A framework model for facilitating do-it-yourself design

Hoftijzer, Jan Willem; Keyson, David

Important note
To cite this publication, please use the final published version (if applicable).
Please check the document version above.

A FRAMEWORK MODEL FOR FACILITATING DO-IT-YOURSELF DESIGN

Hoftijzer, JanWillem;
Keyson, David

TU Delft

ABSTRACT

Today's global context of mass-produced items has resulted in an increasing 'distance', or alienation, between people and the origins of the items they buy and use: an unhealthy human-product relationship.

This observation permits the search for an alternative interpretation of well-being: a transformation that would support resilience and self sufficiency, and a better human product relationship or 'a new partnership', as advocated by various scholars.

In this paper, this new partnership is considered through supporting 'Do-It-Yourself' (DIY) product design: a scenario in which professional designers facilitate laypersons to design for themselves. Anticipating (1) the designer's responsibility, and (2) the layperson's innate desire to create, this paper introduces a 'Design for DIY' framework method to help bridge the knowledge gap between the product designer and the layperson.

The initial starting points of this study, complemented by a range of 'Design for DIY' studies, and an exploration of existing design frameworks and design models, resulted in the design of a 'Design-for-DIY' framework. This paper concludes with recommendations for the testing and further development of the Design-for-DIY framework.

Keywords: Do-It-Yourself, Collaborative design, Design methodology, Participatory design, human-product-relationship

Contact:
Hoftijzer, JanWillem
TU Delft
Netherlands, The
j.w.hoftijzer@tudelft.nl

1 INTRODUCTION

1.1 Problem definition, the need for a better relationship

Today's global context of mass-produced items has resulted in an increasing 'distance', or alienation, between people and the origins of the items they buy and use, which resulted in an unhealthy human-product relationship. In the past, design being an integrated element of industrialized society has merely focused on satisfying the increasing 'need' of consumption, although a higher level of consumption does not elevate the perceived happiness of people (Lipovetsky, 2006, Porritt, 2003). Oppositely, according to Sanders (2006), "Everyday people want to be 'creators' as well". "Innovation processes are shifting from open source software to open source hardware design [] while the do-it-yourself (DIY) movement embraces 'the open' in design", describes Aitamurto (2015). Boisseau (2018) notices that "nowadays it is technically, knowledgeably, practically, and legally easier than before for the man in the street to gain access to the act of designing, i.e., to design". Historic views seems to validate the hypothesis that people have an innate urge to be creative (Csikszentmihalyi, 1998, Nieuwenhuys, 1969); and to be a prosumer (Huppes, 1985, Friedmann, 1961) rather than to be a passive consumer. Opposing the - industrially induced - distant human-product-relationship in an industrial context, Do-It-Yourself (DIY) answers users' needs in terms of Maslow's Pyramid hierarchy: e.g. the level of self-actualization, corresponding to Csikszentmihalyi who states that "man is also homo Faber, the maker and user of objects, his 'self' to a large extent a reflection of things with which he interacts" (Csikszentmihalyi, 1981). A reconnection between people and products would align to the views of various recent and classic scholars (Ehn, 2008, Pacey, 1992, Papanek, 1985, Manzini, 2003, Myerson, 2016) who advocate for a 'new partnership'. This paper discusses DIY activity as a means to decrease the distance between people and the products they use. In order to help increase the human-product relationship, this paper attempts to reason for and establish a 'Design-for-DIY' framework model to help professional designers establish DIY projects[1] for laypersons. This refers to the research question of this study: "How to facilitate laypersons to engage in DIY activity, through the establishment of a Design-for-DIY framework model?"

1.2 Opportunities and context

Today's digital technologies connect people from all over the world, and bring production closer to consumption (Salvia et al., 2016, Fox, 2013, Fox, 2014, Bonvoisin et al., 2017, Anderson, 2012), supporting social relations and collaboration. At the same time, communities aim for so-called de-growth, downshifting lifestyles (Salvia and Cooper, 2016, Tukker et al., 2010), which aligns with the re-emergence of the value attributed to hand-made and one-off items and to the related production activities and artisanship. Perhaps even more importantly, widely accessible instructional media (e.g. websites as Instructables.com and Etsy.com) accommodate a widespread of DIY activity. Furthermore, the presence of tangible and virtual places for creative activities, e.g. maker spaces, supports the emergence of 'creative communities' that develop innovative solutions for 'new ways of living' (Manzini, 2006, Hector and Botero, 2022). Well-known Examples of such platforms are Ponoko, Shapeways, and Instructables, that offer DIY projects and communities (Wong and Lesmono, 2013, Wirth and Thiesse, 2016).

