

Contents

006 **editorial**

research papers

- 010** Megan E. Blissick, Belinda T. Orzada: *The Effects of Design Protection Legislation on Manufacturer Motivation*
- 028** Amanda Queiroz Campos, Luiz Salomão Ribas Gomez: *Fast Fashion and Globalization: Study of Florianópolis' Sister Store of the Spanish Fast-Fashion Retail Chain Zara*
- 044** Massimo Menichinelli: *A Framework for Understanding the Possible Intersections of Design with Open, P2P, Di use, Distributed and Decentralized Systems*
- 072** Deanna Herst, Michelle Kasprzak: *On "Open" Authorship: The Afterlife of a Design*
- 096** Dr. Robert Phillips, Dr. Matt Dexter, Professor Sharon Baurley, Professor Paul Atkinson: *Standard Deviation — Standardization and Quality Control in the Mash-up Era*
- 118** Gábor Pfisztner: *Photography — Remaking Life, the Universe, and Everything*
- 132** Adela Muntean: *The Algorithmic Turn in the Found Footage Filmmaking: The Digital Remake*
- 150** Dr. Christopher Brisbin: *"I hate cheap knock-o s!": Morphogenetic Transformations of the Chinese "Culture of the Copy"*
- 168** Giuseppe Resta: *Models and Re-elaborations in Late Nineteenth Century Architecture: The Great Tower for London Competition*

essays

- 184** Dr. Dénes Tamás: *A "Reinvented" City*
- 200** Bea Correa: *Authentic vs. Fake*
- 214** **Editors and authors**

A FRAMEWORK FOR UNDERSTANDING THE POSSIBLE INTERSECTIONS OF DESIGN WITH OPEN, P2P, DIFFUSE, DISTRIBUTED AND DECENTRALIZED SYSTEMS

Massimo Menichinelli

ABSTRACT

Since the turn of the century, the discipline of design has increasingly focused its attention on its application to projects and groups of users at a larger scale. Researchers and practitioners have tried to understand how design could shift its focus from single users to local and online communities, from isolated projects to whole complex systems. These new perspectives consequently brought the interest of designers to the tools and strategies that can enable their interactions with larger groups of people distributed in several localities. More specifically, designers and researchers started adopting many approaches coming from software development and web-based technologies, like open source, P2P, di use, distributed and decentralized systems. This article proposes a preliminary framework for understanding and working with the integration of design with open, P2P, di use, distributed and decentralized systems. In one direction, such open, P2P, DDD systems can be applied into design practice: this first intersection has many applications, from digital projects to P2P-based initiatives to physical projects designed and manufactured on global networks of distributed laboratories like Fab Labs and Makerspaces. In another direction, design practice can also have a role in enabling such systems through the analysis, visualization, and design of their collaborative tools, platforms, processes, and organizations. Design, therefore, could learn from such systems and also improve them. This second intersection falls into the meta-design domain, where designers can have a role in building environments for the collaborative design of open processes and their resulting organizations.

The article therefore addresses this phenomenon by providing both an analysis of the concepts and the history of both directions and, in order to understand the phenomena with a broader overview, it proposes a preliminary framework for understanding the possible intersections of design with open, P2P, di use, distributed and decentralized systems through both literature and case studies. As the framework is still preliminary, the article provides as a conclusion some possible strategies for validating or improving the framework.

INTRODUCTION

Since the turn of the last century, the discipline of design¹ has increasingly focused its attention on its application to projects and groups of users on a larger scale than in the previous decades. Several approaches have addressed the participation of users inside design processes, from participatory design to user-centered design, from user experience design to co-design (Rizzo 2009). Even in the art world, participation has been relevant in the past decades, especially with new media art, net art² and activism (Bazzichelli 2008; Dezeuze 2012) where it has grown on a larger scale. More recently, design researchers have worked on co-designing with communities instead of single users (David, Sabiescu & Cantoni 2013), and even with online communities using both online and offline tools (Näkki & Antikainen 2008). The shift from local to online communities is important in the path towards including more users in the design processes, potentially even a large number of them thanks to the scaling and enabling features of social media and online platforms. Researchers and practitioners have tried therefore to understand how design could shift its focus from single users to local and online communities, from isolated projects to whole complex systems. The social, economic and technological changes of the past decades have created new scenarios that are strongly influenced by the phenomena of globalization, the quest for sustainability and recurring economic crises. All these phenomena have brought to the attention of a considerable number of researchers and practitioners in many fields the emerging role of territories and of the communities that live in them for shaping the future of society. Even the design discipline itself—which traditionally focused only on artifacts (be they material or immaterial), but much less on territories and communities—has, since the first years of this century, started to focus on how it could address and foster local resources, communities, and initiatives. Some research projects, workshops, and exhibitions were developed, especially in Europe and Italy, with the focus on the relationships between design and local resources, communities, identities and economies (Verwijnen & Karkku 2004; Fagnoni, Gambaro & Vannicola 2004; Cristallo et al. 2006). Some of these researches also focused on how design could interact with the local dimension and the local community (Villari 2013; Maie & Villari 2006; Menichinelli 2006). These new perspectives have consequently brought the interest of designers and design researchers to the tools and strategies that can enable their interactions with larger groups of people distributed in several localities. More specifically, designers and researchers

¹ The design term has several meanings in the English language and it is adopted by several disciplines. Within this paper, we consider design any project or approach developed by the professional and research community of designers, in all its kinds (industrial design, graphic design, interaction design, and so on), and therefore it could refer to both digital and physical artifacts, material and immaterial projects.

² Within this paper, we refer to net art broadly as artworks and approaches developed with the support of Internet for their development, fruition, interaction and participation by users.

started adopting many approaches coming from software development and web-based initiatives and technologies, like *open source*, *P2P*, *di use*, *distributed and decentralized systems* [Fig. 4].

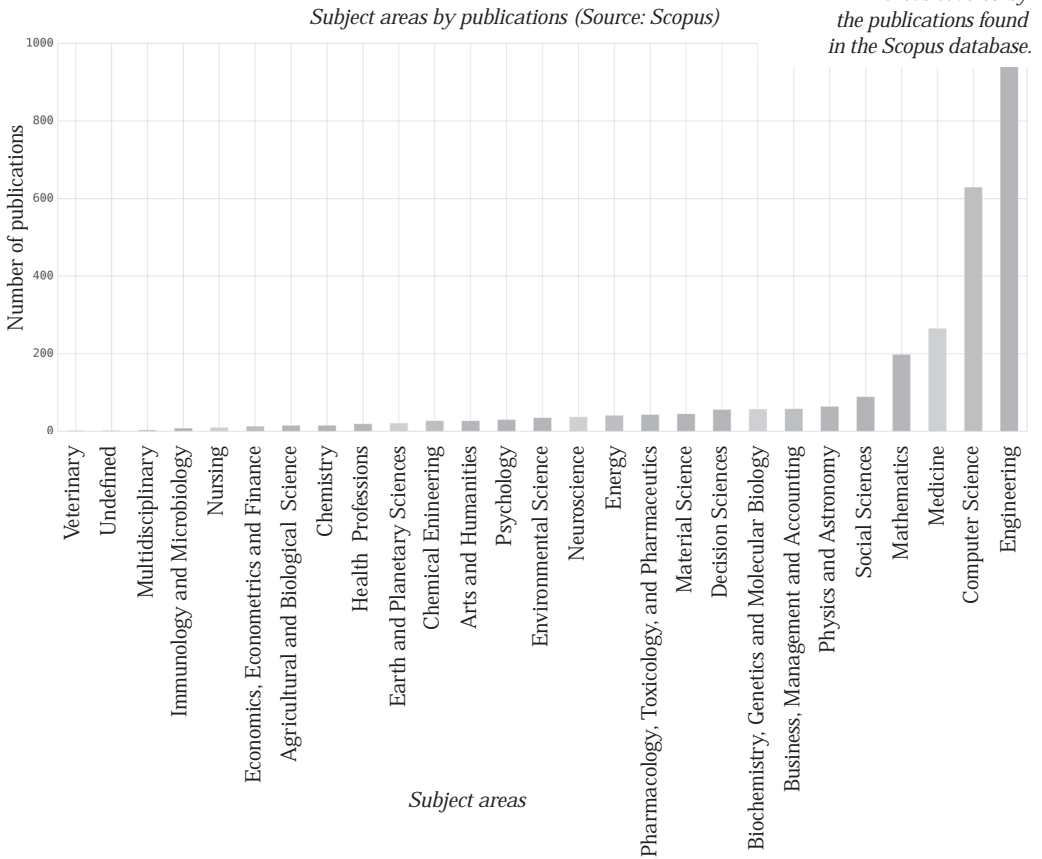
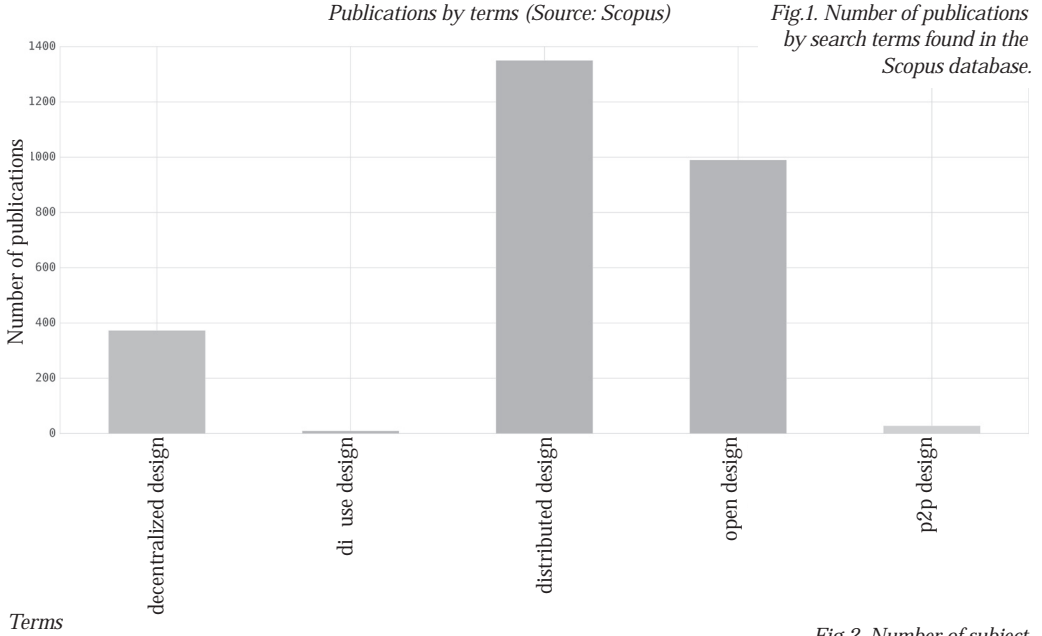
All these web-based initiatives and technologies have become interesting for their ability to exploit the possibility of scaling to hundreds or thousands of people. This new scale for participation and for projects also brought more interest to the dimension of complexity, which is one of the frontiers for the discipline of design, both for visualizing it and for embracing it in many directions. The complexity of the local dimension and of the collective intelligence emerging from potentially high scale participation are redefining many design approaches.

