Prosumer and product design through digital tools

L. Asión-Suñer[1][0000-0001-5654-9308] and I. López-Forniés[1][0000-0001-6352-2023]

[1] Universidad de Zaragoza, Zaragoza 50018, Spain
lauraasion@gmail.com

Abstract. Currently, the growing interest of users and consumers in the participation of the creative process has led to the typical "maker culture" practices. Consequently, there is an increasing number of prosumers -users who produce what they consume- who want to be part of the design and transformation process of the products. In order to achieve it, prosumers have begun to use digital tools that greatly facilitate this task. These tools could vary depending on the number of users involved in the process and the freedom of participation that they have on the product. It has been presented a number of qualitative classification of cases involving the end user, individually or collectively, that has influenced as a prosumer in the product design process. The objective is to study the use of digital tools in the creative phase within the design process according to their different levels of participation with respect to the final product. The cases are shown in four tables according to the number of users involved in the process and their level of participation. In these tables, other important aspects related to the study of digital tools such as the type of contribution of the prosumer to the product or the design phase in which he participates will be identified. In conclusion, this work will show if there is a pattern in the use of digital tools according to the number of users involved in the process and the freedom of participation that they have and which are the reasons for their use.

Keywords: Prosumer, Product Design, Digital Tools, Creative Process.

1   Introduction

In 1980, Alvin Toffler aimed the term *prosumer* for the first time, referring to mass consumers who, with new communication systems, would assume the role of consumer-producers [1]. Technology has evolved and in the last decades there has been a transition from passive consumers to active prosumers [2]. In this way, we would currently understand as a prosumer all those users that actively participate in the creation of products and services that finally uses [3]. Kotler suggested that this advance towards the postindustrial era would decrease the number of pure consumers, who would be replaced by "prosumers"[4]. However, there exists numerous cases, their claims have not been established in society in a generalized manner.

The consumption model has evolved thanks to new technologies of communication and digital literacy, access to the Internet, the proliferation of social networks and Web 2.0 [5]. Prosumer has emerged to become a central figure in the temporary culture [6],

empowered and independent comes to self-realization focused on the achievement of their own product that is shared as online content [7]. New techno-logical tools have burst with greater initial impact in the field of design, allowing the democratization of creative processes, centered on the user and allowing their participation in the process, which guarantees their transmission and permanence [8].

On the other hand, the maker movement has been developed [9,10] as an evolution of the traditional DIY movement, where it has gone from bricolage and assembly to creation and manufacture. The futuristic vision of a user who can become a producer and consumer at the same time, thanks to electronic technology [11], has materialized in some communities that make the prosumer closer to technology and has an easier access to digital tools. In this aspect, it is remarkable the importance of 3D printing, which has been the engine of a new maker current as it is one of the most promising recent technological developments [5]. Currently it is pretended to reach especially the youngest [12] with actions of divulging robotics, 3D design software, agile tools and programming that allow them to develop their own products.

The Toffler model of *prosumer* remains rooted in the era of massive mass media. Roles as consumers and users have long begun to be closely related to those as producer and creator [13]. Specifically, the term *maker* has expanded the motto of DIY (*Do It Yourself*) to DIT (*Do It Together*) or DIWO (*Do It With Others*) and includes disciplines ranging from computer science, electronics and robotics to carpentry and metallurgy [8]. The activities that could be grouped under the category of *maker* range from retail, creation of workspaces and fab labs [14], manufacturing and distribution, exhibition fairs [15] and services [16]. Knott differentiates three types of prosumer according to how they use the tools, materials and indications that companies provide them: the prosumer that follows rules; the one who pursues self-sufficiency; and the one who adapts tools and materials in DIY processes [17].

2　　Methodological description

The main objective of this study focuses on research through a case review in which digital tools has been used throughout the product's creative phases by prosumers. As a result, we hope to find a series of cases that show if there is a pattern in the use of digital tools according to the number of users involved and their different levels of participation with respect to the final product, and which are the reasons for their use.