1.3 A vision of supporting DIY

This paper builds on prior studies that suggest DIY as a practice that promises to support a sustainable relationship between things and people, respectively between people and nature (Salvia, 2013, Bianchini and Maffei, 2013, Van Abel et al., 2011). More specifically, this paper addresses the facilitation of DIY activity, the role and responsibility of designers therein, and the grounding and design of a 'Design-for-DIY' framework to help professional designers facilitate DIY activity.

---

1 A DIY project, or Do-It-Yourself project, typically refers to a specific manual, template, kit or instruction, provided by a professional designer, that motivates, helps and facilitates people in performing DIY (making an repairing) activity.

1.3.1 DIY

DIY was the dominant way of how things were produced in pre-industrial subsistence economies, before the emergence of industrial society (Achterhuis, 2011, Edwards, 2006, Toffler, 1989). Today, "DIY represents a method of building, modifying, or repairing things without the direct aid of experts or professionals", according to Bonvoisin (2017). As the opposite of 'passive consumption', designing and making things for oneself aligns better with people's natural motivations (Franke et al., 2010). DIY enables people to express their intentions, capabilities and identity (Atkinson, 2006, Wolf and McQuitty, 2011, Shove et al., 2005). According to Schreier (2006), as a result people benefit from functional advantages, from the uniqueness of the outcome, from enjoyment of the process and from the 'pride of authorship'. DIY activity enhances awareness and product attachment; it imbues a product with meaning (Mugge et al., 2009, Csikszentmihalyi and Halton, 1981). In short, DIY brings people closer to 'Being' (Maslow, 1998, Helne and Hirvilammi, 2016), and aligns well with Ehrenfeld's definition of sustainability (Ehrenfeld, 2008) which involves ethics, human and nature.

1.3.2 Paradox

The essence of DIY is in the accessibility of design activity to laypersons. However, most people using maker spaces (see Section 1.2) are either professionals or well-skilled hobbyists, not laypersons. There are lots of tools and spaces available, but there seems to be a mismatch, presumably caused by two factors. (1) For most people, consumption is habitual and common sense (Baudrillard, 1998), and (2) The industrial context has made people incapable (and unaware) of making or mending things by themselves: so-called 'de-skilling' (Brugger and Gehrke, 2018).

2 A 'DESIGN-FOR-DIY' INTERVENTION

2.1 The need for a method: a 'Design-for-DIY' framework

The search for a better relationship between people and the products they use, given the potential of DIY, was the reason for the authors to suggest and develop a method; a framework, to help professional designers support DIY activity. The framework should represent the Design-for-DIY process, it should preferably function as a repository of Design-for-DIY knowledge (informing others about projects done) for the designer who uses it, and it should guide the designer's design-for-DIY effort. The Design-for-DIY scenario should preferably address DIY of 'physical' products: that would support laypersons to experience materials qualities and manufacturability (Salvia et al., 2016).

2.2 The role of the professional designer, the role of design

Given the imperfect human-product relationship and design's role therein, as noted above, the professional designer has a moral responsibility to try solving this. "The responsibility for the relationship between industry and culture falls [] on the shoulders of design", stated design historian Penny Sparke (1987). Schumacher and Myerson suggest that designers need to reverse their thinking and concentrate on 'scaling down': adopting a mind-set of participation, designing for people and aiming for engagement (Myerson, 2016, Schumacher, 2010). Manzini (2012) suggests that professional designers can no longer maintain their 'monopoly on design'. In line with Papanek's view (Papanek, 1985), this paper proposes a Design-for-DIY scenario in which the designer takes responsibility and facilitates the layperson's DIY activity. As part of his study that concerned human centred design approaches, Keinonen (2009) has mapped the very helpful 'Design Contribution Square', in which he also indicates the position of DIY (Figure 1).
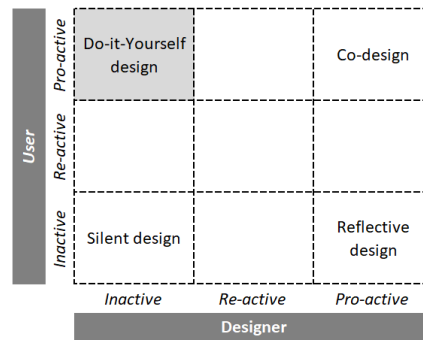
Figure 1: Matrix of design activity, reinterpreted from Keinonen (2009)