In this direction, we might find relevant and useful all the possible projects, approaches and tools that may be generated from the intersections of the design discipline with open, P2P, DDD systems. One of the most popular approaches is open design, intended as the intersection of design with open source, which is an approach commonly credited to the designer Ronen Kadushin (Troxler 2011). According to Ronen Kadushin, open design projects are strictly CAD information published online under a Creative Commons license that can be downloaded, produced, copied, modified, and produced directly from file by CNC machines (Kadushin 2010). Further research has investigated the dimension of the open design phenomenon by addressing open source physical objects (Balka, Raasch, & Herstatt 2009; Raasch, Herstatt, & Balka 2009). This current article argues that there might be many more approaches generated from the intersections of the discipline of design with open, P2P, DDD systems and that they are not necessarily restricted to tangible goods, since many design projects are immaterial or digital. In order to explore this landscape, a search for possible publications was done in several databases like Scopus, Web of Science, JSTOR, Google Scholar [Table 1]:

Search term	Scopus	Web of Science	JSTOR	Google Scholar
"open design"	636	754	36	400
"p2p design"	23	8	0	22
"distributed design"	817	557	26	985
"di use design"	6	6	0	0
"decentralized design"	232	111	11	144

Table 1. Number of possible publications about the intersections of design with open, P2P, DDD Systems in the databases of Scopus, Web of Science, JSTOR, Google Scholar. The terms were searched in title, keywords, abstracts except for Google Scholar, where they were searched in title only.

The results from the databases generally fall in the same scale. The data gathered from Scopus was further investigated, since it provided additional metadata regarding the subject areas and time of the publications. We can generally observe that the publications mostly cover distributed, open and then decentralized design, and very little P2P and di use design [Fig. 1]. The publications were mainly produced in the subject areas of engineering and computer science; medicine and mathematics followed [Fig. 2].



Arts and humanities, and subject areas related to design and net art are poorly represented, showing that the publications in such disciplines are either few, not mapped by Scopus, or that the size of the phenomenon is still small. Furthermore, data about the date of publication shows how the topics were not really addressed in the 1960s and 1970s, but they mostly grew in popularity the 1990s and have experienced an high growth since the 2000s [Fig.3].

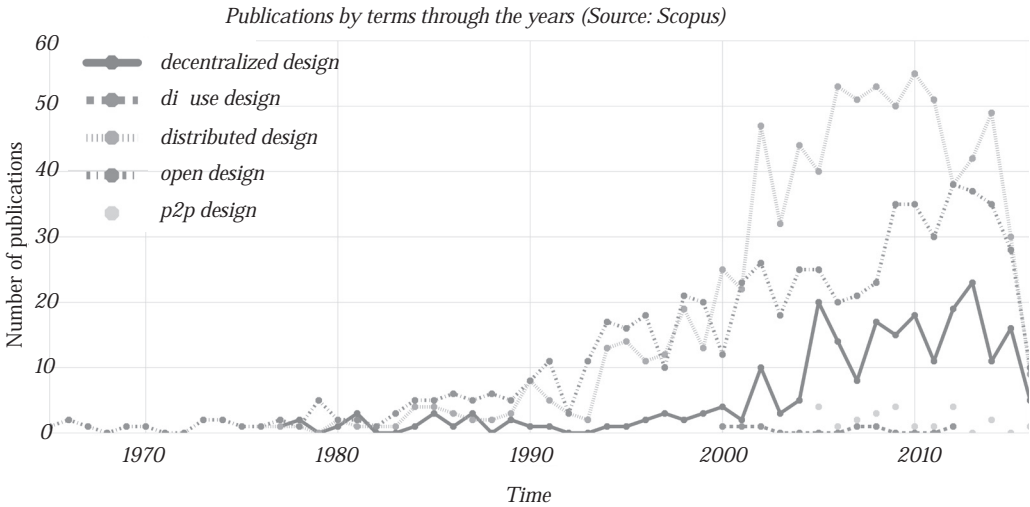


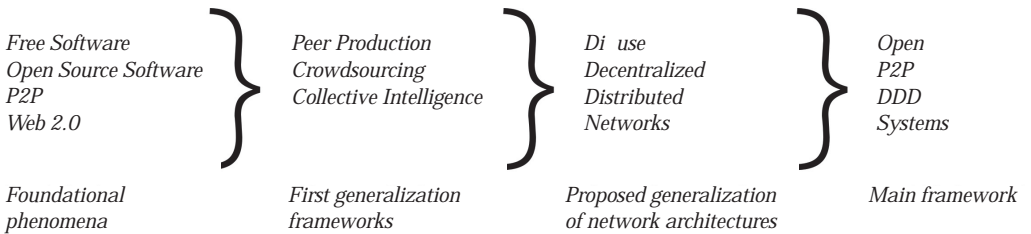
Fig.3. Time plot of the number of publications by search terms found in the Scopus database.

The gathered publications could be therefore only partially related to the discipline of design, only very recently for their majority, and unevenly among open, P2P and DDD systems; questioning the ability of such literature or of such databases to explain the phenomenon, or suggesting that more extensive research could provide more insight. Therefore, the thesis of this paper is that there might be many more approaches generated from the intersections of the discipline of design with open, P2P, DDD systems, that they are not necessarily restricted to tangible goods, that existing literature might be insufficient for understanding them, and that a preliminary framework could be proposed here by analyzing both literature and practical cases. Such a framework is intended for future literature and case analysis in order to enable design researchers to both understand the phenomenon and improve or reject the framework, and design practitioners to know which possible formats, approaches, tools and projects could be adopted in designing projects in their work and how many combinations are possible at the moment, for designing new approaches and tools. A preliminary framework needs validation, rejection, or modifications, and possible strategies for this evolution are outlined in the conclusions of this article.

In order to build this preliminary framework, relevant literature and cases regarding the intersections of design with open, P2P, DDD sys-

tems were analyzed by trying to understand how they integrate, especially with regard to three questions: 1) is the case/publication inspired by open, P2P, DDD systems? 2) is the case/publication based on the adoption of open, P2P, DDD systems? 3) is the case/publication aimed at designing open, P2P, DDD systems? After analyzing the cases and publications, the position of this article is that design could interact with *open source, P2P, di use, distributed and decentralized systems* in two directions: 1) by embracing them in its practices or 2) by applying its practices in order to improve and implement them [Fig. 6]. Many projects and publications have been produced in both directions, but generally with more focus on how design could adopt open source practices and tools inside its practice. Both directions could be therefore explored more by design practitioners and researchers. The article therefore addresses this phenomena by providing both an analysis of the concepts and the history of both directions and, in order to understand the phenomena with a broader overview, it proposes a framework for understanding current possible intersections of design with *open, P2P, di use, distributed and decentralized systems* through literature review and case studies. In conclusion, it points to possible strategies for validation and evolution of the framework.

PROMISING APPROACHES FOR DESIGNING AT A LARGER SCALE: OPEN, P2P, DIFFUSE, DISTRIBUTED AND DECENTRALIZED SYSTEMS



The introduction of digital technologies in the past decades has either enabled new forms of organization and new forms of distribution of resources, or it has modified or rendered obsolete old forms, especially thanks to infrastructures such global network of devices and technologies (the Internet) or information and documents (the World Wide Web). These technologies have shaped new ways of working and participating in projects, which in turn have contributed to shaping these technologies. These new technologies and their related organizational forms have been experimented with not only in software and web projects, but also in projects related to music, biotechnology, movies, science, art, design and so on (Goetz 2003). There are, however, different formats, terms, and approaches for understanding and therefore designing with and for these web-enabled technologies and organizational forms. In order to understand the possible relationships be-

Fig.4. Frameworks for understanding mass-participation phenomena.

tween design and them, this section provides a brief overview of them through a literature review and some cases. This overview intends to establish a starting point for a connection between open, P2P, DDD systems and their integration with design in the next two sections.

