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Distributed Design, a platform approach
Towards more inclusive, plural futures for design

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Abstract

This paper explores the role of the Distributed Design (DD) Platform which is working to socialise the nascent field of distributed design. The Platform comprises fifteen cultural institutions, research centres, Fab Labs and makerspaces to deliver Europe-wide programming across education and training, capacity building and skills development, peer-to-peer exchange and networking; as well as to advocate for and celebrate excellence in the emerging field. It focuses on the generation of new markets, which require new business models and models of distribution. Further, the Platform undertakes collaborative action-research on the state-of-the-art at the convergence of 'making' and design practice in an attempt to narrate the formation of the field. Drawing on learnings, it proposes the development of an approach devised of cultural programming and practical tools aimed at embedding DD values into design practice. These values; Open, Regenerative, Collaborative and Ecosystemic have emerged from the Platform as defining principles. The cases explored in this paper can be seen to embody these values and at the same time, represent their wide applicability. The cases cover the diverse thematic areas of agriculture and healthcare and cover a range of applied practice and technical processes. This too seems to be a defining characteristic of Distributed Design, it is 'application agnostic' and rather than being confined to a traditional field such as Product Design, Service Design or Industrial Design, it can be seen to be defined by process, attitude and values.

Introduction

Distributed design is a phenomenon emerging at the intersection of design and making. As digital design and fabrication tools become more accessible at the domestic scale and the logic of distributed manufacturing practices become more widely understood, a networked approach to design and small-scale production is growing in popularity. What is emerging is a localised, situated approach to design and production, in which nodes are connected at distance by digital platforms which not only transfer data, but act as portals to like-minded collaboration networks. At the domestic scale, the approach aids

hyperlocal and hyper-customised design solutions with the ability to meet individual user needs through digital and parametric design and further, it provides space for diversity in materials, techniques, voices and crafts. The digital layer can include communication, tools and platforms that can augment the limits of physical design and production spaces. They open the possibility for collaboration at distance on aspects of the design-to-production process or open access to education and capacity building resources for professional self-development. The local-to-global potential of distributed design can humanise production processes and provide an alternative to complex global supply chains and a possible solution to over-consumption and the now well-known ills of mass production.

This paper explores the role of the Distributed Design (DD) Platform which is working to socialise the nascent field of distributed design. The Platform comprises fifteen cultural institutions, research centres, Fab Labs and makerspaces to deliver Europe-wide programming across education and training, capacity building and skills development, peer-to-peer exchange and networking; as well as to advocate for and celebrate excellence in the emerging field. It focuses on the generation of new markets, which require new business models and models of distribution. Further, the Platform undertakes collaborative action-research on the state-of-the-art at the convergence of 'making' and design practice in an attempt to narrate the formation of the field. Drawing on learnings, it proposes the development of an approach devised of cultural programming and practical tools aimed at embedding DD values into design practice. These values; Open, Regenerative, Collaborative and Ecosystemic have emerged from the Platform as defining principles. The cases explored in this paper can be seen to embody these values and at the same time, represent their wide applicability. The cases cover the diverse thematic areas of agriculture and healthcare and cover a range of applied practice and technical processes. This too seems to be a defining characteristic of Distributed Design, it is 'application agnostic' and rather than being confined to a traditional field such as Product Design, Service Design or Industrial Design, it can be seen to be defined by process, attitude and values.

To contextualise the approach taken by the Distributed Design Platform, the paper presents an overview of its development under the strategic interests of Fab Lab Barcelona, the research and innovation centre situated at the Institute for Advanced Architecture of Catalonia, IAAC, and the urban model of Fab City. Fab Lab Barcelona's research, including a dedicated line of enquiry, Distributed Design is concerned with the implementation of the Fab City model (Fab Lab Barcelona 2020). This context situates the roots of DD within the discourse of the Maker Movement, a sub-culture of loose and widespread nature (Menichinelli, Schmidt and Ferronato 2019) that can be attempted to be identified through a shared use of digital desktop tools; common cultural practices and collaborative processes of sharing, as well as the use of digital manufacturing technologies, spaces and services to produce artifacts and prototypes (Anderson 2020). As this paper goes on to explore, the DD Platform proposes that distributed design can be understood beyond this origin story and can even be a vehicle to evolve design practice beyond aesthetics, and making beyond digital fabrication, towards a brave new approach to thinking, practicing and organising for more inclusive, plural futures for design.

