

# Open Source, Collaboration, and Access: A Critical Analysis of “Openness” in the Design Field

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## Introduction

The concept of “openness” has appeared with increasing frequency in the scientific literature of design over the past 15 years, represented most often in the expression, “open design.” However, this term has different meanings, and many researchers have pointed out the lack of a common, univocal interpretation. For example, Cruickshank and Atkinson argue that “[o]pen design has become an umbrella term for a wide range of approaches to design and creativity where professional design is challenged.”<sup>1</sup> Likewise, Aitamurto, Holland, and Hussain state “...the ‘open’ landscape in design lacks consensus regarding a unified paradigm landscape definition for open design practice. This lack of agreement partially results from the gap in approaches to design.”<sup>2</sup>

This wide range of possible interpretations can be a source of confusion and misunderstanding. The following research study aims to provide a broad interpretation of the relationship between “openness” and design, through a methodical analysis of sources, practices, and case studies.

## The Concept of “Open Design” in the Scientific Literature

In recent years, many scholars have tried to define the meaning of open design. For example, Peter Troxler suggests that open design “... conveys knowledge about its products transparently, communicating its nature within the products themselves, making production tools, methods, and experience accessible to everybody as a common infrastructure.”<sup>3</sup> In contrast, Cruickshank and Atkinson emphasize the collaborative nature of open design, defining it as “the internet-enabled collaborative creation of artifacts by a dispersed group of otherwise unrelated individuals.”<sup>4</sup> Reise et al. agree with these two definitions by describing it as “the openness of all accompanying documents in a product development process, with the aim of collaborative development of tangible objects.”<sup>5</sup>

- 1 Leon Cruickshank and Paul Atkinson, “Closing in on Open Design: Comparing Casual and Critical Design Challenges,” in *Proceedings of the 10th European Academy of Design Conference* (Gothenburg: University of Gothenburg/ European Academy of Design, 2013): 1.
- 2 Tanja Aitamurto, Dónal Holland, and Sofia Hussain, “The Open Paradigm in Design Research,” *Design Issues* 31, no. 4 (Autumn 2015): 17.
- 3 Peter Troxler, “Libraries of the Peer Production Era,” in *Open Design Now: Why Design Cannot Remain Exclusive*, eds. Bas van Abel Lucas Evers, Roel Klaassen, and Peter Troxler (Amsterdam: Bis Publisher, 2011): 86.
- 4 Cruickshank and Atkinson, “Closing in On Open Design,” 3.
- 5 Carsten Reise, Guenther Seliger, Faruk Manav, Schwenke, Stefan Böhm, and Martin Geyer, “Open Design for Manufacturing: Best Practices and Future Challenges,” in *Proceedings of the 10th Global Conference on Sustainable Manufacturing* (Istanbul: METU Middle East Technical University, 2012).

On the P2P Foundation website, the discussion on “open design” is being conducted on several fronts.<sup>6</sup> For example, at one level of discourse, open design is something that allows the distribution of product blueprints through Creative Commons licenses, thereby allowing the files to be edited, copied, and freely distributed. At another level, the “open paradigm” is the dawn of a new economic system based on diffusion rather than centralization. Aitamurto, Holland, and Hussain argue for seeing many ways to open the different stages of a design process—for example, through crowdsourcing or co-creation or by using open source licenses.<sup>7</sup> They suggest that the “open paradigm” is used not only to define a practice linked to the design process, but also is often used to describe different production and distribution methods made possible by open source hardware, open source software, open design, open processes, open commercialization, and open content.

Marttila, Nilsson, and Seravalli also state that the opening of production in recent years coincides with the rise of creations, both tangible and intangible, made through collaborative and participatory processes and involving common goods.<sup>8</sup>

Finally, Openmanufacturing.net—one of the websites specializing in issues of openness—states that “[t]he open in open manufacturing can be interpreted in a few different ways: open source designs under free licenses, open to do-it-yourself, open to end-user dialogue, open to peer-review, open to collaboration, open to cradle-to-cradle analysis, open to viewing as an ecosystem of processes, open to democratic participation, open to new design ideas, open to new economics, open to the future.”<sup>9</sup>

### Analysis

This plurality of viewpoints suggests that further analysis would be useful to understand which features can be expressed by the concept of “openness” in design. Conducting this analysis and generating a description involved us in developing a bibliography on open design. We found 28 papers, written between 2000 and 2017, that were deemed relevant to this research, based on the following factors: the theoretical progress in the definition of the meaning of “openness” in the design field, the description of the open design process in both the production and design stages, and the study of the active role of the user in the design process.