To achieve this, an initial search of documented cases was carried out but we only found two cases. So, a field search was carried out with the keyword "prosumer" and other related keywords as "collaborative design", "mass customization", "co-creation" and "personalization". After this more precise search, the majority of cases cited in the article were obtained. Finally, a search was carried out through the digital tools identified in the cases found as "design software", "open source" or "tutorials".

A total of 33 cases were identified that, instead of being tested in their entirety, were analyzed and tested superficially to have enough information to make a posterior qualitative classification according to two main aspects. First, the number of participants involved, differentiating between an individual (a single prosumer) or collective (more

than one prosumer) participation. And, second, according to the degree of creative freedom, differentiating between free (prosumers could participate freely and establish their own criteria) or restricted (prosumers could opt among the suggestions offered by the company) user participation in the creative phase of the design process. In this way, in order to optimize the classification of cases, these have been divided into four tables: individual and free participation cases (Table 1); individual and restricted participation cases (Table 2); collective and free participation cases (Table 3); and collective and restricted participation cases (Table 4).

In these tables, three aspects were qualitatively defined. First, the type of contribution of the prosumer to the product, differentiating between new design (ND), re-design (RD), copy (C) or selection of features (SF). Second, the design phase, differentiating between concept (C), development (DV), detail (DT) or presentation (P) phase. And third, the digital tool used, such as online platform (OP), design software (DS), tutorials (T), open source (OS), or vote system (VS), being this particular in each case. We conclude with the analysis of the results in form of discussion and conclusions that deal with aspects related to digital tools and prosumers.

3 Results

The qualitative classification of the results is included in Table 1, Table 2, Table 3 and Table 4. Furthermore, in the cases review we found several websites that offered numerous digital tools for prosumers. Among these portals, it was found a website that offers companies the possibility to customize any of their products through the development of a visual digital tool of selection and filtering [18]; a blog post with a complete list of collaborative resources for 3D modeling and impress [19]; and a page of online resources to do graphic design without being a professional in the field [20].

3.1 Individual and free participation cases

Due to the limitations in the productive systems it is difficult to develop unique products where the prosumer can participate freely. Therefore, some companies give the user the necessary means in order to finish the product by himself [21, 22, 23]. There are cases in which the prosumer can follow an example to build his own product and, in addition, add a creative contribution on the design, manufacture or personalization of it [24, 25]. Finally, some of the cases studied also have platforms where they offer free training so that the prosumer learns tasks such as sewing, welding, 3D design and printing, CNC and resins molding, among others [21, 22, 23, 25, 26].

Table 1. Characteristics of individual and free participation cases.

Case	Contribution	Phase (Results)	Digital tool
Meccano [21]	ND	C + P (Design)	OP + T + instructions
Burda [22]	RD + C	DV + P (Fabrication)	OP + T + instructions
MODI [23]	RD + C	C + DV (Design)	OP + T + instructions

Spreadshirt [24]	ND + SF	C + P (Design)	OP + DS
Instructables[25]	C + RD	C + DV (Design + Fab.)	OP + catalogue + ideas interchange
Desygner [26]	ND + SF	C + P (Design)	DS + online tools + templates
BeoCafe [27]	ND	C (Conceptual design)	3D Software + design + rendering
Slow photo [28]	ND	C + DV (Design + Fab.)	DS + prototyping tool

3.2 Individual and restricted participation cases

Among the existing tools for a user to participate in the design of a product the most used is mass customization, which allows to configure a product through the choice of suggested options by the company. It is widely used in transportation sector [29,30], but it is also present in sectors such as sports and textiles [31, 32, 33].

Table 2. Characteristics of individual and restricted participation cases.

Case	Contribution	Phase (Results)	Digital tool
Helmets 3D [29]	SF	P (Design)	OP + DS
MINI [30]	SF	P (Design)	OP + DS
NikeID [31]	SF	C + P (Design)	OP + DS
Converse [32]	SF	C + P (Design)	OP + DS
Pro Model Deck [33]	SF	P (Design)	OP + DS
Makercase [34]	SF	D (Detail phase)	Makercase
Ordermade WholeGarment [35]	SF	P (Not design)	Co-design software tool

3.3 Collective and free participation cases

Digital tools such as online platforms and forums generate a common collaborative network where prosumers can co-create and share results [36, 37, 38]. Moreover, the phenomenon of 3D printing has overflowed the field of industry and has been set up at other levels [8]. This, together with Open Access, has allowed prosumers to share their creations in forums and file libraries to which any user has access to up-load their models and modify others, thus giving rise to models created by various users [19].

