of relevant case studies.

The underlying research questions concern the role of innovative practices in the scientific publication process, the identification of those stages in which the traditional practices could be released and the envisioning of communication strategies for making innovative practices techniques available to the design scientific community.

The project is based on three main intertwined hypotheses, that are:

- The lifecycle of a scientific publication is going to be more and more circular and iterative instead that a linear one (from data collection, to authoring, peer review and publication and dissemination): the co-creation and co-contribution paradigm are already established in some works, but the circulation, use of re-use of scientific contents can be further promoted and improved, maintaining authorship. For doing this, lifecycle phases need to be individuated and empowered in order to be transformed/enriched in innovative functionalities performing a multi-layered and growing publication (i.e.: sharing, evaluation, reuse etc.);
- The size of a scientific publication is going to/can change during its lifecycle(s), due to different use, re-use and contribution, allowing to add different layers of content;
- In both the above-mentioned process, *traceability of authorship* and *assessment* of contents needs to be pursued in order to maintain rigour and accreditation.

## 2. Methods

### 2.1 Approach

The research has been structured in five phases according to the main research questions.

1. The first phase of the presented research refers to the *contextualization and framing* of the problem, considering both, inquiries related to the innovation in the scientific publication process and ground-breaking case studies;

2. In the second phase, attentive scrutiny and *classification of existing innovative scientific publication formats*, coherent with the above-mentioned hypotheses, have been performed;
3. The third phase is devoted to the envisioning, design and prototype of a new format that will further develop the concept of open lifecycle and size of scientific publication in the field of design, and eventually other disciplines;
4. Finally, the fourth and fifth phases are respectively dedicated to the evaluation of the prototype and its dissemination and spreading across the scientific community.

The paper will exhaustively present the first two phases

The research involves ten researchers coming from different fields of Design.

## 2.2 Evaluation Matrix Design

### *Evaluation Criteria*

The first phase, contextualisation and framing aimed at defining the common elements of innovative practices, has led the design of a shared spreadsheet where all the innovative case studies would be collected in a matrix.

Besides straightforward classification parameters such

- Title of the project;
- Year of publication;
- A brief description;
- Disciplinary field;
- Type of accreditation;
- Type of media supported;
- Format;
- Contact person;
- Management;
- List of keywords.

The size and life-cycle stages categories were introduced being those parameters themselves results of the research. The introduction of those tailor-made categories has led the researcher to classify all the case studies according to the first phase of the research.

### **Size**

The *size* parameter refers to the dimension of the product, according to the type of elements which contains. It could be a single item, an ecosystem or a platform. A *single item* is a single, stand-alone unit with well-defined borders even if composed by a different type of media: for instance: a book, a website, an application (National Science Foundation,

2011). An *ecosystem* is an independent system of contents, with well-defined borders and structured by single and discrete units (Howard Hughes Medical Institute, 2011). Finally, a *platform* which is intended as a service of access, research, consultation and or production of contents (JoVE, 2006) (Figure 1).

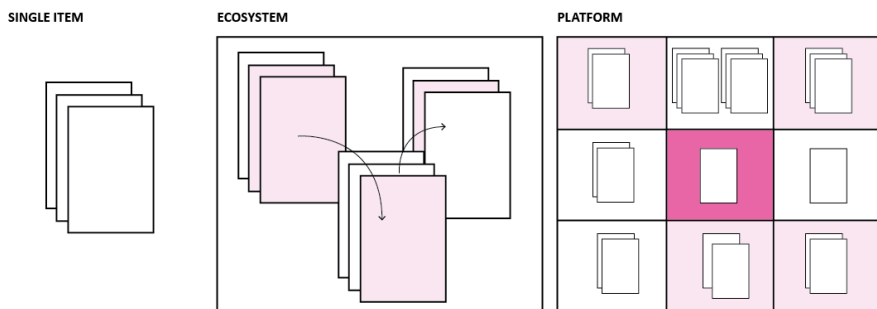


Figure 1. The size evaluation criteria.