The contents of each paper were catalogued according to two criteria: the classification of the different theories cited by the authors and the collection of case studies and real experiences mentioned in the papers. Table 1 lists the papers and specifies the theories and case studies addressed by each one.

6 [http://p2pfoundation.net/Open\\_Design](http://p2pfoundation.net/Open_Design) (accessed January 22, 2019).

7 Aitamurto, Holland, and Hussain, “The Open Paradigm in Design Research,” 17.

8 Sanna Marttila, Elisabet M. Nilsson, and Anna Seravalli, “Opening Production: Design and Commons,” in *Making Futures: Marginal Notes on Innovation, Design, and Democracy*, eds. Pelle Ehn, Elisabet M. Nilsson, and Richard Topgaard (Cambridge: MIT Press, 2014): 87–98.

9 <http://openmanufacturing.net> (accessed January 22, 2019).

**Table 1 | A Portion of the Selection of Theories and Case Studies in the Open Design Literature**

The full table is available at: <http://www.silviagasparotto.com/2018/07/18/open-source-collaboration-and-access-a-critical-analysis-of-openness-in-the-design-field/>

Paper	Theory (keywords)	Case Studies and Experiences
Tanja Aitamurto, Dónal Holland, and Sofia Hussain, "The Open Paradigm in Design Research" <i>Design Issues</i> 31, no. 4 (Autumn 2015): 17.	Co-design, open design, crowd-sourcing, crowdfunding.	Open Ideo, Quirky, Innocentive, Ninesigma, 99design, Jovoto, Rep Rap.
Kerstin Balka, Christina Raasch, and Cornelius Herstatt, "How Open is Open Source? – Software and Beyond," <i>Creativity and Innovation Management</i> 19, no. 3 (2010): 248–56.	Open source innovation, open design, openness.	–
Raasch Christina, Cornelius Herstatt, and Kerstin Balka, "On the Open Design of Tangible Goods," <i>R&amp;D Management</i> 39, no. 4 (2009): 382–93.	Open source, open design, Community-Based-Model, User-Innovation-Model, Co-development.	Oscar, Reprap, Free Beer, Osgv, Openmoko, Neuros Osd.

10 This definition assumes the most common point of view on open design, which considers open design to be a process for creating physical artifacts. Many authors have written about this subject. Massimo Menichinelli, "L'evoluzione dell'Open Design: concetti e tappe," *DIID*, no. 57 (2014): 65–74; Kerstin Balka, "Open Source Product Development. The Meaning and Relevance of Openness" (PhD diss., Hamburg: University of Technology Hamburg, 2011); Jérémy Bonvoisin and Jean-François Boujut, "Open Design Platforms for Open Source Product Development: Current State and Requirements," in *Proceedings of the 20th International Conference on Engineering Design—Innovation and Creativity* 8, (Milan: The Design Society, 2015): 11–22.

### Features of the Concept of "Openness"

An analysis of the articles in Table 1 shows that the selected scientific literature seems deeply interconnected with many other topics. In particular, we can clearly distinguish many references to co-design, crowdsourcing, open innovation, making, and open manufacturing.

Open design, in these contexts, appears to be just one segment or step in a wider range of open processes. In its most recognized meaning, it is considered a process that applies open source licenses to the design of physical artifacts and to their production. This practice allows for the disclosure of any information about a product so that it can be freely replicated, modified, or implemented.<sup>10</sup>

Although the concept of open design might be circumscribed and limited by this definition, the notion of "openness" in the field of design, meanwhile, has been extended. To understand the features of "openness," we analyzed the keywords used in Table 1 and ultimately identified three main characteristics of "openness": open source, collaboration, and access (see Table 2).