Table 3. Characteristics of collective and free participation cases.

Case	Contribution	Phase (Results)	Digital tool
Ikea Hackers [36]	ND + RD	C (Conceptual design)	OP + catalog + ideas interchange
ProsumerFX [37]	ND	C (Conceptual design)	DS for image processing

Braineet [38]	ND	C (Conceptual design)	OP + App
ReViste [39]	RD	C + P (Design)	Not a digital tool (physical)
Github [40]	ND +RD	C (Conceptual design)	OS + CAD + 3D models repository
3D Printeros [41]	ND	C + DV (Design+Fab.)	Cloud + OS + Remote 3D printer
Robotix [42]	ND + RD + C	C + DV (Design)	OP + T + Ideas interchange
Scratch [43]	ND	C (Design)	OP + Software
Maker Shed [44]	ND + RD + C	C + DV (Design)	OP + T + Hardware
Vectary [45]	ND	C + P (Design)	3D software + forum + co-design
OnShape [46]	ND	C + DV (Design)	Learning centre + cloud + library

3.4 Collective and restricted participation cases

In collective cases whose participation on the product is restricted, the user's participation only has relevance as a number, giving types of participations. First, users make design decisions collectively through voting, surveys or user tests, where they value products or services to apply innovations or improvements. In this way, through the choice of features, users can make collective design decisions about the final result of the product [47, 48, 49]. Second, users participate through voting systems or crowdfunding to decide if a product already designed by the company or by another user will finally go to the market [50, 51]. And third, there are platforms of products and services that present new contents adjusting to the multiple selection of options made by their viewers [52, 53]. In all three cases, a participation that in principle is individual, ends up becoming a collective result.

Table 4. Characteristics of collective and restricted participation cases.

Case	Contribution	Phase (Results)	Digital tool
Lay's [47]	ND + SF	Market (Fab. + commercialization)	OP + VS + social networks
La Marque du Consommateur [48]	ND + SF	DV (not design)	OP + VS + questionnaire
Manchester City FC [49]	SF (ND + RD)	C + P (Design)	OP + VS + testing
Lego Ideas [50]	ND + SF	Market (Fab. + commercialization)	OP + VS
MADE [51]	ND + SF	Market (Fab. + commercialization)	Cloud + crowdfunding + OP
Netflix [52]	C + SF	P (Not design)	Data processing algorithm
Amazon [53]	C + SF	P (Not design)	Data processing algorithm

4   Discussion

The original idea of Toffler about prosumer [1] has derived in two alternative ways. The first one, known as "mass customization", is to achieve a high degree of personalization by having consumers establishing the design requirements. In this way, the consumer does not participate in the manufacture, but rather limits himself to personalize the product through a filtering of options that affects the final design. The second way is to make the prosumer participate in the chain of transformation of the product either in the creative phase of design, in the production of some of the parts or in the final phases such as assembly or installation. It is necessary to define these two alternatives, since there are many sectors that have used the term prosumer, confusing it with mass customization, personalization at the point of sale or online personalization.

The term self-consumption, which is closely related to prosumer, consists of producing or managing the resources that the consumer himself enjoys. The most well-known examples are associated with the production of food, energy, water or clothing. Consumers could be individuals, groups, companies or public entities. In this way, in the freedom scale we would find self-consumption in the highest rank and mass customization in the lowest. The ideal prosumer and that would fit the original definition of Toffler [1] would be the one between these two extremes. I.e., that prosumer who can act with freedom on the product, but who has certain interdependence of a third party that provides the base on which to act. Two good examples classified that comply these characteristics are MODI [23] and 3D Printer OS [41].

The importance of digital tools in the current era to consolidate the presence of the prosumer tendency is indisputable. These tools allow the user to participate not only in the design phases, but also in the manufacturing and personalization. However, we must also highlight the importance of physical tools such as fab labs [14] or 3D printers [8]. It is these physical tools that complement the work of the digital tools and work in harmony with them to make possible the final materialization of the product.