These technologies and organizational forms have become interesting for their ability to enable participation, collaboration, and sharing on a mass level. Historically, their origin can be traced back to the first years of computer science and software development, when it took place in many academic institutions, and from where it also took the ethic of sharing and participation which would later become the *Hacker ethic* (Himanen 2001). At the beginning of the 1980s, however, the software industry started changing its business models with the introduction of personal computers, and the development of software was less based on sharing and more on closed strategies based on proprietary rather than common licenses. In 1985, Richard Stallman founded an initiative that would be the starting point for renewed interest in sharing and collaboration: for him, being able to access the source code of a software is a requirement for personal freedom, hence the term *free software* (and the Free Software Foundation he established for facilitating its development) (Stallman 2002). The main components of free software were the *GNU operating system* and the *GPL license*, which are still the basis for many projects today. The free software movement, however, grew slowly because of the difficulties in finding like-minded hackers. A turning point came with the opening up of the Internet to the general public at the beginning of the 1990s, which enabled more hackers to meet and create a community, and Linus Torvalds to develop the core of the *GNU operating system*, the *Linux kernel* (hence the more formal name *GNU/Linux* for the commonly named Linux operating systems). Linux proved to be another foundational project, not just on the technical level, but also for proving that a complex project could be developed by an online community in a more efficient way than a traditional closed and hierarchical project: the participation of a large complex social system is the key to its success (Raymond 1999; Kuwabara 2000). The term *free* was controversial and less accepted by companies, and in order to promote the concepts further, a group of hackers developed the term *open source* and the Open Source Initiative instead (Perens 1999), shifting the focus from freedom to openness, with a stronger accent on methods and processes than on philosophy, with more focus on the design of systems and processes than on ideas and principles. Both terms and approaches overlap and have different nuances at the same time, but the term *open source* gained particular momentum and became an inspiration for the adoption of the same practices and principles outside the software movement, a phenomenon that was firstly witnessed at the beginning of the 2000s (Goetz 2003) and that has sometimes been called *open source everything* (Steele 2012). The concept has been considered not just in terms of technology, but as an organiza-

tional form and approach more suited to the knowledge society (Mulgan, Steinberg, & Salem 2005).

Like software development, the same trend is found with Web platforms which, around 2005, stopped being static or managed only by a closed team and started opening the production of content to every user. This phenomenon became associated with a further evolution of the Web and therefore of many initiatives that could be organized on the Web, thanks to the term *web 2.0* (O'Reilly 2005). New online platforms like YouTube or Facebook emerged and at the time they were considered as both new kind of business and a social experiment of digital democracy on a mass scale, thus also representing a further evolution in the role of citizens (Grossman 2006). All these free, open and 2.0 initiatives of potential mass-collaboration were then analyzed mainly in terms of business potential (Tapscott & Williams 2006; Tapscott & Williams 2010) or in terms social and collaborative approaches which could lead to the emergence of a global *collective intelligence* (Leadbeater 2009; Shirky 2008; Shirky 2011; Surowiecki 2005). All these approaches tried to create a framework for understanding and promoting these initiatives of mass-collaboration, and slowly more differences and criticisms emerged in the approaches and in the literature and public opinion. The term *crowdsourcing*, for example, started as a generic term for mass-collaboration (Howe 2006; Howe 2008), but later became more synonymous with mass-competition where tasks are highly regimented and pre-specified in order to exploit cost reduction thanks to the outsourcing to the online crowd, rather than a free and collective exploration of creative opportunities (Benkler 2016). Web 2.0 platforms and social media are increasingly under the analysis regarding their real neutral position and influence on the social, political, and economic dimensions of society (Lovink & Rasch 2013; Morozov 2014; Morozov 2012). The increase in the size of such platforms has brought more side effects to society and welfare (Morozov 2016) and politics (Epstein 2015) than just global interactions; there are effects that work at a deeper level, affecting our relationship with knowledge by making us privilege some ways of processing information over others, with unprecedented dynamics that are not always necessarily democratic or expressions of a collective intelligence, and with more profound philosophical and epistemological implications (Lynch 2016). These critical dimensions further suggest how such formats are not always completely positive, but also how important it is to reflect on how it would be possible to modify and design them.

Some approaches therefore have tried to find differences among all these cases of mass-participation. A relevant approach that focuses on the organizational and economic implications of such initiatives is the concept of *peer production* (Benkler 2002), which consists of a subset of cases of collective intelligence where control and activity are decentralized, where monetary and non-monetary incentives are present and where inputs and outputs are mostly governed as open

commons (Benkler 2016). Peer production is important not as a technological innovation, but rather as an innovation in the organization of work thanks to technology, which enables an organization different from markets or hierarchies. In peer production, the distributed pool of users/designers participating in a project can better identify who is the best person for a task, with an improved identification and allocation of human creativity, since human knowledge, experiences and skills are highly variable and distributed. The concept of peer production has been mainly developed around the production of digital content, but it has also inspired discussion around how it could be applied to physical goods (Siefkes 2008; Bauwens 2009).

The same goal of generalizing methods and principles from mass-collaboration to the whole society is one of the aspects that has generated interesting reflections on the possible dynamics enabled by *peer-to-peer* software, where nodes in the network (devices, but also users) are directly connected without a middleman. Peer-to-peer software infamously emerged at the end of the 1990s with the file-sharing service *Napster* and are therefore commonly linked to the illegal distribution of digital content. However, such and similar cases proved to be more interesting because of their more efficient distribution for a much wider variety of content than a traditional centralized network (Benkler 2002). Furthermore, this principle for social interaction has been elaborated as a whole scenario for a sustainable future society besides mere software applications (Bauwens 2005; Kostakis & Bauwens 2014). Peer-to-peer software is indeed bringing innovative approaches to many practices, and not just in video-conference systems or file sharing. An interesting example in this direction comes from *Bitcoin*, a peer-to-peer based software that enables decentralized pseudonymous transactions of a digital currency which is in turn generated by the distributed data processing that users offer in order to verify and record such transactions in a distributed database, the *blockchain* (Nakamoto 2008). The blockchain is what is commonly considered as the most innovative component of Bitcoin, as the decentralized “trustless” proof mechanism of all the transactions on the network, that can be extended from currency to markets to organization, art and many other projects (Swan 2015). The global interest around Bitcoin and the blockchain has generated many experiments and approaches regarding their generalization, like *Dapps* (decentralized applications), *DAOs* (decentralized autonomous organizations), *DACs* (decentralized autonomous corporations), and *DASs* (decentralized autonomous societies). All these terms essentially propose peer-to-peer-based and sometimes AI-based software that can decentralize consensus without a centralized communication and control that can manage organizations, sometimes in an autonomous way (Swan 2015; Raval 2016).

We have seen the main technologies and related organizational forms, principles and framework that have influenced the general

awareness about the possibilities and modalities for managing participation (collaboration and competition) on a mass scale. They mostly refer to decentralized communications where each participant is a peer, where the work is based on shared assets and outcomes and agency is distributed over networks. All these initiatives started as technological innovation but have also reached (or are believed to reach in the future) the economic and social dimensions of society. As we have seen, there is a common stress on the distributed and decentralized nature of communication, control and agency in socio-technological networks. The distinction between centralized, decentralized and distributed networks of communication has been part of many reflections on the architecture of communication networks since the inception of the Internet, with the goal of designing a network that could withstand enemy attacks (Baran 1964). These, however, are mainly theoretical discussions about ideal types of networks, and many times there are no clear boundaries and definitions of them, or terms are adopted mainly as a reaction to traditional hierarchies, intended as centralized networks where one node control all the other nodes or the interactions among the other nodes. As a conclusion of this section, we propose to integrate open and P2P dynamics into a simple framework that tries to clarify such concepts of systems defined by network architectures as the fundamental architecture of social and technological interactions. We propose to add a *di use* kind of system, and we integrate *di use*, distributed and decentralized systems with open and P2P systems, extending Paul Baran's famous visualization of networks (Baran 1964) [Figure 4 — Figure 6]:

Di use systems: the general meaning of this term could be linked to ill-organized, not concentrated or localized initiatives ("Di use" 2015). Therefore, they could generally refer to systems where the agents are spread and not connected or coordinated (if not at the local level within a very short range) and where activities and assets are not homogeneously present in all the agents.

Distributed systems: the general meaning of this term could be linked to computer networks in which processing and storage of information is shared among many coordinated devices ("Distributed" 2015). Therefore, they could generally refer to systems where activities and assets are shared and coordinated among the agents, and where control and influence is spread as much as possible among the agents and locally optimized at short range.