It shows in which ways the professional designer's contribution (preparing and facilitating) may relate to the layperson's contribution. This paper focuses on the left area of Figure 1, and on the support of the top left segment: DIY design. The goal of the Design-for-DIY framework is to increase the layperson's level of design skills and knowledge, and to stimulate that layperson in taking an active role. This study distinguishes (1) the long term (visionary) goal of total autonomy and self-sufficiency (top level in Figure 1) for the layperson, and (2) a realistic attempt to reach people who would normally not engage in DIY (lower levels).

3 EXPLORATION OF THE 'DESIGN-FOR-DIY' PROCESS

3.1 'Design-for-DIY' studies

A series of four 'Design-for-DIY' studies were executed (Table 1), to gain knowledge of the Design-for-DIY process and to be able to constitute the envisioned Design-for-DIY framework. The studies focused on the design steps a designer should perform to facilitate a layperson's DIY activity. A number of potential tasks for a designer facilitating a DIY project were identified in practice studies and so included in the Design-for-DIY studies themselves: e.g. to facilitate the layperson's DIY process and activity; to create a DIY environment, and to include materials and information. The studies were exploratory in nature and were designed and executed to help bring to the surface issues to take into account in developing a Design-for-DIY framework. They also helped to discern whether the notion of a generic framework capturing the various approaches taken and design challenges addressed would be feasible.

Table 1: Design-for-DIY studies

name	method	data	facilitators	participants laypersons	partipants design students
1. 'DfDIY' of a coffee maker	research through design	observation of process and results, and interviews	1 to 3	17	
2. 'DfDIY' of a desk lamp	idem	observation of process and results, and interviews	1	7	
3. 'DfDIY' of headphones	idem	observation of process and results	1	8	4
4. 'DfDIY' re-using plastics	idem	observation of process and results	1	2	

3.2 A brief summation of the studies and their outcomes

Case of the Coffee maker (#1): Participants in this study were asked to choose and assemble their own coffee maker from a variety of second-hand jars, cans, lids and rings available. This project helped mapping the various DIY tools, sources and the iterative processes that need to be part of a DIY process. The coffee maker project discerned the tasks for the designer: (1) managing the 'Maakplaats' workshop environment, (2) creating the project instructions (of various sorts and levels), and (3) helping the layperson while DIY-ing.

(#2) Case of the Desk lamp: This study concerned a toolkit that enabled the layperson to manually manipulate a tangible ribbon of which the resulting form was subsequently communicated to the designer. Figure 2 illustrates the DIY process to run by the layperson, indicating the interaction and task division between designer and layperson, and the transfer of the intended design.

(#3) Case of the Headphones: This project focused on offering an accessible and attainable toolkit template for the layperson to help him design a personalized wearable design. An interesting aspect of this project is the option of a final design interpretation before finalizing and 3D printing it: post-design. The headphones project made a clear distinction between fixed elements (pre-fabricated) and the elements that were open for DIY design and manipulation.

(#4) Re-using plastics at Scrap (a warehouse of industrial plastics waste materials): This specific study focused on the design of tools and instructions for assembling parts and materials from 'Scrap' and providing instruction sheets to facilitate DIY activity by laypersons. The Scrap case concerned an organisational extension to the Scrap warehouse: towards a platform for DIY activity. Practically, the additions to Scrap's offer concerned a tangible workstation that offers toolkits, instructions, the design of dedicated welding tool, and it specifically enables the manipulation of the 'traditional' Scrap materials.
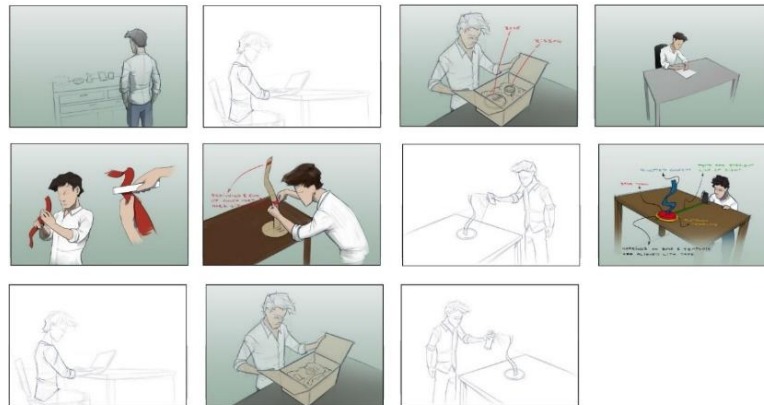