#### *Openness as Open Source*

Open-source models originated in the 1980s to challenge the design and distribution of commercial software. In fact, "open-source" indicates, the process by which anyone familiar with a programming language can develop, integrate, or modify the source code of software, allowing for decentralized, non-hierarchical control and flexible structures.

Open sourcing as a process can lead to positive results when participation occurs. Wenger offers three criteria that define participation in such a process: It is a joint initiative made possible by

**Table 2 | Terminology Indicating Openness as Open Source, Collaboration, and Access in Open Design Literature Review**

<b>Open Source</b>	<b>Collaboration</b>	<b>Access</b>
DIY	Co-creation	Distributed design
Common-based peer-production	Co-design	Common-based peer-production
Complexity	Co-development	Commons
Creative commons licence	Co-innovation	Complexity
Decentralized innovation	Collaboration (generic)	Crowdfunding
Distributed technology	Collaboration between communities	Decentralized innovation
Free software	Collaborative consumption	Digital fabrication
Network	Collaborative development	Distributed technology
Online sharing distribution	Collaborative processes	DIY
Open architecture	Collaborative spaces	Mass customization
Open fabrication	Collective invention	Mass production
Open hardware	Collective-creation	Mass-creativity
Open source,	Common-based peer-production	Mass-innovation
Open structure	Community based development	Open content
Openness	Community-based-model	Open fabrication
Outsourcing manufacturing	Complexity	Open innovation
Peer production	Computer-mediated collaboration	Open knowledge
Peer-to-peer process	Cooperation	Open manufacturing
Personal or Self-Fabrication	Crowd production	Outsourcing manufacturing
Sharing	Crowd-creativity	Peer-to-peer economy
	Crowd-innovation	Peer-to-peer process
	Crowdsourcing	Personal or self-fabrication
	Democratizing innovation	Sharing
	Distributed collaboration	Sharing economy
	Horizontal innovation	Online sharing distribution
	Internet-enabled collaboration	Interaction design
	Mass customization	
	Mass production	
	Mass-creativity	
	Mass-innovation	
	Meta-design	
	Network	
	Open collaborative models	
	Open innovation	
	Participation	
	Participatory design	
	Peer production	
	Peer-to-peer process	
	Producership	
	Prosumerism	
	Social design	
	Social product development	
	Social production	
	User-creation	
	User-innovation model	

the construction of a collective identity and the sharing of priorities and meanings; it includes a shared repertoire of rituals, routines, and tools and a commitment to reciprocity advocated by mutual trust; and in it, diversity is a positive and necessary aspect.<sup>11</sup>

Openness as open-source development is based on free, horizontal, diffuse, and shared cooperation. Its aim is to create communities that share common goals to implement the native project and to modify and improve it with future developments.

In the papers analyzed, the open-source nature of design is defined using expressions such as “peer-to-peer process,” “free software,” and “creative commons license,” and by adjectives such as “decentralized” or “distributed.” The review also revealed many different case studies related to open-source methods, including case studies of Reprap, Open Structure, Arduino, and GitHub.

#### *Openness as Collaboration*

“Collaboration” is the second feature of “openness” revealed in our literature review. The difference between open sourcing and collaboration lies in their modes of operation: The concept of open sourcing suggests the ideas of expansion and fragmentation, while “collaboration” evokes the aggregation of a plurality of subjects. In this sense, the open paradigm seeks to emphasize the possibility of expanding the process to “n” numbers of people working together.

Collaboration can imply participation, cooperation, and sharing. Collaborative relationships are encouraged and supported by environments like the Internet, which facilitate interactions among people with common interests and beliefs. From an economic perspective, collaboration has become a useful way to create value: An entire area of the new economy—the so-called sharing economy—is based on a model of mutual trust, sharing, and cooperation.

The analysis in Table 2 shows that of the three characteristics describing “openness” in the design field, collaboration is mentioned most frequently, and it is confirmed and articulated by other words, including co-design, community, cooperation, democratization, or participation.

#### *Openness as Access*

“Open” as an adjective is commonly used to denote an aspect of a service, a device, or a resource that potentially is accessible to anyone. Access is a condition related to a real or virtual content, such as objects, tools, environments, and information. The “open paradigm” is therefore a pre-condition of access, and because of this sequence, these two terms sometimes appear to be interchangeable or are used interchangeably.