Decentralized systems: the general meaning of this term could be linked to the dispersion, distribution, or delegation of functions, position and powers from a central authority or place to regional and local authorities or places ("Decentralization" 2015). Therefore, they could generally refer to systems where activities and assets are shared and coordinated among the agents, and where control and influence is con-

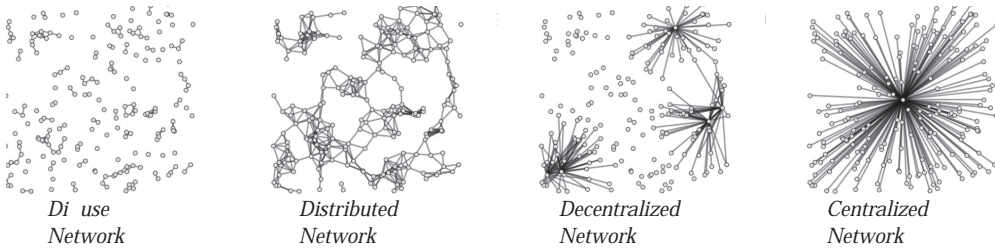


Fig.5. Network simulations for DDD Systems.

³ <https://gist.github.com/openp2pdesign/ecb64798f004bd9c7619a5445d3cbfe4>

The framework of such DDD systems is a preliminary and broad one, and it would require a more complex formulation that is beyond the scope of this article, especially with approaches related to network science in order to uncover its network structure. This article proposes a simple and preliminary description, in order to build the preliminary framework of design with open, P2P, DDD systems. In this case, DDD networks were simulated by software [Fig.6]³, providing a first rough description of such networks: 1) in di use systems, nodes are connected by network proximity at a very low distance, enabling only very local structures; 2) in distributed systems, nodes are connected by proximity, but at a larger distance, enabling local structures to be connected globally; 3) in decentralized systems, nodes are connected by proximity to local hubs which are more important in the networks; 4) in centralized systems, nodes are connected to one or very few hubs who completely control the whole network.

Open and P2P systems, coupled with general DDD systems can be regarded as the main framework for understanding phenomena of mass-participation. The intersections of these phenomena with the design discipline has generated several approaches and applications that will be explored in the next two sections and that will be referred by number to the main visualization of the framework proposed in this article [Figure 4 — Figure 6]. There are two main directions for the intersections we will examine here, and the following sections will address them in their interactions with design.

DESIGN ADOPTS OPEN, P2P, DIFFUSE, DISTRIBUTED AND DECENTRALIZED SYSTEMS

In one direction (1), such open, P2P, di use, distributed and decentralized systems can be applied in design practice: this first intersection has many applications, mostly with the open source practice. The open design phenomenon (1.1) has passed through a first stage of hypotheses and first attempts (1999-2005), then through a period of expansion and construction of an ecosystem between several projects (2005-2010), and finally to a stage of relevant interest from mainstream researchers, media and institutions (2010-) in which it is seen not only as a hypothesis but as a feasible proposal with many elements yet to be explored. The origin of open design is sometimes traced back

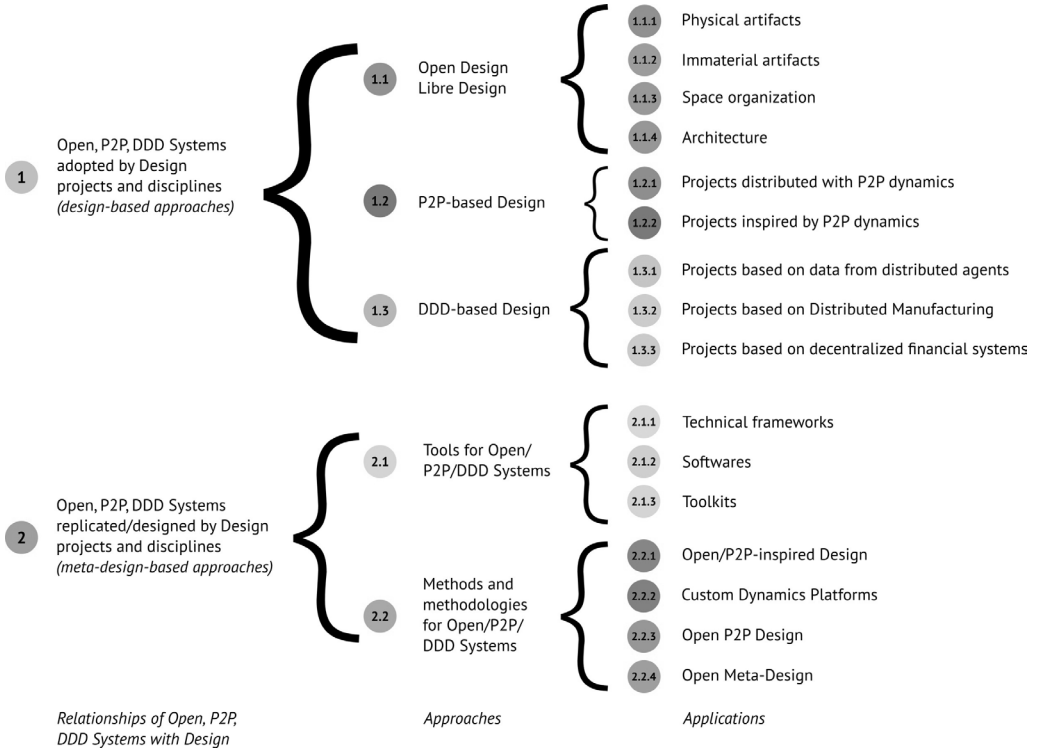


Fig. 6. A framework for understanding the intersections of design with open, P2P, DDD

to the work of Ronen Kadushin and his *Open Design Collection* of Creative Commons-licensed objects that can be manufactured digitally and that started in 2005 (Troxler 2011). However, one of the first online platforms for open and collaborative design, *Thinkcycle*, was already active in a research project at MIT during 2001-2002 (Sawhney 2003). These two origins already show different approaches: open design as digital files of projects (which is the focus of this section) or open design as an online platform for collaborative design processes (which is the focus of the next section). The following cases and publications are examples of this direction, and could be adopted in existing projects and research or they could provide inspiration for further work along this direction.

As shared digital files of projects (1.1.1), open design has been applied to several different fields of design, and not just to product design. Among the early projects, *Openmoko* (“Openmoko™—Open. Mobile. Free.” 2013) and then *BugLabs* (“Bug Labs” 2015) are particularly interesting for being completely open products in the software, hardware and design (encasing and interface) files. Openmoko was a smartphone project released as open source; BugLabs consists of a series of electronic devices that can be integrated in order to build complete products (furthermore, the design components of BugLabs were designed by IDEO). There have been, however, cases of open design that are not

related to technology or industrial products; among the many projects, two directions are particularly interesting: fashion design and typographic design. The fashion industry is an interesting case for open design, given its peculiar IP regime with little protection and a tradition of imitation and learning from peers (Raustiala and Sprigman 2012). One of the most interesting projects of open design in fashion design, for its wide reach and completeness, was *OpenWear*, a collaborative clothing platform, open fashion collection, and brand developed between 2009 and 2012 with the goal to optimize the competitiveness of small producers through collaboration, common-based resources and community (Niessen et al. 2010; Romano 2015). Besides the reflection and the experimentation on the economic and social impact of an open design project on workers, the project made a founding contribution to the reflection on open design not just as blueprints but also as a brand. Regarding typographic design, this direction is interesting because this is an immaterial kind of design, but definitely linked to its tradition more than to technology (**1.1.2**). The first examples could be seen in the *Gentium* font ("Gentium" 2015), the *Ubuntu Font Family* for the Ubuntu Linux operating system ("Ubuntu Font Family" 2011) but even in *Source Sans Pro* (Hunt 2012), designed by Adobe, the company that delivers an important part of the proprietary software used by designers (and therefore a historical step in the diffusion of open design among commercial and proprietary companies). Other interesting open design experimentations can be found also regarding the organization of spaces as in interior design like the *Instructable Restaurant* (Hendriks 2011) (**1.1.3**) or in architecture (**1.1.4**), with first experimentations in competitions like *Open Architecture Network* (TED 2006) or in academic research such as the *Open Source Building Alliance Operation (OSBA)* at MIT (Larson et al. 2004), in experiments from practitioners such as the *WikiHouse* online platform (TED 2013) or in recent collaborative reflections on open design in architecture as a new culture (Ratti & Claudel 2014). Recent cases of corporations and media becoming more interested in experimenting with open design could be considered as a sign of it entering the mainstream (Menichinelli 2011b; Menichinelli 2011c; Menichinelli 2011d). A further element that has contributed to the growth of the phenomenon is the emergence of the distributed manufacturing scenario (Bauwens 2009; Bianchini & Maffei 2013) and of the identity of Makers (Anderson 2012; Hatch 2014), which in part develop design projects in a collaborative way in a global community of many Maker laboratories with shared traditional and digital manufacturing technologies such as Fab Labs, Makerspaces, Hackerspaces etc. (Abel et al. 2011).

The main reflections regarding open design have been early attempts at understanding it as a potential framework (Ciuccarelli 2008), statistical analysis of the early cases (Balka, Raasch, & Her-

statt 2009), mainstream di usion (Abel et al. 2011), and analysis regarding its relationship with innovation and the role of designers (Cruickshank 2014). Other authors link open design with the evolving practices of co-design, identifying it as a fourth “turn” directed towards a further engagement of users in the design process thanks to a focus on open and peer-driven processes taking place in resources as shared commons (Marttila & Botero 2013). A common approach for understanding these collaborative phenomena is the drafting of definitions instead of manifestos (Perens 1999; Stallman 2002). As a further sign of the recent emergence of the phenomenon, there are many attempts at defining open design (Tooze et al. 2014; Aitamurto, Holland, & Hussain 2014), but at the time of writing there is no generic, common and collectively shared or developed complete definition. Furthermore, almost mirroring the split between free software and open source software (but without the same history, chronological order and dynamics) some activists, practitioners and researchers prefer to use a term closer to free software such as *libre design* or its local translation—mainly in Brazil (Instituto Faber-Ludens 2012) and France (Association Entropie 2013).