Figure 2: The envisioned DIY design process in study #2. The storyboard shows a layperson who runs a sequence of steps: ordering; receiving a DIY kit; designing and manipulating the provided product dummy; documenting his design; uploading; receiving the outcome, and optionally painting it.

3.2.1 Design-for-DIY studies: overall conclusions

The results and insights of this exploration have served as valuable and relevant information in search of a suitable, preferably generic, Design-for-DIY framework. In all four projects, the designers provided instructional media, and designed a concrete kit to distinguish (1) the fixed elements and (2) the free design space available to the layperson. To reach their intended audiences, the designers of all the cases included a DIY platform environment to enable laypersons to enrol in the DIY project and obtain the necessary support. The designers of all four studies appeared to have considered the varying layperson's skills and levels of experience, which they did by distinguishing means of facilitation and support. In line with conclusions drawn from DIY practices in history (Hollinetz, 2015, Bonvoisin et al., 2017, Atkinson, 2006, Goldstein, 1998), the studies brought the importance of collaboration to the surface, as well as templates and tools for manipulation. As a general conclusion from the studies, the DIY projects appeared to be possible, feasible and doable, and the Design-for-DIY processes were reasonably similar. The data that support the findings of these studies are available from the corresponding author.

3.3 Framework usage scenario

The studies helped to map the development steps to be taken by the professional designer, which supported the identification of numerous common aspects of the Design-for-DIY process (see Table 2), the Design-for-DIY scenario. A Design-for-DIY scenario can be characterized as a modern mentor-apprentice relationship between designer and layperson, however mostly at a distance, which resonates with pedagogy insights that stress the positive impact of mentoring on both engagement and learning (Adams and Lenton, 2017). Further, sources that associate with craft and DIY indicate DIY's relationship with values and practices the concern e.g. mentorship and community-building (Garber, 2013). The designer's role thus changes from being a directive, decisive authority to that of a facilitator. In order to anticipate the variety of projects, the variety of layperson's profiles, and

considering the professional designer's preferences, the Design-for-DIY framework should be flexible: designers should be allowed to consider the elements they need, and skip those parts they do not need.

Table 2: Generic steps of Design-for-DIY, derived from the studies, elements of the framework-to-establish

Usage scenario Design for DIY framework

1 The intiation of a project, either by professional designer or layperson
2 Considering (and discuss) a design case: the product type
3 Preliminary design of a product, by the professional designer
4 Considering the task division: designer/ layperson
5 Considering and preparing the support materials for the layperson
6 Considering, preparing and designing the kit and 'interface' for the layperson
7 Establishing, designing instructions and manuals, course elements
8 Considering and establishing the DIY platform/ environment
9 Considering and preparing other services and to offer
10 Anticipating and preparing the in loco support to offer
11 Assembling all elements of the DIY project on offer
12 Inviting/ sharing the project with laypersons
13 Introducing the DIY environment and projects
14 Providing knowledge/ course elements
15 Guiding/ supporting/ advising the layperson while he/she is doing DIY
16 (Co-designing and/ or post design)
17 (Helping to) manufacture
18 Concluding a project together with the layperson
19 Support further development, follow up