The Context: Fab Labs and Fab City.

Advancements towards Industry 4.0 have consistently brought networked, advanced manufacturing capacities closer to the domestic scale. Micro-factories and flexible-factories present the opportunity for the un-coupling of production and global supply chains, and the logic of this model has not only led to industry-level innovation but has ushered in the 'distributed means of making and open design' (Kostakis and Papachristou 2014). In 2005, Professor Neil Gershenfeld of the MIT Centre for Bits and Atoms (CBA) predicated the rise of the Fab Lab, a fabrication laboratory of domestic-scale digital fabrication technologies such as computer numerically controlled (CNC) mills, laser cutters, engravers and '3D printers' and subsequently the increased facility to materialise the digital, or 'turn data into things and things into data' (Gershenfeld 2012). Since 2005, demand has seen over 1750 Fab Labs open across 100 countries to date, and this increase has occurred alongside the parallel rise in popularity of hackerspaces and makerspaces. Advancements in telecommunications have led to the digital interconnection of these individual, yet identical workshops into a global distributed production infrastructure which enables the 'ability to send data across the world and then locally produce products on demand (Gershenfeld 2012)'. This context allows for more focus on territorial manufacturing, with the intention to support local economies, lessen reliance on central systems and enable wide local participation in design and production process.

This domestic infrastructure embodies a logic and intention to materialise the digital and 'move bits not atoms' which on a city-level could have revolutionary implications. This concept can be conceptualised within the wider framework of Fab City. Devised in 2014 in a collaboration between IAAC, Barcelona City Council and the MIT CBA, Fab City proposes a paradigm shift, from the current linear system which is organised as 'PITO' (product-in, trash-out) to a circular model that preferences local mobility of materials and global mobility of information: 'DIDO' (data-in, data-out) (Diez n.d.). It focuses on the movement of data, use of local material supply chains and distributed production at the city scale as an alternative to the movement of materials and goods from production to consumer. As supply and production chains become deconstructed and decentralised in this model, design too becomes decentralised and hence, distributed. Distributed among locations, laboratories, approaches and cultures, it could be suggested that in distribution, design is also democratised. The decentralisation of production means designers gain access to collaborators, knowledge and tools across global infrastructure networks including but not limited to the small-scale prototyping facilities of Fab Labs. It also heralds the generation of new markets which require their own business and distribution models.

The territorial implementation of the Fab City vision is connected to the global distributed infrastructure of Fab Labs. They act as local incubators of open design processes and provide access to local production and digital technologies, also acting as places to socialise distributed design values in pursuit of the 'DIDO' paradigm. Fab Labs and indeed most small-scale physical production spaces (such as the members of the DD Platform), provide the substrate from which distributed design practice can be taught, shared and nurtured. Acting as 'third places' (Oldenburg 1989) 'to promote collaboration (especially professional) and creativity' in order to 'facilitate collaboration and knowledge sharing' (Scaillerez and Tremblay 2017). It can be said that these third spaces humanise the cyber-physical developments occurring at mid-to-large-scale industry scale, such as advanced

manufacturing, supply chain optimisation, synthetic intelligence and material development, by providing a window at the small-to-medium scale through which designers, makers and consumers can participate in the rapid development towards Industry 4.0. Further, they become places for cultural development and the breeding of new ways of working, thinking and valuing. As stated by Gershenfeld, 'the spread of digital fabrication tools is now leading to a corresponding practice for open-source hardware' (2012) and the digital infrastructural layer used to share at distance with like-minded practitioners is beyond a data exchange mechanism, but part of a wider critical practice in which design is improved and modulated globally (Kostakis and Papachristou 2014). As such, the DD Platform encompasses more than the design of blueprints or artefacts optimised for production through distributed manufacturing. More, it questions design and making as a holistic process of critical engagement between people and the material world.