11 Etienne Wenger, *Communities of Practice: Learning, Meaning, and Identity* (Cambridge: Cambridge University Press, 1999).

Access easily can be offered—even when a third party permits and modulates it or makes it operational. Despite these potential limitations and conditions, the technological developments in just a few years has allowed the word “access” to become synonymous with content made available free of charge. In everyday language, “open access” has gradually become a condition that not only is attributable to the web and virtual contents, but also might be extended by analogy to objects, environments, and production systems. Thus, “access” is the third feature expressed through the concept of “openness,” and it describes the ability to reach a place, a resource, or information. As shown by the analysis of the scientific publications, words such as “common,” “distributed,” “peer-to-peer,” “sharing,” and even “making” or “digital fabrication” indicate that more and more resources are available to a large number of people.

### Is Open Design at a Dead End?

In this context, the role of design clearly is changing. It no longer is related to an authorial dimension but is influenced by a chain of events that the designer is not always able to control.

This transformation is probably the most significant reason for the limitations of open processes in design. The following paragraphs examine the three features of openness (i.e., open sourcing, collaboration, and access) to identify some of their restrictions or boundaries.

#### *The Limits of Open-Source Methods in Design*

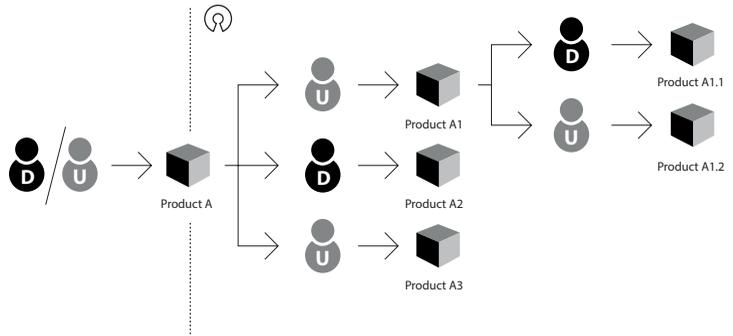
According to most interpretations, the open design process should follow the rules of open source. However, in many of the cases reviewed here, this approach is not entirely respected. The main obstacle seems to be the production and distribution of later versions of the code or product: the process called “forking.” One of the most significant examples of an entirely open-source process applied to the design of a physical object is the Reprap 3-D printer, which was released with a Creative Commons license and over the years has evolved into different variants as different individuals have participated.<sup>12</sup> This “ramified” (i.e., forking) process allows many product variations, starting from a single source. Some researchers define an open-source approach as an evolutionary process because the differentiation and the spread of source codes allow changes and incremental improvements to be made over time.<sup>13</sup>

Design history tells us that the practice of “forking” has in fact always existed, although it has not always been identified by this term. The famous title of Bruno Munari’s book on design methodology conveys this sense of design practice: *Da cosa nasce*

12 <https://reprapworld.com> (accessed January 22, 2019).

13 See, e.g., Michael W. Godfrey and Qiang Tu, “Evolution in Open Source Software: A Case Study,” in *Proceedings of the 2000 International Conference on Software Maintenance* (IEEE: San Jose, 2000): 131–42. DOI:10.1109/ICSM.2000.883030; Kumiyo Nakakoji, Yasuhiro Yamamoto, Yoshiyuki Nishinaka, Kouichi Kishida, and Yunwen Ye, “Evolution Patterns of Open-Source Software Systems and Communities,” in *Proceedings of the International Workshop on Principles of Software Evolution* (New York: ACM Press, 2002), 76–85. DOI:10.1145/512035.512055.

Figure 1  
The ideal open-source process.