3.4 Reference design models and frameworks

To learn and to serve as a reference for the development of a generic Design-for-DIY framework, this paper explores a small but relevant selection of existing product design process frameworks that address DIY facilitation, or open design process models. Tsimiklis' visualised relationship between open innovation and the double diamond 4D design process model (Tsimiklis and Makatsoris, 2015) conveys an interesting approach to including open source input to a traditional design process, however it focuses merely at the double diamond's front end. Aitamurto's (2015) plotting of open design practices onto a circular representation of the product design process gives a nice overview, but it is not a hands-on aid for the professional designer to run a 'Design-for-DIY' process. Bird's depiction of co-design process elements, in her 'Generative Co-Design Framework for Healthcare Innovation' (Bird et al., 2021) forms a rather close representation of what the studies of §3.2 have unveiled, and is therefore a relevant reference. The model comprises a pre-design phase, a co-design phase and a post-design phase. Kymalainen (2015) describes the stages of a DIY facilitation process in a written 'framework for co-creating DIY service concepts', in which he distinguishes the pre-co-design phase, the co-design phase, and the post-co-design phase. The relevance of Kymalainen's and Bird's models for our Design-for-DIY research lies in the fact that it separates the different tasks within the 'system' of Design-for-DIY: it comprises a preparation phase, followed by phases in which the actual involvement of the layperson is facilitated. Koo (2018) has described a similar sequence of stages when describing a co-design process in a South-Korean consumer-oriented public service context. Lupton's (2006) model is not a strict process model for facilitating DIY activity, but in a way it is: it tells designer what to consider when constructing a DIY project, and it tells laypersons what to try and do when DIY-ing. Fablab (Bo-Kristensen, 2018, Gershenfeld, 2012) has depicted its 'designing the design process' model in their Fablab manual, approaching it from an educational perspective: the model clearly distinguishes the concentric shells of (1) setting learning goals, (2) arranging design materials, and (3) design activities. The model is relevant for this study, as it distinguishes the different cycles of preparation, and the design stages inside the most centric design activities shell. However, it does not provide a clear sequence of steps to the designer, to consider when designing for DIY.

4 SET UP OF A DESIGN-FOR-DIY FRAMEWORK

The knowledge gained in this research serves as input for the construction of the Design-for-DIY framework, a means to help the designer set up DIY projects. Additional to the aforementioned challenges, the Design-for-DIY framework should address both the professional designer tasks and the steps to be taken by the layperson. First the professional designer performs various design iterations in constructing and preparing the actual DIY project to offer, followed by the layperson who is invited to assert his/her creativity and involvement, and perform DIY activity. All the above has led to the insight that 'Design-for-DIY' requires a novel Design-for-DIY process model. The model should preferably include a small range of design cycles, to represent the different design tasks (e.g. preparing the DIY toolkit) and the iterations that are parts these tasks (e.g. the synthesis of a toolkit). Additional to the consideration of relevant cyclic frameworks from literature (Vossen et al., 2013, Bo-Kristensen, 2018) and from the Design-for-DIY studies, this pleads for a multi-level approach. Both literature

(Peppler and Bender, 2013) and the Design-for-DIY studies indicate the pedagogic character of 'Design-for-DIY' and the importance to support creativity, both elements associated with circular and with spiral shapes and structures that represent designers' cognitive processes (Roozenburg and Cross, 1991, Schön, 1984) (Evans, 1959, Vossen et al., 2013).

Table 3: Knowledge and requirements for the setup of the Design-for-DIY framework
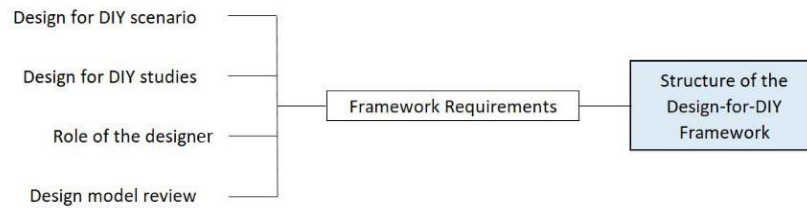
All the findings together in this study have contributed to the development of the multi-cyclic Design-for-DIY framework depicted in Figure 3, comprising two dimensions: (1) the dimension of concentric design cycles (tasks, functions) to perform, and (2) the analytical and iterative design stages that are part of each cycle.