### Publication lifecycle

The publication lifecycle which is not innovative per se (Björk, 2005) is intended as a recursive chain of steps aimed at the final publication. As already introduced, the aim of the project is to transform the stages in specific processes for innovating the publication, both in the analysis of case studies, and especially in the new publication format prototype.

Indeed, during the case studies classification, the need to identify at what stage in the publication cycle the innovation had been introduced emerged; for that reason, has been added in the classification parameters.

Initially, the proposed publication life cycle included ten separate stages, which have been inferred from the analysis of the literature.

Innovation in scientific publishing at the level of exploration, means designing artefacts able to help researchers in finding articles correlated to their research interests and for some years now it has been managed by machine learning algorithms such as natural language processing which allow better customisation of interests. Moreover, some platforms allow users to save and archive material to be cited later.

At the stage of sharing, are involved platforms and websites helping users to share in-progress research. Micropublication (Micropublication, 2019) is an example such as (Cornell University, 1991) repositories which allows a direct conversation with other researchers.

Moreover, there are some examples at the connection stage, which is strictly correlated with the sharing phase. The stage of connecting refers to the dynamics adopted to connect with



other researchers. Academia (Academia, 2008) and ResearchGate (Madisch, 2008) are well-known and striking examples.

Then, especially when dealing with collaborative articles, innovative practices of writing articles are required. CodeOcean (CodeOcean, 2017) and Overleaf (Overleaf, 2014) are only two of the existing dozens.

Between the *writing* and *publishing* stage, a critical and underestimated moment is the one dedicated to the *composition* of contents. *Composing* means articulating and augmenting, giving the user the opportunity to increase the value of the research. This stage, more than the others, is crucial in the design activity. The naming itself of the stage refers to that design task which embeds the selection, structure and communication of the scientific contents.

The *publishing* stage includes all the tools and platforms aimed at accelerating the publication of peer-reviewed science. Moreover, the *reading* stage includes systems and tools which allow improving the reading experience. The annotation tool *Hypotheses* (Hypothesis, 2013) is one of those examples. The process of evaluation has been subject to innovations too, being open peer reviews increasingly common. The *re-using* stage covers tools and platforms aimed at tracking scientific contributions and ensuring that the original research is reproducible. Finally, some other cases, focus on the *innovation* of the *assessment* stage, which best practice is the assessment and check of the impact of scholarly research.

### *Evaluation Matrix*

Furthermore, according to the ten evaluation criteria aforementioned, an evaluation matrix of case studies has been designed in order to systematically and collaboratively store the outstanding cases in the literature.

From a list of more than 400 projects, presenting innovative practices in the publication lifecycle, 50 relevant cases have been chosen as more relevant to our research, taking in consideration their level and stage of innovation, trying to cover each publication stage with a balanced number of examples.

Finally, the latest version including the most ground-breaking 20 cases has been made.

The evaluation matrix, which will be commented and explored in the Results session, will be the starting point for the third phase of the research project.

## **3. Results**

As we mentioned above, the paper is presenting the preliminary results of ongoing research.

In this session

- The evaluation matrix;
- The updated publication lifecycle scheme;
- The *Prode* identity and the website-archive.

will be presented.

As we mentioned in the Methods paragraph, the publication lifecycle stages have been exploited for classifying case studies. The majority of the presented projects is not specifically tailored for a specific discipline or field but there are some cases such as *Jove* (JoVE, 2006), *Distill* (Distill, 2016) and *Parametric Press* (Matthew Conlen, 2019) that are discipline-oriented and very effective. By browsing the matrix (Figure 2), it's clear that the discipline-oriented cases embed innovation in the stages of *writing, composing and publishing* which lies at the heart of the cycle. Indeed, the way contents are organised, mixed, structured and augmented must be peculiar to each field of research. If the literature offers examples where ad hoc platforms have been created for medicine, biology and computer science there still seems to be room for experimentation in the Design field.