Active in fifteen locations across Europe, the DD Platform acts as a local-to-global facilitator for the two levels of knowledge transfer: socialisation and development at the domestic-scale and knowledge and data exchange at distance via networks. More so, it provides a space for a critical enquiry through action-based research and cultural programming into understanding what design looks like in the Fab City context. What practice emerges from the commitment to 'move bits not atoms' and how can designers critically engage in this space that questions the state of our relationship with designed products and looks to strengthen local connections between people and materiality?

Platform ecosystem

The innovation offered by the DD Platform is that it is actualising the logic of Fab City by surpassing the limits of physical spaces to develop a digital ecosystem of tools to facilitate network connectivity. The platform ecosystem is in development as part of the ongoing research of the platform. An 'alliance of innovative platforms is already gathering under the thinking of Distributed Design to connect, share and articulate the circular, ecosystemic, distributed systems' which are envisaged (Diez, Armstrong and Whyman 2019). Collaborating platforms thus far include: fablabs.io, the 'social network' of the international Fab Lab Network which currently hosts over 31,000 users and maps and profiles the 1750 Fab Labs and their production capacity (Fab Foundation 2020). Faberin, a Spanish design-to-production platform for high-end design; Materiom, an open source biomaterial recipe archive; Make Works, a user-centric database to promote local small/medium-scale manufactures; and the online collaboration platform Wikifactory (Armstrong, Diez, et al., Platform Ecosystem 2019). Currently, these separate platforms are connected through practice and by shared values, but it is foreseen that via technical integrations such as white labels or smart contracts an interconnected digital toolchain can be developed. Key activities of the Platform aim to increase the societal readiness level of this platform ecosystem. In 2019, a white label was created between fablabs.io and Wikifactory called projects.fablabs.io. Initiated by DD Platform, the integration saw 418 new users onboard to the platform in the first year and has seen a range of projects uploaded from spirulina incubators to more recently, designs for personal protection equipment (Wikifactory 2020).

The platform ecosystem is planned as a dynamic, interconnected toolchain that not only supports the technical capacity of design. The stacking of digital infrastructure on top of physical infrastructure is aimed at enabling the creation of a like-minded community of

practice, a cultural infrastructure that supports practitioners' participation in distributed design as a critical practice and brings a practicality to questioning the state of our relationship with designed products. It provides a digital toolchain for action, strengthening connections between people and materiality by demystifying production processes and lowering the level for entry to exploration. Further, this combined infrastructure promises to support localised, situated design practice by expanding knowledge generation and by exchanging situated solutions at distance with others who may benefit from them. It reinforces a 'set of ideas, processes, technologies, and shared values' which 'can be interpreted as a socio-technical paradigm' (Maffei and Bianchini 2013).

A hybrid profile

The DD Platform recognises that in this context, the role of practitioner is changing rapidly. The profile of a 'distributed designer' has been suggested to emerge at the intersection of two global trends: the Maker Movement and the digitisation of the design discipline (Armstrong, et al. 2019). On one hand, designers can be seen to be adopting maker technology and processes such as open source design or technical tools, while on the other hand, makers evolve their design attitude and capabilities (Institute for Advanced Architecture of Catalonia 2020). In the domestication of distributed manufacture there appears to be an 'overlapping of roles … owing to the transformation and convergence of the design, production, and distribution processes, what was previously undertaken jointly by a firm, a designer, and a possible distribution firm can now be incorporated into a single actor that owns or manages all those competencies' (Bianchini 2012). Additionally, with the aid of digital infrastructure, independent actors may combine complimentary skills locally or at distance to undertake the idea-to-market pipeline in collaboration with others. Through this ecosystemic approach to design, self-producers have the freedom to work across multiple projects employing a variety of skills. The high-level of teamwork and collaboration skills required cannot be overlooked, and efforts must be made to normalise collaborative processes and shared gains in the design field, moving away from the ego-centric 'rock star designer' (Deakin 2019) which has thus far dominated the industrial, 'PITO', approach to design.