4.1.1 Design levels represented in the cycles of a Design-for-DIY framework

The proposed Design-for-DIY framework represents the major design tasks to be done, at different decision levels. The model aims to facilitate a dialogue between the designer and the layperson. The concentric shape also reflects the iterative cyclical character of models for teaching and learning as documented by various scholars (Gibbs, 1988, Van Boeijen et al., 2020). The option of re-running a cycle resonates with the 'learning-by-doing' approach. These cycles are represented in chronological order, each segmented in a series of steps per cycle (Figure 3).   Each cycle prepares for the next, in centripetal direction. The order in which successive cycles are positioned in the framework is considered fixed, however the designer is free to improvise, and choose his or her preferred path. Referring to Figure 3, cycles 1 to 4 represent the preparatory and facilitating tasks by the owner/designer, while the fifth (the DIY cycle) is where the layperson actually undertakes the DIY project, guided by the designer. *Cycle 1*: The Project cycle helps to define the goals and contents. The layperson's interests, the product's suitability and accessibility, all need to be considered, as was e.g. the case in study #1. *Cycle 2*: The pre-design cycle serves as a preliminary product design cycle and as a reference for the project, as well as an example for the layperson. Activities in the Pre-design cycle are geared towards anticipating DIY options. The need for such a cycle was observed in all four case studies. *Cycle 3*: The design of the toolkit, a fundamental element of all Design-for-DIY cases run, should include clear task allocation, specific tools and instructions, and e.g. a specific design-space available to the layperson. *Cycle 4*: The Platform cycle considers designer support, tangible and digital materials for inspiration, examples, and e.g. community and network. Related to this, this cycle should cater for a 'post-design' re-interpretation step, in respect of manufacturing, safety, aesthetics and so on. The Design-for-DIY studies #2 and #3 (Section 3) indicated the value of such a 'Post-design' step. *Cycle 5*: The DIY Design cycle invites the layperson to perform their DIY task, guided to a greater or lesser extent by the facilitating designer. This specific 5th cycle caters for repetition, for applying lessons learnt, and for taking up the challenge of increased complexity.

4.1.2 Design process stages represented in each of the main cycles

As explained, each of these cycles comprises a full and iterative design process. Either a model as e.g. the Double Diamond model (Design-Council, 2019) or Roozenburg and Eekels' Basic Design cycle could represent the stages within each of the cycles. The latter has served as a reference here.
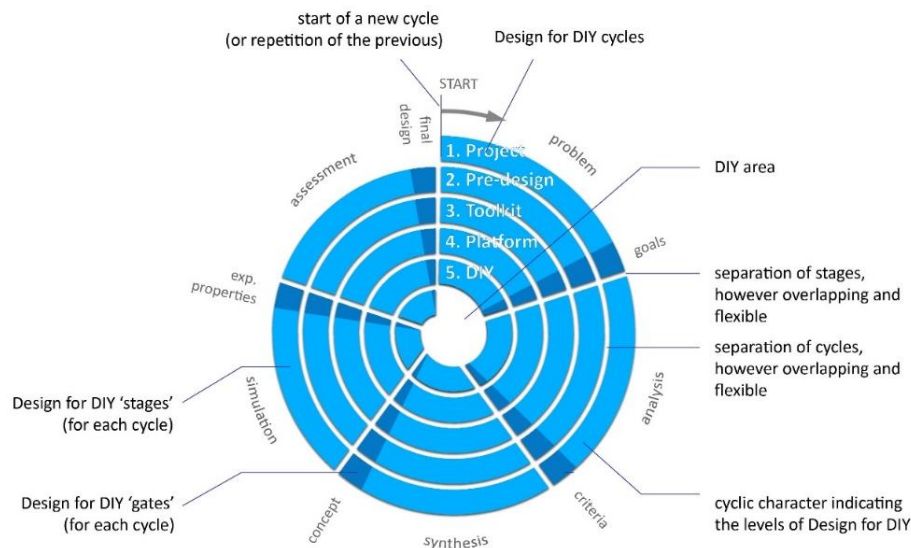
Figure 3: The proposed Design-for-DIY Framework, its cycles and stages

5 DISCUSSION AND CONCLUSIONS

5.1 Value to practice and theory

A design framework has not only operational value, but (1) it also serves as an extension of the designer, similar to a tool or object being an extension of human beings (Verbeek, 2015, Pugh, 1991), enabling them to establish a better intervention and have better impact, and (2) the availability of a framework makes designers aware of the DIY concept. This also confirms the value of (establishing) a Design-for-DIY framework for design theory: the framework can serve as a basis for further knowledge development, supporting a wide variety of DIY, design and sustainability related areas.

5.2 Focus

Since design-for-DIY concerns a fundamental and conceptual proposition, short-term feasibility (as e.g. economic profitability) is not one of this study's starting points. This perspective is based on the notion that the underlying problem has its roots in that same context of short-term feasibility (see the Introduction section). To sketch an optional scenario, the designer's capacity could be envisioned as serving the supplier of either DIY materials, DIY tools, or the platform (compare Scrap (study #4 in the article), or e.g. Maker Nexus). The designer could also be a subsidized professional whose job it is to propel people to engage in DIY and making activity (Fablab-Enschede, 2017). The Design-for-DIY approach has the potential to gain ground. Our Design-for-DIY framework can help structure future DIY projects in such a manner that they respond to new developments and challenges, and promote a more sustainable human-product relationship. Our framework and the accompanying vision could help to increase awareness and so inspire the democratization of design, e.g. through teaching the concept of Design-for-DIY as part of design curricula.