The P2P, di use, distributed and decentralized systems mostly refer to social dynamics and organizational formats, and therefore these are approaches that can be translated to design projects less easily, due to the complexity of the topic. Regarding P2P, although we could see a series of P2P-based design initiatives (**1.2**), few examples can be traced to the introduction of a category of *physibles* (i.e. digital files of physical object that could be 3D printed) on The Pirate Bay (Laird 2012), concretizing the common fears of a piracy of physical products within P2P networks. Other examples, while not directly linked to P2P, can be understood as being inspired by P2P dynamics (1.2.2): the Coca-Cola Company manufactured a few cans and bottles for its beverages that enable and foster the sharing of the beverage among its customers, almost in a P2P way (Kiefaber 2013; Monllos 2014). Regarding DDD systems and *DDD-based design initiatives* (**1.3**), there are three main directions of application inside design projects: (**1.3.1**) using data from distributed agents to build a collective project, even if it is uncoordinated (Agarwal et al. 2011); (**1.3.2**) the adoption of the distributed manufacturing scenario for the production and distribution of projects (Bauwens 2009; Bianchini & Ma ei 2013); (**1.3.3**) the use of decentralized financial systems for the production and distribution of an artifact: *Plantoid* by Okhaos (okhaos 2015) is an example of a self-creating, self-propagating artwork that uses Bitcoin to gather and manage the necessary resources for funding artists to participate in its creation and distribution. Here the main concepts are therefore linked to the managing and exploiting of networks in developing, producing and distributing projects.

DESIGN FOR THE ORGANIZATION OF OPEN, P2P, DIFFUSE, DISTRIBUTED AND DECENTRALIZED SYSTEMS

On another direction (**2**), design practice can also have a role on enabling and replicating such open, P2P and DDD systems through the analysis, visualization, and design of their tools, software, toolkits, platforms and collaborative processes and organizations. Design, therefore, could not only learn from such systems but also improve them. This second intersection can be considered more as part of the meta-design domain, where designers can have a role in the building of environments for the collaborative design of open processes and their resulting organizations. Meta-design is a broader concept with several meanings and no single definition; here we refer to Giaccardi's overview of the topic (Giaccardi 2003). Meta-design is not an established design approach and practice, but rather an emerging design culture (especially related to interaction design) that intersects with net art. The interest on the meta-level shifts the focus from objects to process, from contents to structures, from design as planning to design as seeding or emergence. Giaccardi identifies three main different meanings for meta-design, based on the different meanings of the prefix "meta-":

1. *behind (or designing design)*: "Design of design processes" / "Design of the generative principle of forms" / "Design of the design tools";
2. *with (or designing together)*: "Design of media and environments that allow users to act as designers" / "Design of the organization of flows";
3. *between/among (or designing the "in-between")*: "Designing the spaces of participation" / "Design of relational settings and active bodies".

Open, P2P, DDD systems have many connections with meta-design: on one hand there are many meta-design approaches that enable them; on another hand, meta-design has historically been associated with many technologies and approaches which are now related with such systems, such as mass-customization, digital fabrication, generative design, open processes, and participation in online communities. This direction is mostly related to the concept of design for social innovation, where designers work on the social dimension and for social goals (Manzini 2015), with these approaches therefore considered (**2.1**) tools, components and toolkits to be applied in projects or (**2.2**) as a whole project or rather comprehensive approaches to projects. Both approaches could be integrated: for example, tools from (**2.1**) could be part of comprehensive approaches in (**2.2**). These approaches have different philosophies and different interest at the *meta*-level, and therefore they enable different types of projects and systems [Table 2].

Approach	Short description	Meaning of the meta-level	Focus of the meta-level
<i>Design projects Linked with Open, P2P, DDD Systems (1)</i>	<i>Design of a physical or immaterial artifact inspired by, based on or distributed or realized by Open, P2P, DDD Systems</i>	—	—
<i>Open Projects for Open Projects (2.1)</i>	<i>Design of a physical or immaterial artifacts that can facilitate the development of projects within Open, P2P, DDD Systems</i>	1 (behind)	Tools
<i>Open/P2P-inspired Design (2.2.1)</i>	<i>Design of an organization, service or process with dynamics inspired by Open, P2P, DDD Systems</i>	3 (between/among)	Platforms
<i>Custom platforms (2.2.2)</i>	<i>Design of a custom platform with hybrid organizational dynamics</i>	2 (with) 3 (between/among)	Platforms
<i>Open P2P Design (2.2.3)</i>	<i>Design of an Open and P2P process for the emergence of an Open and P2P process</i>	1 (behind) 2 (with) 3 (between/among)	Platforms, processes
<i>Open Meta-Design (2.2.4)</i>	<i>Meta-Design of Open, P2P, DDD Systems organizations and processes based on open platforms and data</i>	1 (behind) 2 (with) 3 (between/among)	Platforms, organizations, processes, data

In **(2.1)** we can find *tools for open, P2P, DDD systems* such as **(2.1.1)** technical frameworks that facilitate the collaboration in open projects, **(2.1.2)** software specifically design for enabling open projects, or adopted by open projects and **(2.1.3)** toolkits as collections of tools, technical frameworks, and software. An example of technical frameworks **(2.1.1)** can be found in *OpenStructures* (TEDx Talks 2012), an open grid designed in order to facilitate the integration of several open projects or several modules into larger assemblies. There are many examples of free/open source software projects that facilitates the development of open and P2P projects **(2.1.2)**. Regarding design projects, these might be generic raster, vector or 3D design software, or more specific software for fashion design projects such as *Valentina* (Prokoudine 2013) or typographic design projects such as *Birdfont* (Prokoudine 2014), specifically designed for fostering open projects by giving more accessible and therefore democratized tools. However, many more free/open source or proprietary software projects could be helpful in replicating open and P2P projects even if this is not the primary goal or if design is not necessarily involved. Software projects like *Sourcemap* (Bonanni et al. 2010), which provide a diagnostic tool for carbon accounting through design, analysis,

Table 2. Synthesis of main approaches and their relationships with Meta-Design.

and visualization of supply chain management, could be adopted in the improvement of the Distribute Manufacturing scenario. Frameworks, tools, and software projects could then be packaged in custom toolkits for replicating open projects (2.1.3), thus providing a ready-made and logically constructed toolkit. An example of such toolkits could be experimentations like *P2P Design Strategies* (Bonetti 2009), a set of techniques that allow a team of graphic designers working in a peer-to-peer environment, or Frog Design's *Collective Action Toolkit*, a set of activities and methods edited in order to enable groups of people to create solutions their local communities through collaboration and organization ("Collective Action Toolkit" 2013).

Material or immaterial tools (such as frameworks and software), used alone or in collections (toolkits), are an example of meta-design (2.1). In this case, the focus is on tools; however, there are also many cases where the focus is on the process or organization of the design projects or generally on *methods and methodologies for open, P2P, DDD systems* (2.2). Among these cases, we can identify informal or less structured approaches that can be therefore named *open/P2P-inspired design* (2.2.1); environment for an active participation of users in projects which have *custom dynamics platforms* (2.2.2); open and P2P processes integrated with design tools and culture in order to build open and P2P organizational forms in *open P2P design* (2.2.3) and the integration and simplification of this approach into an open version of meta-design in *open meta-design* (2.2.4).

Open/P2P-inspired design (2.2.1) could be considered a category for all the cases where open, P2P, DDD systems were designed, or where their emergence and growth was facilitated as the main object of the project; usually through a platform (generally an online platform, but sometimes coupled with physical artifacts and physically-located services and activities) as the foundation for the interactions among the participants. Here there is much less interest in the meta- level, a less structured approach, or an approach that has not been developed for open, P2P, DDD systems. Early experimentations in this direction were developed by the *RED* unit within the UK Design Council, where reflections and projects of public services based on P2P interactions were developed (Cottam & Leadbeater 2004). Beside these first experimentations, there have been several more cases of both research and design, and production and provision of public services with P2P dynamics through co-creation (Botero, Paterson, & Saad-Sulonen 2012). These cases have been mostly developed in the context of an integration of the public sector, the third sector and citizens, but the last decade has seen an enormous amount of services designed with P2P dynamics that are mostly localized in the integration of private sector and citizens. These are mainly cases of online platforms which provide a space for P2P dynamics between users and are based more on sharing, bartering, lending, trading, renting, gifting and swapping dynamics than conventional dynamics of selling, buying or serving (which are

still present, but in a minority of cases). Some of the most famous examples of these businesses are *eBay*, *craigslist*, *Zopa*, *Zipcar*, *Uber*, *Airbnb*. Generally, within these platforms goods and services are distributed with P2P dynamics rather than from a central point of control; there are however several possible patterns of organization and business models, which has led to several different terms for these cases (Botsman 2015): *collaborative economy* (an economic system of decentralized networks and marketplaces with p2p dynamics); *sharing economy* (an economic system based on sharing underused assets or services, for free or for a fee, directly from individuals); *collaborative consumption* (the reinvention of traditional market behaviors through technology, taking place in ways and on a scale not possible before the internet); *on-demand services* (platforms that directly match customer needs with providers to immediately deliver goods and services). Even if these seem to be mostly technology-driven initiatives, design is increasingly one of the forces driving them. One of the most famous of these cases is Airbnb, an online platform that enables users to rent their houses or rooms to other users in an almost P2P way (admittedly, Airbnb's platform is still the central place for the interactions). Airbnb was designed, developed and managed by two designers and it is considered a relevant example of the growing phenomenon of design-led entrepreneurship (Mata Garcia 2014). The founders developed its business around the users rather than around the market or a technology, and this approach surprised Silicon Valley (Fairs 2014).