Case studies

The following section brings to light the processes and values of Distributed Design through two thematic clusters which have arisen organically through the Platform activities. The themes of healthcare and agriculture exemplify how distributed design approaches are emerging from the needs of individuals, communities or territories and how hyper customisation and designer-user collaboration can be appropriate methodologies for socialising the values of distributed design.

Agriculture, meeting community needs

Platform member P2P Lab is a Greek research organisation focused on the commons. Their research is situated in the Epirus region of northwestern Greece in the small mountainous village cluster of Tzoumerka. The remote area is focused on primary industry with little to no outside investment to support local small-scale ventures in arboreal cultivation, beekeeping and husbandry (Priavolou 2019) (Deakin 2019). Whilst recognising

other agricultural communities who gather to co-create agricultural technologies such as US based Farm Hack and French Atelier Paysan, P2P Lab focuses on a model called Design Local - Manufacture Global which 'asserts that local communities can produce technologies adapted to their own needs and context — empowered by designs, methods and knowledge, then shared globally by similar communities' (Priavolou 2019). P2P Lab has aided the establishment of Tzoumakers, a collaborative physical space in the village of Kalentzi in the Tzoumerka region. The lab aims to bring together territorial knowledge of primary production with the skills and attitude of the local maker community to develop low-cost solutions to needs rising from local agricultural practice, for example inaccessible machinery or laborious manual processes (Cosmolocalism 2019).
As a Distributed Design Platform local event in 2019, P2P Lab facilitated a workshop at Tzoumakers with European and Greek designers that aimed to create awareness and promote the emerging collaborative productive model and the possibilities of open source hardware and software design. The workshop aimed to situate production at the Tzoumakers space which is frequented by local farmer and maker community. The five-day workshop saw four outputs: a mechanical fruit press, a modular greenhouse, a harvester on wheels and GROUU Smart Nursery, an open source plant incubator with a sensor-enabled smart watering system.

Figure 1: GROUU Smart Nursery installation at Tzoumakers

Andre Rocha, designer and maker of GROUU Smart Nursery and Platform member representative of Instituto Politécnico de Lisboa attended the 2019 Tzoumakers workshop. The convivial space afforded by the physical lab which hosts an active user base and is embedded into the community, was successful for Rocha to 'engage [with] local actors ... even getting them onboard with the project' (Rocha 2019). Rocha commented that the

development of designs such as GROUU Smart Nursery that integrate modular digital technologies that may be adapted to address local needs, require a socialisation process and community acceptance in order to be successfully adopted into a territory (Rocha 2019) (Priavolou 2019). The physical space of Tzoumakers, which is connected to a commons and open design approach, not only provided the technical knowledge and know-how value but also sociocultural value. 'Creating tools together and sharing that knowledge open-source is about empowering farmers to make their own tools, for the specific needs they have. But it's also about building and strengthening community and cooperation in rural areas, which can be very isolated' explains Tzoumakers co-founder Alekos Pantazis (King, 2019.)

Agriculture is a key activity in the peripheral and less-developed regions of the EU and a crucial productive sector (Priavolou 2019) and as such, the approaches developed by P2P and their collaborators are intended to provide benefit beyond the physical lab. Therefore, projects that have been developed by the Tzoumakers initiative are documented open source to ensure access to the knowledge and opportunity for implementation elsewhere. The DD Platform supports the diffusion of this open knowledge and aims to provide opportunities for it to be evolved into widely available cultural products such as on the project website as resources and documented in the 2019 book 'Design, Remix, Share, Repeat' self-published by the platform, which captured the experience of GROUU Smart Nursery.