*Parametric Press* (Conlen, 2019) and *Distill*, are built atop *Idyll* (Heer, 2018) an open-source toolkit for writing interactive articles. Even if geared towards computer science, data visualisation and social science topics, both of them offer to the user the possibility to build interactive views and customise digital content — which is a feature to take in consideration when moving to the Design field —.

One of the main outcomes of these phases was the identification of three most promising stages from the publication lifecycle the *writing, publishing and composing* from which to start designing the final prototype. Indeed, giving the researcher the possibility to customise interactive digital content, is the stage of the publication lifecycle named *composing*. (Figure 3)

As a result of the first two phases, a website has been designed, in order to both share the research process and present the ongoing results: at the end of the research, the website will be the main touchpoint providing a framing and contextualisation of the research, an easily updatable archive of projects and the main point of access to the final prototype.

The website has been designed in order to share the results among the scientific community of the design field. For that reason, the name of the project is PRODE, which *means PRO Design, Scientific PROduction in DDesign*.

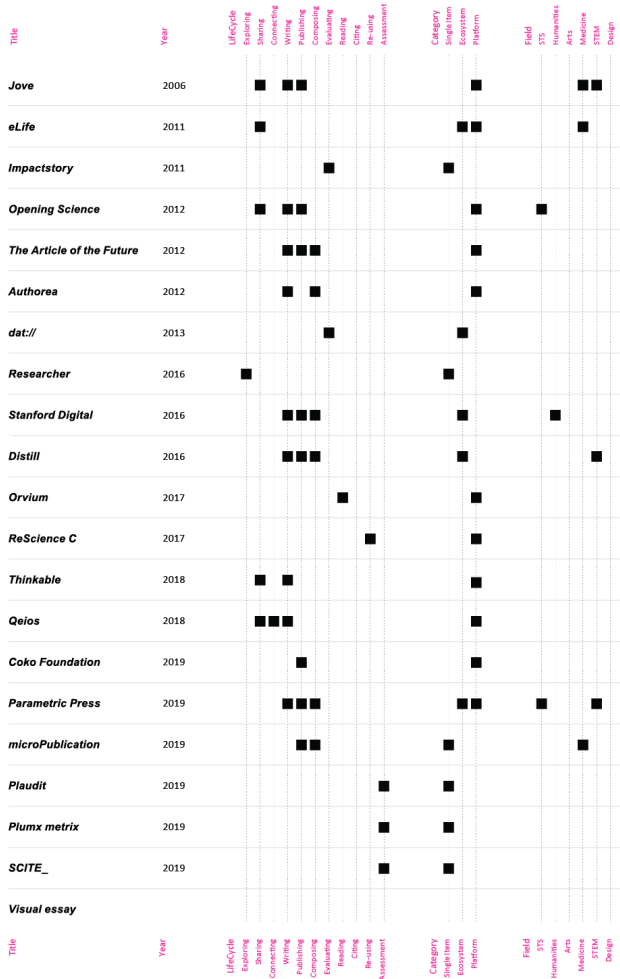


Figure 2. A matrix showing the most relevant case studies collected. For browsing the complete matrix check the website.



Figure 3. The publication lifecycle according to the case studies analysis. Highlighted in pink the stages of the publication lifecycle identified as promising.

Until this moment the website is structured in four pages:

- The home page: where the research project is presented;
- The about section where the produced material and the aim of the research is explained;
- The news page where activities are shared with the community;
- The case studies area, that, serving as an archive, collects and shows the analysed and relevant case studies.

In the case studies page, projects can be filtered by publication lifecycle stages through a dropdown menu. One of the most important features of the website is that the case studies area is easily editable, being directly connected to a google spreadsheet which effortlessly updates data. The spreadsheet feeding the website is organized according to some of the criteria of the evaluation matrix:

- the title of the project;
- a relevant image;
- the year of publication;
- the brief description;
- the size;
- the type of product;
- the field.

By doing so, the website becomes both *an explorative tool* and *a logbook* for the research team.