There are many business-based social media or free and open source online platforms that open, P2P, DDD systems could adopt for their organization and processes; however there are interesting cases in *custom dynamics platforms (2.2.2)*, that is, online platforms that are specifically designed with uncommon organization and processes as a goal. One of the best examples in this direction can be found in *OpenIDEO*, an online platform (coupled with a toolkit) for the development of solution of social challenges by a global community of designers. Launched by IDEO in 2010, it was specifically designed around IDEO's design methodology. Each social issue is addressed via a challenge, a three- to five-month collaborative process within an online community where members can contribute and build off each other. OpenIDEO could be also considered as part crowdsourcing, part Web 2.0, and part open design. This experience could be connected to the idea that there are several different formats of social (or organizational) dynamics and that, at least at this stage where these phenomena are still recent and under development, custom organizations and processes could be a promising strategy instead of relying on ready-made platforms, and therefore organizations and processes.

These considerations share a common idea with another approach called *open P2P design (2.2.3)* which tries to develop custom organizations and processes for each community (Menichinelli 2006). This approach was developed within the context of exploring the relation-

ships between design and localities and therefore local communities (Verwijnen & Karkku 2004; Fagnoni, Gambaro, & Vannicola 2004): given the extreme diversity of each locality and its communities regarding culture, history, geography, economy, and many more dimensions, the basic concept of this approach is that specific organizations and processes are needed for each community and locality. Inspired by the idea that the key to the success of many open source projects is the complexity of a community that can therefore tackle a complex challenge and project (Kuwabara 2000), the open P2P design approach tries to build open, P2P, DDD systems through organizations and processes where both designers and communities work together in the designing of open, P2P, DDD systems that can be helpful for the future self-organization of the communities. The approach is based on the idea that collaborative processes can be modeled as activities and it is therefore linked to activity-centered design approaches (Kaptelinin & Nardi 2009; Gay & Hembrooke 2004); it further extends the concept of platform for collaborative communities from an online place, to a set of artifacts, rules, and roles that must be shared within the social network of the participants, thus giving a network-based architecture to platforms. The approach first started as a generic methodology (Menichinelli 2006), which was then extended with a set of tools from service design, participatory urbanism, sociology, and other disciplines (Menichinelli 2011a). The approach was experimented with in a series of workshops where it was applied to Maker communities and Maker laboratories, after which it was simplified and transformed into the more recent *open meta-design* approach (**2.2.4**) (Menichinelli 2015; FAD Barcelona 2013). The workshops proved that the open P2P design approach is too complex and suggested the development of a simpler approach which could be understood more clearly by users, and which could be considered as a broader class of open P2P design. While open P2P design could be framed as “open design of open P2P processes”, open meta-design reframes it as “open design of design processes”: the approach tries to present a simpler way for generating different formats of processes and organizations instead of generic open and P2P processes. The approach focuses on processes made as networks of activities in an ecosystem of actors and on the organizations emerging from such networks of interactions. Such processes and organizations are approached through a combination of 1) a specific visualization format (instead of relying on separate tools and toolkits); 2) a software platform for their management and on 3) a specific ontology and related data format.

CONCLUSIONS

Open, P2P and di use, distributed and decentralized systems can be considered a preliminary broad framework for understanding several different formats of mass-participation that have emerged in the past

years thanks to the emergence of the Internet and the World Wide Web. This framework refers to several terms, frameworks and experiments that are a still recent phenomenon, and have recently been the subject of discussion and criticism, after the initial phase of general optimism. This article addressed how this phenomenon has encountered the design discipline by providing both an analysis of the concepts and the history of the phenomenon, and by providing a general and preliminary framework for understanding it. As a first step, concepts and cases of the main mass-participation phenomena have been contextualized into an open, P2P, DDD systems framework. As a second step, two main directions of relationships of such systems with the discipline of design were identified and structured into families of approaches. The article therefore tried to show that the intersection of open, P2P and DDD systems with design is not limited to the popular view of open 3D models that can be downloaded with P2P applications and 3D printed locally, but that there are more approaches to work on immaterial, social, and organizational levels as well. The broader and more comprehensive overview of the phenomenon could be a starting point not only for understanding it, but for further experimenting with it, by both researchers and practitioners.

The framework presented, however, is still preliminary. DDD systems are mostly abstract and ideal types of networks and therefore activities, and a more rigorous formulation according to network science is suggested. The network structures presented in the article are just simple descriptions that explain the DDD framework in very generic terms, and further development of such network structures is suggested, by adopting several centrality measures and real life cases. The proposed framework is still theoretical and represents a first proposal for categorizing the possible cases of intersections between design and open, P2P and DDD systems. Further research is required in order to understand the validity of such framework, for modifying and improving it; we suggest three possible directions for this here, by rebuilding the framework from: data (a *data-driven approach*), the experience of makers, hackers, designers (a *bottom-up approach*), or from the experience of experts like researchers, relevant designers and so on (an *expert-driven approach*). In the first direction, the framework could be tested or even rebuilt with a data-driven approach, by analyzing literature and cases. Several approaches might be adopted according to the available data and its structure: co-authorship networks could show the social dimension of the cases; if only textual data is available, the text could be analyzed with natural language processing. Machine-learning algorithms could then be useful for clustering the analyzed cases and literatures in groups that could later be labeled. A second direction could bring the experience and knowledge of practitioners working with design and open, P2P, DDD systems such as makers, hackers, designers: surveys or interviews could uncover their perception of all the possibilities. A third direction would instead focus on the experience and knowledge

of experts (researchers, authors, journalists) about such possibilities. This triangulation would open up the framework proposed here, and mix it with a global overview (1), an overview from the practice (2) and an overview from experts (3). Furthermore, as the integration of design with open, P2P and DDD systems could be seen as a relatively recent, emerging, and unstable phenomenon, such frameworks should take this into consideration and any research should also focus on the evolution of the phenomenon in order to understand the real scale and also therefore the possible adoption of any frameworks. We suggest that such a recent phenomenon could be understood and improved not just with research but also with experimentation with communities and other organizations. As a conclusion, further quantitative research on the dimension of the phenomena and of its applications would be strategic in order to understand its real impact and the value of any framework that tries to describe it.

REFERENCES

- Abel, Bas, Lucas Evers, Roel Klaassen, and Peter Troxler, eds. 2011. *Open Design Now: Why Design Cannot Remain Exclusive*. Amsterdam: BIS Publishers. <http://opendesigntoday.org/>.
- Agarwal, Sameer, Yasutaka Furukawa, Noah Snively, Ian Simon, Brian Curless, Steven M. Seitz, and Richard Szeliski. 2011. "Building Rome in a Day." *Communications of the ACM* 54 (10): 105. doi:10.1145/2001269.2001293.
- Aitamurto, Tanja, Dónal Holland, and Sofia Hussain. 2015. "The Open Paradigm in Design Research." *Design Issues* 31 (4): 17–29. doi:10.1162/DESI_a_00348.
- Anderson, Chris. 2012. *Makers: The New Industrial Revolution*. New York: Crown Business.
- Association Entropie. 2013. *Conférence Sur Le "Design Libre."* <https://vimeo.com/59070443>.
- Balka, Kerstin, Christina Raasch, and Cornelius Herstatt. 2009. "Open Source Enters the World of Atoms: A Statistical Analysis of Open Design." *First Monday; Volume 14, Number 11 - 2 November 2009* 14 (11). <http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2670/2366>.
- Baran, Paul. 1964. "On Distributed Communications." Santa Monica, CA.: RAND Corporation. http://www.rand.org/pubs/research_memoranda/RM3420.html.
- Bauwens, Michel. 2005. "P2P and Human Evolution: Peer to Peer as the Premise of a New Mode of Civilization" 1. http://www.networkcultures.org/weblog/archives/P2P_essay.pdf.
2009. "The Emergence of Open Design and Open Manufacturing." *We_magazine*. <http://www.we-magazine.net/we-volume-02/>.
- Bazzichelli, Tatiana. 2008. *Networking: The Net as Artwork*. Arhus: Digital Aesthetics Research Center. http://www.digital-aestetik.dk/wp-content/files/networking_bazzichelli.pdf.
- Benkler, Yochai. 2002. "Coase's Penguin, Or, Linux and The Nature of the Firm." *The Yale Law Journal* 112. <http://www.yalelawjournal.org/the-yale-law-journal/content-pages/coase%27s-penguin,-or,-linux-and-the-nature-of-the-firm/>.
2016. "Peer Production and Cooperation." In *Handbook on the Economics of the Internet*. Edward Elgar, edited by Johannes Bauer and Michael Latzer. Cheltenham, UK and Northampton, MA: Edward Elgar.
- Bianchini, Massimo, and Stefano Maffei. 2013. "Microproduction Everywhere." In . Social Frontiers Conference promoted by Nesta UK, 14th-15th November. <http://www.transitsocialinnovation.eu/content/original/Book%20covers/Local%20PDFs/93%20SF%20Bianchini,%20and%20Maffei%20Distributed%20economies%20paper%202013.pdf>.
- Bonanni, Leonardo, Matthew Hockenberry, David Zwarg, Chris Csikszentmihalyi, and Hiroshi Ishii. 2010. "Small Business Applications of Sourcemap: A Web Tool for Sustainable Design and Supply Chain Transparency." In *Proceedings of the 28th International Conference on Human Factors in Computing Systems*, 937–46. CHI '10. New York, NY, USA: ACM. doi:10.1145/1753326.1753465.
- Bonetti, Emanuele. 2009. "Peer-to-Peer Design Strategies." *Parcodiyellowstone*. <http://p2pdesignstrategies.parcodiyellowstone.it/>.
- Botero, Andrea, Andrew Paterson, and Joanna Saad-Sulonen, eds. 2012. *Towards Peer-Production in Public Services: Cases from Finland*. Aalto University. <https://aaltodoc.aalto.fi:443/handle/123456789/11830>.