5   Conclusions

The classification carried out shows a clear dependence of each quadrant with the type of digital tool used. The most notable case is where the prosumer's participation is restricted, since the user's contribution is only made through the selection and filtering of options by means of an online platform to affect the product's presentation phase. That is not the case with free participation, which allows the user to contribute new ideas that affect the conceptual phase of the product through digital tools such as 3D software, tutorials, instructions and specific apps, among other tools.

The difference between hardware product and software product is not only in its tangibility, but also in the way in which the user can participate in its design, transformation or manufacture. Both types of product can share digital tools such as online platforms, design software or open source. However, there are tools that can only be linked to hardware products due to their tangible nature and their need for subsequent manufacturing, such as mass customization, 3D printing or physical tools.

Otherwise, if there is something that characterizes collective cases, it is the use of tools such as online platforms, repositories of files, clouds, online libraries and forums. These open source tools facilitate communication between users to enable the exchange of ideas, the creation of challenges and the realization of collaborative projects at a distance. This is why we can affirm that the presence and development of Web 2.0 has influenced the current prosumer, in which there is also an increasingly tendency closer to remote hardware control, as has been seen in some cases [41].

Despite the large number of tools, there are few documented cases, especially with regard to the ideal prosumer previously defined. This is related to the fact that the prosumer is a very specific small group, that makes fairs [15] and creates eco-systems and working communities [16] only between them. This makes low cultural impact in society despite the large number of available tools, which means that the resulting projects are often not shown to other users, that could even become potential users.

References

1. Toffler, A., Alvin T.: The Third Wave. Bantam books, New York (1980).
2. Levine, R., Locke, C., Searls, D.: The Cluetrain Manifesto. Basic books, New York (2011).
3. Ritzer, G., Dean, P., Jurgenson, N.: The Coming of Age of the Prosumer. American Behavioral Scientist 56(4), 379–398 (2012).
4. Kotler, P.: The prosumer movement: A new challenge for marketers. Advances in Consumer Research 13 (1), 510–513 (1986).
5. Rayna, T., Striukova, L., Darlington, J.: Co-Creation and User Innovation: The Role of Online 3D Printing Platforms. Journal of Engineering and Technology Management 37, 90–102 (2015).
6. Comor, E.: Contextualizing and Critiquing the Fantastic Prosumer: Power, Alienation and Hegemony. Critical Sociology 37(3), 309–327 (2011).
7. Ritzer, G., Jurgenson, N.: Production, Consumption, Prosumption: The Nature of Capitalism in the Age of the Digital `Prosumer'. Journal of consumer culture 10(1), 13–36 (2010).
8. Val Fiel, M.: Prosumer and 3D Printing: Democratization of the Creative Process. Revista 180. Arquitectura, arte, diseño (37), 17–22 (2016).
9. Anderson, C.: Makers: la nueva revolución industrial. Ediciones Urano, Barcelona (2013).
10. Hatch, M.: Maker Movement Manifesto: Rules for Innovation in the New World of Crafters. McGraw-Hill Education, New York (2014).
11. McLuhan, M., Nevitt, B.: Take Today: The Executive as Dropout. Harcourt Brace Jovanovich, New York (1972).
12. Herrero-Diz, P., Ramos-Serrano, M., Nó, J.: Minors as Creators in the Digital Age: From Prosumer to Collaborative Creator. Theoretical Review 1972-2016. Revista Latina de Comunicacion Social 71, 1301–1322 (2016).
13. Bruns, A.: From Prosumer to Produser: Understanding User-Led Content Creation. In: Transforming Audiences Conference, London (2009).
14. Mikhak, B., Lyon, C., Gorton, T., Gershenfeld, N., McEnnis, C., Taylor, J.: Fab Lab: an alternate model of ICT for development. In: 2nd International Conference on open collaborative design for sustainable innovation, pp. 1-7. ThinkCycle, Bangalore (2002).
15. Maker Faire, https://makerfaire.com, last accessed 2019/03/14.
16. Thingiverse, https://www.thingiverse.com/, last accessed 2019/03/14.