5.3 Alignment to the goals set for the 'Design-for-DIY' Framework

When reflecting on the framework model design, it seems tenable to conclude it has a clear structure, in which it distinguishes cycles representing large process parts and stages (in circular direction) representing the smaller design steps to take. This structure appears to facilitate free manoeuvring between cycles and stages, and in doing so provides design freedom and flexibility to the designer of DIY projects. When considering the trajectories run in the studies (Section 3.2), each of these projects' processes would fit in the 'Design-for-DIY' framework of Figure 3, considering that the framework model is a representation of the process that the facilitating designer needs to run.

5.4 Future and complimentary research

Near future design experiments will help assess the exact clarity, completeness and flexibility of the 'Design-for-DIY' framework. Designers will be asked to perform the task of designing for DIY, that is:

creating and providing DIY projects to layperson, using the Design-for-DIY framework as guidance and reference. Additionally, we propose to conduct formal studies in which designers offer DIY projects to be carried out by laypersons, and so learn from the implementation of the Design-for-DIY framework. The experiments will help asses and improve the framework as proposed.

REFERENCES

Achterhuis, Hans. 2011. "Alle Reden Tot Zorg; Een mens is geen kattenbrokje." De Groene Amsterdammer, Jan. 31st. 2011, 4.

Al-Murani, Bäsmä. 2019. "Design thinking methods in early phase of ship concept development."

Anderson, Chris. 2012. Makers: The New Industrial Revolution. New York: Random House.

Atkinson, Paul. 2006. "Do It Yourself: Democracy and Design (editorial)." Journal of Design History 19 (1):1-10. https://dx.doi.org/10.1093/jdh/epk001.

Bianchini, Massimo, and Stefano Maffei. 2013. "Microproduction everywhere." Defining The Boundaries of the emerging new Dis.

Bo-Kristensen, Mads. 2018. Fablab schools; Towards Digital Smart, Entrepreneurial and Innovative Pupils: faBlaB schools eu project partners.

Bonvoisin, Jérémy, Jahnavi Krishna Galla, and Sharon Prendeville. 2017. "Design principles for do-it-yourself production." International Conference on Sustainable Design and Manufacturing.

Brugger, Florian, and Christian Gehrke. 2018. "Skilling and deskilling: technological change in classical economic theory and its empirical evidence." Theory and Society 47 (5):663-689.

Buijs, Jan, and Rianne Valkenburg. 1996. Integrale Produktontwikkeling. Utrecht: Lemma bv.

Csikszentmihalyi, M., and E. Halton. 1981. The Meaning of Things: Domestic Symbols and the Self. Cambridge: Cambridge University Press.

Design-Council, The. 2019. "The double diamond model." The Design Council.

Edwards, Clive. 2006. "Home is where the Art is." Journal of Design History 19 (1):11-21.

Ehn, Pelle. 2008. "Participation in design things." Participatory Design Conference (PDC), Bloomington, Indiana, USA (2008).

Ehrenfeld, John R. 2008. Sustainability by design: a subversive strategy for transforming our consumer culture. New Haven and London: Yale University Press.

Evans, J Harvey. 1959. "Basic design concepts." Journal of the American Society for Naval Engineers 71 (4):671-678.

Fablab-Enschede. 2017. "FabLab Enschede vervaardigt plaquette voor 'Smart Enschede'." accessed 25-6. https://www.fablabenschede.nl/fablab-enschede-vervaardigt-plaquette-voor-smart-enschede/.

Fox, Stephen. 2013. "Paradigm shift: do-it-yourself (DIY) invention and production of physical goods for use or sale." Journal of Manufacturing Technology Management.

Franke, Nikolaus, Martin Schreier, and Ulrike Kaiser. 2010. "The "I designed it myself" effect in mass customization." Management science 56 (1):125-140.

French, Michael J, JT Gravdahl, and MJ French. 1985. Conceptual design for engineers: Springer.

Gershenfeld, Neil. 2012. "How to make almost anything: The digital fabrication revolution." Foreign Affairs 91 (6):43-57.