Botsman, Rachel. 2015. "Defining The Sharing Economy: What Is Collaborative Consumption--And What Isn't?" *Co.Exist*. May 27. <http://www.fastcoexist.com/3046119/defining-the-sharing-economy-what-is-collaborative-consumption-and-what-isnt>.

"Bug Labs." 2015. <http://buglabs.net/>.

Ciuccarelli, Paolo. 2008. *Design Open Source. Dalla Partecipazione Alla Progettazione in Rete*. Bologna: Pitagora Editrice.

"Collective Action Toolkit." 2013. Frog Design. <http://www.frogdesign.com/work/frog-collective-action-toolkit.html>.

Cottam, Hilary, and Charles Leadbeater. 2004. *RED Paper 01: Health*. Design Council. <http://www.designcouncil.org.uk/resources/report/red-paper-01-health>.

Cristallo, Vincenzo, Ermanno Guida, Alfonso Morone, and Marina Parente, eds. 2006. *Design, Territorio E Patrimonio Culturale*. Clean Edizioni.

Cruickshank, Leon. 2014. *Open Design and Innovation: Facilitating Creativity in Everyone*. Farnham, Surrey: Gower Pub Co.

David, Salomão, A. Sabiescu, and Lorenzo Cantoni. 2013. "Co-Design with Communities. A Reflection on the Literature." In *Proceedings of the 7th International Development Informatics Association Conference (IDIA)*, 152–66. https://www.researchgate.net/profile/Salomao_Cumbula/publication/257998124_Co-design_with_communities._A_reflection_on_the_literature/links/00b7d526926461062e000000.pdf.

"Decentralization." 2015. *Merriam-Webster.com*. <http://www.merriam-webster.com/dictionary/decentralized>.

Dezeuze, Anna, ed. 2012. *The Do-It-Yourself Artwork: Participation from Fluxus to New Media*. 1 edition. Manchester ; New York : New York: Manchester University Press.

"Diffuse." 2015. *Merriam-Webster.com*. <http://www.merriam-webster.com/dictionary/diffuse>.

"Distributed." 2015. *Merriam-Webster.com*. <http://www.merriam-webster.com/dictionary/distributed>.

Epstein, Robert. 2015. "How Google Could Rig the 2016 Election." *POLITICO Magazine*. August 19. <http://www.politico.com/magazine/story/2015/08/how-google-could-rig-the-2016-election-121548>.

FAD Barcelona. 2013. *Massimo Menichinelli - Process, Community, Business: The Systems Behind Open Design*. FAD Barcelona. <https://www.youtube.com/watch?v=w8uUSzRtBPE>.

Fagnoni, Raffaella, Paola Gambaro, and Carlo Vannicola. 2004. *Medesign: Forme Del Mediterraneo*. Firenze: Alinea.

Fairs, Marcus. 2014. "Silicon Valley 'Didn't Think a Designer Could Build a Company.'" *Dezeen*. January 28. <http://www.dezeen.com/2014/01/28/silicon-valley-didnt-think-a-designer-could-build-a-company-interview-airbnb-co-founder-brian-chesky/>.

Gay, Geraldine, and Helene Hembrooke. 2004. *Activity-Centered Design: An Ecological Approach to Designing Smart Tools and Usable Systems*. The MIT Press.

"Gentium." 2015. *SIL*. <http://software.sil.org/gentium/>.

Giaccardi, Elisa. 2003. "Principles of Metadesign: Processes and Levels of Co-Creation in the New Design Space." Doctoral Dissertation, Plymouth: University of Plymouth. <https://pearl.plymouth.ac.uk/handle/10026.1/799>.

Goetz, Thomas. 2003. "Open Source Everywhere." *Wired*, November. <http://www.wired.com/wired/archive/11.11/opensource.html>.

Grossman, Lev. 2006. "You - Yes, You - Are TIME's Person of the Year." *Time*, December 25. <http://content.time.com/time/magazine/article/0,9171,1570810,00.html>.

Hatch, Mark. 2014. *The Maker Movement Manifesto. Rules for Innovation in the New World of Crafters, Hackers, and Tinkerers*. New York: McGraw-Hill Education.

Hendriks, Arne. 2011. "INSTRUCTABLES RESTAURANT Open Design in a Restaurant Setting." *In Open Design Now: Why Design Cannot Remain Exclusive*, edited by Bas Abel, Lucas Evers, Roel Klaassen, and Peter Troxler. Amsterdam: BIS Publishers. <http://opendesignnow.org/index.php/case/instructables-restaurant-arne-hendriks/>.

Himanen, Pekka. 2001. *The Hacker Ethic and the Spirit of the Information Age*. New York, NY, USA: Random House Inc.

Howe, Jeff. 2006. "The Rise of Crowdsourcing." *Wired*, June. <http://www.wired.com/wired/archive/14.06/crowds.html>. 2008. *Crowdsourcing: Why the Power of the Crowd Is Driving the Future of Business*. 1st ed. Crown Business.

Hunt, Paul D. 2012. "Source Sans Pro: Adobe's First Open Source Type Family." *The Typekit Blog*. August 2. <http://blog.typekit.com/2012/08/02/source-sans-pro/>.

Instituto Faber-Ludens. 2012. *Design Livre*. 1.0 ed. São Paulo: Instituto Faber-Ludens. <http://design-livre.org/download/>.

Kadushin, Ronen. 2010. "Open Design Manifesto." http://www.ronen-kadushin.com/files/4613/4530/1263/Open_Design_Manifesto-Ronen_Kadushin_.pdf.

Kaptelinin, Victor, and Bonnie A. Nardi. 2009. *Acting with Technology: Activity Theory and Interaction Design*. The MIT Press.

Kiefaber, David. 2013. "Coca-Cola's New Can Splits in Half So You Can Really Share the Happiness." *AdWeek*. May 31. <http://www.adweek.com/adfreak/coca-colas-new-can-splits-half-so-you-can-really-share-happiness-149906>.

Kostakis, Vasilis, and Michel Bauwens. 2014. *Network Society and Future Scenarios for a Collaborative Economy*. 2014 edition. Basingstoke: Palgrave Pivot.

Kuwabara, Ko. 2000. "Linux: A Bazaar at the Edge of Chaos." *First Monday* 5 (3). <http://firstmonday.org/article/view/731/640>.

Laird, Sam. 2012. "The Pirate Bay Wants You to Download Physical Objects Now." *Mashable*. January 24. <http://mashable.com/2012/01/23/pirate-bay-download-physical-object-physibles/>.

Larson, K., S. Intille, T. J. McLeish, J. Beaudin, and R. E. Williams. 2004. "Open Source Building - Reinventing Places of Living." *BT Technology Journal* 22 (4): 187-200. doi:10.1023/B:BTJ.0000047598.66712.e0.

Leadbeater, Charles. 2009. *We-Think: Mass Innovation, Not Mass Production*. 2nd ed. Profile Books.

Lovink, Geert, and Miriam Rasch, eds. 2013. *Unlike Us Reader: Social Media Monopolies and Their Alternative*. Inc Reader 8. Amsterdam: Institute of Network Cultures. <http://networkcultures.org/blog/publication/unlike-us-reader-social-media-monopolies-and-their-alternatives/>.

Lynch, Michael P. 2016. *The Internet of Us: Knowing More and Understanding Less in the Age of Big Data*. 1 edition. New York: Liveright.

Maffei, Stefano, and Beatrice Villari. 2006. "Design for Local Development. Building a Design Approach for the Territorial Capital Resources Based on a Situated Perspective." In *Cumulus Working Papers. Nantes 16/06*. University of Art and Design Helsinki. https://www.academia.edu/507998/Design_for_local_development_Building_a_design_approach_for_the_territorial_capital_resources_based_on_a_situated_perspective.

Manzini, Ezio. 2015. *Design, When Everybody Designs: An Introduction to Design for Social Innovation*. Translated by Rachel Coad. Cambridge, Massachusetts: The MIT Press.