Figure 2: Twistr rendering

Healthcare – personalisation and hyper-customisation

The Distributed Design Platform identifies a cluster of interest in healthcare from activities led by the two Milenese Platform members, Polifactory, the makerspace of Politecnico di

Milano and the Fab Lab, OpenDot. This research has identified a series of unique benefits that are afforded by the application of distributed design principles. It also has given space for critical reflection on regulation and standardisation in the medical sector.

Polifactory engages a user-centric design innovation methodology to facilitate a co-design process between patients, domestic carers, designers and health or care professionals. Next Steps was an experimental initiative delivered as a DD Platform local activity which brought together biotechnology company Sanofi Genzyme, a patient support association for families living with glycogenesis Associazione Italiana Glicogenosi (AIG) and designers and makers from the makerspace Polifactory. The process included a collaborative needs assessment and co-creation process that explored creative solutions with the patient innovators (Bianchini and Maffei 2019). The outputs of the processes included four mobility aids: removable protective skins for crutches; an IOT device to improve the control of a walker; open source components to personalise standard walking aids and a made-to-measure 3D printed walking stick using parametric design. They were exhibited at European Maker Faire Rome as part of the local Platform activities.

OpenDot, an independent Fab Lab has been following a similar action-research and innovation approach through a collaboration with Together to Go Foundation (TOG), a Milan-based foundation for the rehabilitation of children suffering from complex neurological diseases. The collaboration has led to a co-design method based on eight principles to 'design with, not for people with disabilities' (Mandelli 2019). The process draws on participatory and inclusive design approaches, but utilises parametric and open design to create shareable designs for healthcare aids that can be customised to different sizes or situations. An example can be seen in Lorenzo's Bike a design project that aimed to create a bicycle suitable for Lorenzo and his family. They required a bike that could fit Lorenzo's mobility needs but was not as expensive as a new family car! A design was realised using OpenDot and TOG's eight principals in collaboration with Lorenzo, his carers, family and physiotherapist. OpenDot designers employed 'three-dimensional parametric modelling … the designer only needed to edit one parameter in an equation for the other parameters to get adjusted automatically' (Mandelli 2019). This meant that very simply, by design, the bike could be hyper-customised to not only meet Lorenzo's needs, but also meet the needs of other children. The outcome of this, is that Lorenzo's Bike design has also become a bike design for Viola and Shaig (Mandelli 2019). The digital layer of tools in this case, becomes crucial to the design process, but it doesn't define the outcome anymore so than the co-design process or the original need. These elements are complimentary and each is necessary to the project's success.

Figure 3: Lorenzo's first ride on his bike

Discussion

The inclusion of healthcare and agriculture can be seen as surprising themes for a Platform that services the Cultural and Creative Industries, but these two cases highlight the 'application agnostic' approach of DD which is constituted by ideas, processes, technologies, and shared values (Maffei and Bianchini 2013). The theme of agriculture reflects praxis that is humble and culturally aware. Tzoumakers and GROUU Smart Nursery practice with an appreciation of place and the P2P Lab display a situational awareness, sensitive to the knock-on effect their activities may have on the local economy and the livelihoods of their collaborators. The examples in the thematic cluster of healthcare demonstrate with clarity the potential of open, local design practice through unique approaches to co-design that achieve hyper-customised products and services through that are empathetic and human.

Key Learnings and Values

A synthesis of key learnings can help shape our perception of how platform values: Open, Regenerative, Collaborative and Ecosystemic, are shaping this emerging field.

New Markets

New and emerging markets are opening including those based on commons and those based on care. Designers are working to develop healthcare aids and wellness devices driven by patient/carer needs as a complimentary market to the highly

regulated medical industry in a similar way in which farmers are assuming the role of designer to create low-cost alternatives to farm machinery (Cosmolocalism 2019).

Circularity

Design has the ability to be circular, through custom products that have repair, remanufacturing, refurbishment and upgrading in mind in order to create life-long user-product relationships.

Open and rethought

Open hardware and software solutions can be employed to customise components and upgrade existing products on the market to make them accessible to all. The use of new technologies, materials and new applications of known materials can boost creativity and lead to uncanny and unique solutions that question our reliance on closed, standardised solutions.