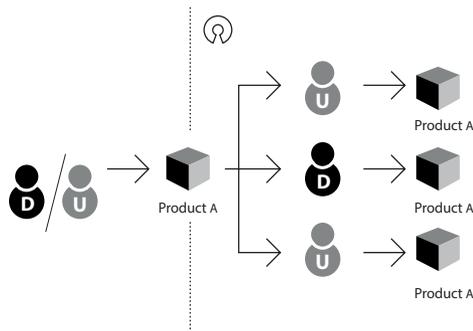


cosa. Appunti per una metodologia progettuale [One thing leads to another. Notes for a design methodology].<sup>14</sup> In this book, Munari describes an approach that emphasizes the importance of analysis and research in the design process, which he does not consider to be an act of pure creativity. The development and improvement of an object, as described by Munari, is based not on a single starting point—a creative idea, an existing object, or a visual stimulus—but on a wide range of factors and options, generated by the exploration, the knowledge, the sensitivity, and the creativity of a person, all of which must be considered throughout the process to achieve a synthesis. Similarly, most everyday objects—the products of anonymous design, such as the umbrella or the comb—have been improved over time, step by step, to the point that they have developed almost perfect form with little room for improvement.<sup>15</sup>

Although in open design the source code—in the form of files, blueprints, or documentation—is released with a Creative Commons license, tracing later or improved versions of an open-source product is very rare. Figure 1 presents the ideal open-source process applied to design—for example, the Reprap 3-D printer. In contrast, Figure 2 visualizes what happens in most cases: The designer (D) or the user (U) releases the blueprints of an object under a Creative Common licence, but the product is manufactured, over and over, without any changes or improvements.

- 14 Bruno Munari, *Da cosa nasce cosa. Appunti per una metodologia progettuale* [One Thing Leads to Another: Notes for a Design Methodology] (Bari: Laterza, 2010).
- 15 Alberto Bassi, *Design anonimo in Italia, Oggetti comuni e progetto incognito* [Anonymous Design in Italy, Common and Unknown Objects] (Milano: Mondadori Electa, 2007).

Figure 2  
The outcome of common open design processes.



This discrepancy raises the question of why the open-source process is only partially imitated and used in open design. Many critical issues emerge. First, the open design process involves physical products. According to Balka and to Aitamurto, Holland, and Hussain, this factor is the leading cause for the limited use of the process.<sup>16</sup> The physical nature of objects implies higher production costs compared to software writing (coding). Second, open design doesn't have a widespread, standardized language of design, while in open source the coding language often creates a common knowledge base. (Open-source computing also is practiced by groups of people—professionals or highly motivated and highly skilled amateurs—whose common language also contributes to a common cultural orientation.) Language is a code consisting of regulated and shared signs that allows comparison and comprehension. Meanwhile, design has a plurality of expressions and a myriad of different languages. Some projects (e.g., the OpenStructures project<sup>17</sup>) have tried to solve the problem of the lack of a common language by developing standardized modular schemes and projects, but this approach seems to weaken the expressive potential of design. Language represents a fundamental aspect of the design practice, and the decision to use a specific aesthetic and style determines the perception of the object itself.

Facilitating the transfer of the open-source process to design would require not just a common language, but also common values, including a capacity to trust each other and to work toward common goals. In summary, the protocol for developing and designing a product using the open-source method has both input barriers and output barriers. The former are the extreme differences in language and the premises of subjective design. The latter lie in the material nature of the artifact and in the more common “closed-mode” approach to product development.

#### *The Limits of Collaboration in Design*

The scientific literature concerning collaboration in design often uses expressions, such as “democratization,” “empowerment,” “participation,” “community,” and “collective” to emphasize that the direct involvement of many people is essential for greater effectiveness and fairness.<sup>18</sup> Meanwhile, other research studies emphasize that the involvement of a group of people—whether localized or widespread, restricted or large—involves several problems, including participants’ motivations for contributing to a project and their tendency to compromise.<sup>19</sup>

People tend to participate in a collaborative project for two primary reasons: real monetary compensation (e.g., the Quirky platform) and being recognized of valuable through the certification of individual professional skills. In his study on processes and

16 Kerstin Balka, *Open Source Product Development: The Meaning and Relevance of Openness* (Berlin: Springer Science & Business Media, 2011): 23–24; Aitamurto, Holland, and Hussain, “The Open Paradigm in Design Research,” 18–19.

17 <http://beta.openstructures.net> (accessed January 22, 2019).