17. Knott, S.: Design in the Age of Prosumption: The Craft of Design after the Object. Design and Culture 5(1), 45–67 (2013).
18. Smart Customizer, https://www.smartcustomizer.com/, last accessed 2019/03/14.
19. DIY 3D Printing, http://diy3dprinting.blogspot.com/, last accessed 2019/03/14.
20. Online Design Tools, https://adespresso.com/blog/online-design-tools/, last accessed 2019/03/14.
21. Meccano, http://www.meccano.com, last accessed 2019/03/14.
22. Burda, https://www.burdastyle.es/, last accessed 2019/03/14.
23. MODI, https://modi.luxrobo.com/, last accessed 2019/03/14.
24. Spreadshirt, https://www.spreadshirt.es/, last accessed 2019/03/14.
25. Instructables, https://www.instructables.com/howto/prosumer/, last accessed 2019/03/14.
26. Desygner, https://desygner.com/es/, last accessed 2019/03/14.
27. BeoCafe, https://www.behance.net/gallery/34204619/BeoCafe, last accessed 2019/03/14.
28. Photography the Slow Way, https://www.yankodesign.com/2011/04/22/photography-the-slow-way/, last accessed 2019/03/14.
29. 3D Helmets, http://www.3dhelmetsnzi.com/, last accessed 2019/03/14.
30. MINI Yours Customised, https://yours-customised.mini/, last accessed 2019/03/14.
31. NikeID, https://www.nike.com/es/es_es/c/nikeid, last accessed 2019/03/14.
32. Converse Design Your Own, https://www.converse.com/es/es/landing-design-your-own, last accessed 2019/03/14.
33. Pro Model Deck, http://www.promodeldeck.com/es/, last accessed 2019/03/14.
34. MakerCase, https://www.makercase.com/, last accessed 2019/03/14.
35. Peterson, J., Larsson, J., Mujanovic, M., Mattila, H.: Mass Customisation of Flat Knitted Fashion Products: Simulation of the Co-Design Process. Autex Research Journal 11(1), 6–13 (2011).
36. Ikea Hackers, https://www.ikeahackers.net/, last accessed 2019/03/14.
37. Dürschmid, T., Söchting, M., Trapp, M.: ProsumerFX: Mobile Design of Image Stylization Components. In: SA '17 Symposium on Mobile Graphics & Interactive Applications, vol.1, pp. 1–8. Bangkok, Thailand (2015).
38. Braineet, https://www.braineet.com/en/, last accessed 2019/03/14.
39. ReViste, https://openurbanlab.com/2018/11/09/arranca-el-proyecto-reviste-taller-creativo-de-iniciacion-al-upcycling-denim/, last accessed 2019/03/14.
40. GitHub, https://github.com/, last accessed 2019/03/14.
41. 3D Printer OS, https://www.3dprinteros.com/, last accessed 2019/03/14.
42. Robotix, https://www.robotix.es/es/, last accessed 2019/03/14.
43. Scratch, https://scratch.mit.edu/, last accessed 2019/03/14.
44. Maker Shed, https://www.makershed.com/, last accessed 2019/03/14.
45. Vectary, https://www.vectary.com/features/, last accessed 2019/03/14.
46. OnShape, https://www.onshape.com/products/education, last accessed 2019/03/14.
47. Lay's busca de nuevo sabor del millón de dólares, https://www.hostelvending.com/noticias/noticias.php?n=5647, last accessed 2019/03/14.
48. La Marque Du Consommateur, https://lamarqueduconsommateur.com/, last accessed 2019/03/14.
49. Manchester City FC, https://www.mancity.com/news/club-news/club-news/2016/june/new-man-city-website, last accessed 2019/03/14.
50. Lego Ideas, https://ideas.lego.com, last accessed 2019/03/14.
51. MADE, https://www.made.com/, last accessed 2019/03/14.
52. Netflix, https://www.netflix.com/, last accessed 2019/03/14.
53. Amazon, https://www.amazon.es/, last accessed 2019/03/14.