Marttila, Sanna, and Andrea Botero. 2013. "The 'Openness Turn' in Co-Design. From Usability, Sociability and Designability Towards Openness." In *Co-Create 2013, the Boundary-Crossing Conference on Co-Design in Innovation*, 99–110. Espoo, Finland: Aalto University. <http://thirdsector.mlog.taik.fi/files/2013/10/marttila-botero-cocreate.pdf>.

Mata Garcia, Laura. 2014. "Designing Entrepreneurship. Creating Enterprise through Design Culture." Doctoral Dissertation, Milano: Politecnico di Milano, Dipartimento di Design. http://issuu.com/lauramatagarcia/docs/thesis_wo_appendixes_lauramatag.

Menichinelli, Massimo. 2006. "Reti collaborative : il design per un'auto-organizzazione open peer-to-peer." Milano: Politecnico di Milano, Facoltà del Design (III). <http://www.openp2pdesign.org>.

2011a. "Open P2P Design Toolkit. How to Co-Design an Open Collaborative Process." http://issuu.com/openp2pdesign/docs/openp2pdesign.toolkit_pixelache.

2011b. "openp2pdesign.org » Open Design Is Going Mainstream Now (first Part)." April 5.

<http://www.openp2pdesign.org/2011/open-design/open-design-is-going-mainstream-now-first-part/>.

2011c. "openp2pdesign.org » Open Design Is Going Mainstream Now (second Part)." April 7. <http://www.openp2pdesign.org/2011/open-design/open-design-is-going-mainstream-now-second-part/>.

2011d. "openp2pdesign.org » Open Design Is Going Mainstream Now (third Part)." April 11. <http://www.openp2pdesign.org/2011/open-design/open-design-is-going-mainstream-now-third-part/>.

2015. "Open Meta-Design: Tools for Designing Collaborative Processes." In *Empowering Users through Design: Interdisciplinary Studies and Combined Approaches for Technological Products and Services*, edited by David Bihanic. New York, NY: Springer.

Monllos, Kristina. 2014. "Ad of the Day: Coke Designs a Friendly Bottle That Can Only Be Opened by Another Bottle." *AdWeek*. May 28. <http://www.adweek.com/news/advertising-branding/ad-day-coke-designs-friendly-bottle-can-only-be-opened-another-bottle-157988>.

Morozov, Evgeny. 2012. *The Net Delusion: The Dark Side of Internet Freedom*. Reprint edition. New York: PublicAffairs.

2014. *To Save Everything, Click Here: The Folly of Technological Solutionism*. First Trade Paper Edition edition. New York: PublicAffairs.

2016. "Welcome to the New Feudalism – with Silicon Valley as Our Overlords | Evgeny Morozov." *The Guardian*. April 24. <http://www.theguardian.com/commentisfree/2016/apr/24/the-new-feudalism-silicon-valley-overlords-advertising-necessary-evil>.

Mulgan, Geoff, Tom Steinberg, and Omar Salem. 2005. *Wide Open : Open Source Methods and Their Future Potential*. London: Demos. <http://www.demos.co.uk/publications/wideopen>.

Nakamoto, Satoshi. 2008. "Bitcoin: A Peer-to-Peer Electronic Cash System." <https://bitcoin.org/en/bitcoin-paper>.

Näkki, Pirjo, and Maria Antikainen. 2008. "Online Tools for Co-Design: User Involvement through the Innovation Process." In *The NordiCHI 2008 Workshop How Can HCI Improve Social Media Development*, 92–97. <https://aaltodoc.aalto.fi/bitstream/handle/123456789/10255/publication1.pdf?sequence=3>.

Niessen, Bertram, Oleg Koefoed, Lise Skov, Zoe Romano, and Alessandro Delfanti. 2010. "OpenWear." EDUfashion. <https://boa.unimib.it/bitstream/10281/19152/1/Openwear%20e-book%20final.pdf>.

okhaos. 2015. "Plantoid." *Okhaos*. <http://okhaos.com/plantoid/>.

"OpenmokoTM - Open. Mobile. Free." 2013. *Openmoko*. August 31. http://wiki.openmoko.org/wiki/Main_Page.

O'Reilly, Tim. 2005. "What Is Web 2.0 - O'Reilly Media." *Oreilly.com*. September 30. <http://oreilly.com/web2/archive/what-is-web-20.html>.

Perens, Bruce. 1999. "The *Open Source Definition*." In *Open Sources: Voices from the Open Source Revolution*, 171–85. http://kojp.mtf.stuba.sk/mironovova/lib/exe/fetch.php/2_semester:projects:gl_ossary:0708:glossary_2sem_0708_aia4_srokamichal_osdtext.pdf.

Prokoudine, Alexandre. 2013. "Introducing Valentina, Free Fashion Design Software." *Libre Graphics World*. December 31. <http://libregraphicsworld.org/blog/entry/introducing-valentina-free-fashion-design-software>.

2014. "Meet BirdFont 1.0, Free Type Design App." *Libre Graphics World*. September 17. <http://libregraphicsworld.org/blog/entry/meet-birdfont-1-0-free-type-design-app>.

Raasch, Christina, Cornelius Herstatt, and Kerstin Balka. 2009. "On the Open Design of Tangible Goods." SSRN Scholarly Paper ID 1487831. Rochester, NY: Social Science Research Network. <http://papers.ssrn.com/abstract=1487831>.

Ratti, Carlo, and Matthew Claudel. 2014. *Architettura open source. Verso una progettazione aperta*. Torino: Einaudi.

Raustiala, Kal, and Christopher Sprigman. 2012. *The Knocko Economy: How Imitation Sparks Innovation*. 1 edition. Oxford U.K. ; New York: Oxford University Press.

Raval, Siraj. 2016. *Decentralized Applications: Harnessing Bitcoin's Blockchain Technology*. 1 edition. O'Reilly Media.

Raymond, Eric S. 1999. *The Cathedral and the Bazaar*. 1st ed. Sebastopol: O'Reilly. <http://www.catb.org/esr/writings/cathedral-bazaar/>.

Rizzo, Francesca. 2009. *Strategie Di Co-Design : Teorie, Metodi E Strumenti per Progettare Con Gli Utenti*. Milano: Franco Angeli.

Romano, Zoe. 2015. "OpenWear - Collaborative Clothing." In *Agents of Alternatives. Re-Designing Our Realities*, edited by Alastair Fuad-Luke, Anja-Lisa Hirscher, and Katharina Moebus. Berlin: Agents of Alternatives e.V.

Sawhney, Nitin. 2003. "Cooperative Innovation in the Commons: Rethinking Distributed Collaboration and Intellectual Property for Sustainable Design Innovation." Massachusetts Institute of Technology. <http://dspace.mit.edu/handle/1721.1/61861>.

Shirky, Clay. 2008. *Here Comes Everybody: The Power of Organizing Without Organizations*. Penguin Press HC, The. 2011. *Cognitive Surplus: How Technology Makes Consumers into Collaborators*. New York: Penguin Books.

- Siefkes, Christian. 2008. *From Exchange to Contributions: Generalizing Peer Production into the Physical World*. Version 1.01b. Berlin: Siefkes-Verlag. <http://peerconomy.org/text/peer-economy.pdf>.
- Stallman, Richard. 2002. "The *Free Software Definition*." In *Free Software Free Society: Selected Essays of Richard M. Stallman*, edited by Joshua Gay, 41–44. Boston: GNU Press.
- Steele, Robert David. 2012. *The Open-Source Everything Manifesto: Transparency, Truth, and Trust*. Berkeley, Calif.: Evolver Editions.
- Surowiecki, James. 2005. *The Wisdom of Crowds*. New York: Anchor Books.
- Swan, Melanie. 2015. *Blockchain: Blueprint for a New Economy*. 1 edition. Beijing : Sebastopol, CA: O'Reilly Media.
- Tapscott, Don, and Anthony D. Williams. 2006. *Wikinomics: How Mass Collaboration Changes Everything*. New York: Portfolio Penguin. 2010. *Macrowikinomics: Rebooting Business and the World*. Portfolio Hardcover.
- TED. 2006. *My Wish: A Call for Open-Source Architecture*. TED. https://www.ted.com/talks/cameron_sinclair_on_open_source_architecture. 2013. *Alastair Parvin: Architecture for the People by the People*. <https://www.youtube.com/watch?v=Mlt6kaNjoeI>.
- TEDx Talks. 2012. *Open Structures: Thomas Lomme at TEDxEutropolis*. <https://www.youtube.com/watch?v=5FXTIOytJRI>.
- Tooze, James, Sharon Baurley, Robert Phillips, Paul Smith, Edwin Foote, and Sarah Silve. 2014. "Open Design: Contributions, Solutions, Processes and Projects." *The Design Journal* 17 (4): 538–59. doi:10.2752/175630614X14056185480069.
- Troxler, Peter. 2011. "The Beginning of a Beginning of the Beginning of a Trend." In *Open Design Now: Why Design Cannot Remain Exclusive*. Amsterdam: BIS Publishers.
- "Ubuntu Font Family." 2011. *Ubuntu*. <http://font.ubuntu.com/>.
- Verwijnen, Jan, and Hanna Karkku. 2004. *Spark! - Design and Locality*. Helsinki: University of Art and Design Helsinki.
- Villari, Beatrice. 2013. *Design, comunità, territori. Un approccio community-centred per progettare relazioni, strategie e servizi*. Milano: Libraccio Editore.