18 See, e.g., Pelle Ehn, Elisabet M. Nilsson, and Richard Topgaard, eds. *Making Futures: Marginal Notes on Innovation, Design, and Democracy* (Chicago: MIT Press, 2014); Anna Seravalli, “Making Commons: Attempts at Composing Prospects in the Opening of Production” PhD diss., Malmö University, 2014. <http://muep.mau.se/handle/2043/17232> (PhD thesis); and Elizabeth B.-N. Sanders and Pieter Jan Stappers, “Co-Creation and the New Landscapes of Design,” *CoDesign* 4, no. 1 (2008): 5–18.

19 See, e.g., Finn Kensing and Jeanette Blomberg, “Participatory Design: Issues and Concerns,” *Computer Supported Cooperative Work* 7, no. 3–4 (1998): 167–85.

dynamics in the Quirky community, Milad Hajiamiri states that economic motivation is one of the vectors for contributing to a project.<sup>20</sup> He specifies that the community's involvement in the development of a product is most conspicuous in the phases that require less effort and fewer individual skills and in which the promise of remuneration is proportional to the time dedicated to working.

These dynamics seem to confirm the interpretation of the earlier Darwinian principle of natural selection, in which the individual advantage dominates over the collective. However, in his last work, *The Descent of Man, and Selection in Relation to Sex*, Darwin partially accepts critics' questioning of the thesis of individual selfishness as an evolutionary criterion, and he opens to an evolutionary theory that embraces cooperation and altruism in defining his "social anthropological instinct."<sup>21</sup>

This evolution in Darwin reflects the contradiction between the neo-liberal conception of human motivation based on economic return and individual hedonism (*homo economicus*) and the social commons conception geared toward collaborative social interests. The first criterion is based on property rights and the quest for autonomy through competition, and the second emphasizes exchange, donation, aggregation, and the sense of community.

Some authors believe that the increase in collaborative design emerges especially when the goal of design is a matter not of competition but of a common good.<sup>22</sup> Charlotte Hess and Elinor Ostrom provide the following definition of "commons": "a resource shared by a group of people that can occur on a wide range of scales and, critically, raises challenges of use, governance, and sustainability that can be characterized as social dilemmas."<sup>23</sup> The modern literature on the topic reports an increase of the commons in many different sectors.<sup>24</sup> In particular, objects considered to be common property—and distributed out of a shared feeling of opposition to the exclusive rights to use and reproduce an artifact—are increasingly being produced in fab labs (small digital fabrication laboratories widespread all over the world), with the cooperation of many professionals.<sup>25</sup>

In open design processes, collaboration is neither predictable nor spontaneous; instead, collaboration is closely related to motivation, whether for moral or economic advantage. The more differentiated the motivations and the larger the group, the more difficult the collaboration is to manage. In contrast, if a smaller number of people are similarly motivated, they create a more cohesive group that works together more smoothly, that focuses on precise objectives, and that increases the project's probability of success.

- 20 Milad Hajiamiri and Fatma Korkut, "Perceived Values of Web-Based Collective Design Platforms from the Perspective of Industrial Designers in Reference to Quirky and OpenIDEO," *A/Z ITU Journal of the Faculty of Architecture* 12, no. 1 (2015): 147–59.
- 21 Charles Darwin, *The Descent of Man and Selection in Relation to Sex* (London: Murray, 1888).
- 22 See, e.g., Seravalli, "Making Commons"; and Peter Troxler, "Making the Third Industrial Revolution—The Struggle for Polycentric Structures and a New Peer-Production Commons in the FabLab Community," in *FabLab: Of Machines, Makers and Inventors*, eds. Julia Walter-Herrmann and Corinne Büching (Bielefeld: Transcript Verlag, 2013), 181.
- 23 Charlotte Hess and Elinor Ostrom, "A Framework for Analysing the Microbiological Commons," *International Social Science Journal* 58, no. 188 (2006): 335–49.
- 24 Charlotte Hess, "Mapping New Commons," in *Proceedings of the Twelfth Biennial Conference of the International Association for the Study of the Commons*, Cheltenham, UK, July 14–18, 2008.
- 25 Seravalli, "Making Commons"; Ehn, Nilsson, and Topgaard, eds., *Making Futures*; Yochai Benkler and Helen Nissenbaum, "Commons-Based Peer Production and Virtue," *Journal of Political Philosophy* 14, no. 4 (2006): 394–419; and Yochai Benkler, "Practical Anarchism: Peer Mutualism, Market Power, and the Fallible State," *Politics & Society* 41, no. 2 (2013): 213–51.