Aesthetics and preference

Finally, aesthetics and personal preference. Not to be forgotten, the power of well-designed products. Particularly in the field of mobility aids and prostheses which 'tend to become physical extensions of people' (Bianchini, Maffei and Bolzan 2019). Personal and cultural identity and self-expression are crucial to familiarity and comfort of products, especially those that are in close contact to people or in regular use (Bianchini, Maffei and Bolzan 2019).

Distribution and convergence

It can also be seen in the case studies, that design is not only being 'deconstructed and decentralised' through technological advancement and changing values, but aspects are also converging. The profile of the 'distributed designer' not only merges making and design aptitudes but also acquires a host of other characteristics in order to lead and collaborate with inclusive design teams and develop immersive solutions at the local scale, that can be successfully networked with others. Further, the cases show that situated design and production practice requires creative professionals to also act as interlocutors or a form of Community Champion (Making Sense n.d.) who embodies the DD values and connects the local context to the global level of knowledge exchange. These actors can be connected to a physical production space such as Fab Lab or makerspace and regularly engage with idea development or solutions that respond to their own context, like the example of Tzoumakers co-founder Alekos Pantazis. This coupled with supply chain transparency and personal contact with end users means the act of designing takes on new responsibility and meaning. The political, social, environmental and economic impact of their outputs become vital considerations for design choices. As a result the 'distributed designer' can be seen to be evolving towards a hybrid profile (Diez and Tomico 2020), a design profile that mixes various sets of technical and human skills which prepares them to be resilient and agile designers at every scale of the DD paradigm (Diez and Tomico 2020). Going beyond a multidisciplinary or transdisciplinary designer (Leblanc 106–122) the hybrid profile describes a practice in which designers explore their own beliefs and engage in situated responses to large-scale solutions in order to have immediate impact,

an approach that equips designers to be locally connected (Cosmolocalism 2019).

Final Thoughts

The question of how to support and extend the influence of distributed design values is key to the Distributed Design Platform's trajectory. Questions may remain as to how the values Open, Regenerative, Collaborative and Ecosystemic can and will be adopted into mainstream industry founded on Industrial values. Recent examples do exist, and the Platform aims to follow such examples. One key strategy of the Platform is extracting and exploiting the outcomes of activities in the form of practical resources such as handbooks, guides or narrative learnings in the form of video or podcast production. These educational and cultural products are then embedded to enhance local activities. Of particular interest is the creation and delivery of resources by design educators, an approach currently being taken by IAAC's Master in Design for Emergent Futures, Polifactory at Politecnico Di Milano, Other Today (as part of Product Design with Professional Experience at Brighton University), Tallinn University of Technology, and Instituto Politécnico de Lisboa. Resources become part of a pedagogical approach that also includes tooling and technical skills development. A similar knowledge diffusion approach is also engaged across the Platform programming, with Platform coordinators IAAC focusing on the creation of high-quality, content-rich media and cultural products that can be widely disseminated to public audiences. In addition, activities to influence public discourse through programs with industry leaders such as The INDEX Project, Precious Plastic and Space 10 are substantial including the Plastic for Good Challenge and Distributed Design Awards (Institute for Advanced Architecture of Catalonia 2020). This paper did not focus on the scope of public programming undertaken by the Platform, which could lead to an interesting future investigation. Moving forward, the Platform must target approaches to reach and have influence over the habits of traditional consumers in an effort to move further beyond physical spaces and the design practice towards mainstream cultural impact, after all, as Gershenfeld states, the real strength of a fab lab is not technical; it is social (Gershenfeld 2012). Finally, efforts must be made to further expand the Platform reach beyond the limits of the European context perhaps aided by the expansive Fab Lab network. This could diffuse the novel approaches developed by the Platform in Europe and lead to fruitful exchange with other regional contexts. These next steps for the Platform can further develop the potential of distributed design amongst the many to decentralise and democratise the future of design.

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