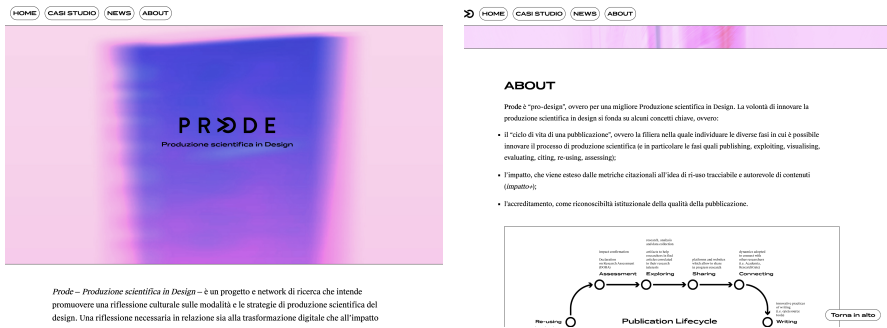


Figure 4. The Home page and the About section of PRODE. <https://produzionescientificaindesign.github.io/Prøde/>

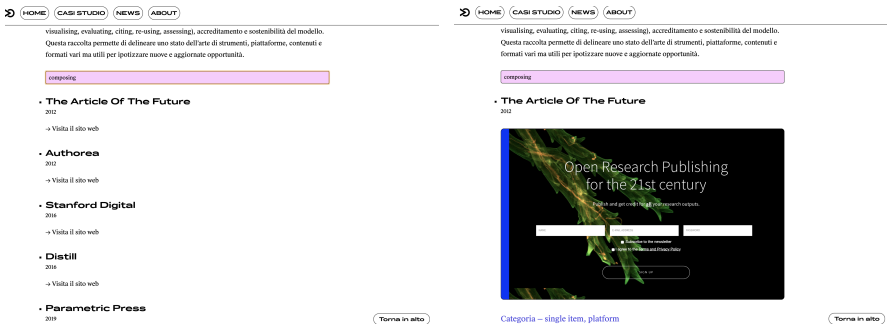


Figure 5. The case studies page. On the left a view filtered by the “composing” stage. On the right, a single case study. Users can filter data and explore single projects by reading the short description or visiting the web pages.

## 4. Discussion

The paper mainly highlights and distils the theoretical contribution of the presented ongoing research. The practical contribution, dealing with the envisioning and design of the prototype is still in its embryonic phase and, for this reason, it will be discussed later.

The definition of the publication lifecycle and the identification of writing, composing and publishing as the most promising stages are the main theoretical contributions of the paper. Specifically, the composing phase could be linked to common design practices and become the most encouraging one for the development of the research.

The design discipline can be a pivotal field for the experimentation and discussion of new scientific publication formats, so this is the reason why, after designing a prototype format, the aim is to have a discussion with a seminar to present the project to design-field researchers and scholars and to publishers to ask to try it and gain feedback as well first new formatted developable science.

The final output will be a prototype of a format that through scalable and implementable parameters will offer different models of visualization and units of organization of scientific content, allowing to experiment in more traditional formats, multimedia and multi-channel dissemination and sharing.

As first experiment, it is intended to draw on content already existing in the department and provided by the community itself, according to availability and interest.

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**About the Authors:**

**Eleonora Lupo.** Designer, PhD in Disegno industriale e comunicazione multimediale, is Associate Professor in Design at Politecnico di Milano. Her research interests are mainly Humanities and Culture Driven Innovation, Design for Cultural Heritage and Product and process design cultures.

**Beatrice Gobbo.** Since November 2018, she has been a PhD student in Design at the Politecnico di Milano. She is a member of Density Design Lab, a research group focused on data visualization and information design. With her current research she is investigating on the role communication design and information visualisation in the field of explainable artificial intelligence

**Emilio Lonardo.** PhD Candidate, Tutor at Politecnico di Milano and Lecturer at Poli.Design. Academic work mainly focused on urban regeneration. Professionally he is founder and Project Manager of the DOS - Design Open' Spaces project which deals with urban empowerment.

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