### *The Limits of Access in Design*

As Domenico De Masi stated, “[i]f in the Renaissance the classical culture was produced by the few for the few, and in the age of industrial society, mass culture was produced by the few for the many, in the post-industrial society, Postmodern Culture is produced by the many for the many ....”<sup>26</sup> The production of culture, products, and services for many people is made possible as a result of the growing opportunities created by the Internet and by greater access to both production and information tools and instruments.

Although the concepts of opportunity and access often are used as synonyms and thus might lead us to imagine that they are two equal terms, ethical differences emerge between the two. Erik Olin Wright identifies the differences this way: The concept of equal opportunity defines a static condition, determined by external factors or standards governing both positive and negative predicaments. “Equal opportunity to thrive or starve is still equal opportunity,” he notes.<sup>27</sup> Conversely, equal access gives everyone the ability to use resources freely and thus the opportunity to improve living conditions and realize personal aspirations.

The concept of access, even within the processes of opening up, is sometimes confused with the concept of opportunity. Crowdsourcing provides one example of this confusion. In this process, access to the design phase is in fact mediated by a proprietary platform that defines the criteria of behavior and the degree of freedom of the crowd. Thus, the resources might not be used freely because every action is influenced by the subject’s own purposes, which in the case of a for-profit company, is generating profit. For example, Quirky has an apparently equal structure because decisions are made in a more shared fashion than the choices made by a hierarchically organized structure. However, the reasons why Quirky decided to adopt the process of crowdsourcing and open innovation in designing objects are dictated not only by the desire to democratize the process but also by strategies that improve and expedite the analysis of their target consumers and that determine which product best suits the market.<sup>28</sup> In addition, the production stage, like the design stage, also has limitations.

The use of complex tools means having some knowledge and an individual predisposition to the design and production of objects. Fab labs, as the ultimate example of opening, provide access to production tools but still limit their users to those who have special skills and are able to exploit this potential.<sup>29</sup> Skills required in a fab lab might be 3-D modeling and printing, using laser-cutting machines, an understanding of materials and their properties, drawing, and programming. The need to acquire these skills in many cases becomes a barrier to access.

26 Domenico De Masi, *Mappa mundi: modelli di vita per una società senza orientamento* [Mappa mundi: life models for a society without orientation] (Milan: Bur, 2015), 630. (Translation of quotation by the author.)

27 Erik Olin Wright, “Transforming Capitalism Through Real Utopias,” *American Sociological Review* 78, no. 1 (2012): 4.

28 For a more complete analysis of Quirky’s model, see, e.g., Silvia Gasparotto, “Networked Production and Outsourced Design: A Comparison of Three Case Studies,” in *Proceedings of the 12th EAD Conference, Design for Next* (Taylor and Francis online 2017): 2746–59.

29 Skills required in a fab lab could be 3D modeling and printing, using laser-cutting machines, an understanding of materials and their properties, drawing, and programming.

The limits of accessibility are set by the starting conditions, which can be determined by direct and indirect causes. These conditions are relevant for the decision making and planning, but also to create unmediated access and to sort out who has the skills required to take advantage of an opportunity.

### **Conclusion**

The lack of uniformity in the definition of open design derives from the plurality of meanings of the word “open,” which, according to this analysis, can be summarized through the features of open source, collaboration, and access. Because of the complexity and plurality of open design, speaking generically of the “opening of the design processes” or the “open paradigm in the field of design,” is probably more accurate. In this case, considering open design as part of a more complex system is useful. This system, or ecosystem, allows us to locate within it the processes that, in the current scenario and in the future, fit the three opening characteristics proposed. This type of structure makes it possible to provide an initial, sufficiently flexible and adaptable orientation to the opening processes that are occurring in the current design scene and that are changing practices, relationships, and methods.

This structure provides the starting point for further research studies in this ever-changing field. Such changes alter the designer’s role—from having total control of the process to a necessary relationship with new and different stakeholders. Moreover, the transformation is affecting the established relationships between designer and manufacturer by increasingly integrating into the process also the public, both as individuals and as groups.