Gibbs, G. 1988. Learning by Doing: A Guide to Teaching and Learning Methods. Oxford: FEU.

Goldstein, Carolyn. 1998. Do It Yourself: Home Improvement in 20th-Century America. New Jersey: Princeton Architectural Press.

Helne, Tuula, and Tuuli Hirvilammi. 2016. "The relational conception of wellbeing as a catalyst of the ecosocial transition." In The Ecosocial Transition of Societies: The Contribution of Social Work and Social Policy, edited by Kati Närhi Aila-Leena Matthies, 36-53. Abingdon, UK: Taylor & Francis.

Hirsch, Danielle, and Pieter Pauw. 2022. "Duurzame Doelen haal je niet alleen in Eigen Land." NRC Handelsblad, January 4th, 2022, 18-19.

Hollinetz, Hannelore Hollinetz and Martin. 2015. Otelo – Open Technology Labs in Austria. In Patterns of Commoning, edited by D. Bollier and S. Helfrich: Commons Strategy Group and Off the Common Press.

Keinonen, Turkka. 2009. "Design Contribution Square." Advanced Engineering Informatics 23 (2):142-148.

Kumar, Vijay. 2012. 101 design methods: A structured approach for driving innovation in your organization: John Wiley & Sons.

Kymäläinen, Tiina. 2015. "The design methodology for studying smart but complex do-it-yourself experiences." Journal of Ambient Intelligence and Smart Environments 7 (6):849-860.

Lipovetsky, Gilles. 2006. Le bonheur paradoxal: essai sur la société d'hyperconsommation. Vol. 377: Gallimard Paris.

Maldini, Irene. 2016. "Attachment, Durability and the Environmental Impact of Digital DIY." The Design Journal 19 (1):141-157. https://dx.doi.org/10.1080/14606925.2016.1085213.

Manzini, Ezio. 2006. Design, Ethics and Sustainability: guidelines for transition phase. In Cumulus working papers Nantes University of Art & Design Helsinki

Manzini, Ezio. 2012. "Design research for sustainable social innovation." In Design research now, 233-245. Birkhäuser.

Maslow, A. H. 1998. Towards a Psychology of Being. New York: John Wiley.

Mugge, R., J.P.L. Schoormans, and H.N.J. Schifferstein. 2009. "Emotional Bonding with personalized products." Journal of Design Engineering 20 (5):467-476.

Muller, Wim. 2001. Order and meaning in design: Lemma.

Myerson, Jeremy. 2016. "Scaling Down: Why Designers Need to Reverse Their Thinking." She Ji: The Journal of Design, Economics, and Innovation 2 (4):288-299. https://dx.doi.org/10.1016/j.sheji.2017.06.001.

Oleksiuk, Ihor. 2018. "Stakeholders management in a service design process in the pharmaceutical company."

Pacey, Philip. 1992. "'Anyone designing anything?'Non-professional designers and the history of design." Journal of Design History 5 (3):217-225.

Pahl, G., K. Wallace, L.T.M. Blessing, W. Beitz, and F. Bauert. 2013. Engineering Design: A Systematic Approach: Springer London.

Papanek, Victor. 1985. Design for the Real World. London: Thames & Hudson Ltd.

Peppler, Kylie, and Sophia Bender. 2013. "Maker movement spreads innovation one project at a time." Phi Delta Kappan 95 (3):22-27.

Porritt, Jonathon. 2003. Redefining Prosperity: Resource productivity, economic growth and sustainable development: Sustainable Development Commission.

Pugh, Stuart. 1991. Total design: integrated methods for successful product engineering: Addison-Wesley.

Roozenburg, N.F.M., and J. Eekels. 1998. Productontwerpen, structuur en methoden. Den Haag: Lemma bv.

Roozenburg, Norbert FM, and NG Cross. 1991. "Models of the design process: integrating across the disciplines." Design studies 12 (4):215-220.

Salvia, Giuseppe. 2013. "Design for satisfactory and sustainable patterns of consumption and production. Il design per la pratica contemporanea del Do It Yourself."

Salvia, Giuseppe, Carmen Bruno, and Marita Canina. 2016. "digitally making as an opportunity for skilling and empowerment." cumulus association biannual international conference.

Salvia, Giuseppe, and Tim Cooper. 2016. "The role of design as a catalyst for sustainable DIY." In Sustainable Consumption, 15-34. Springer.

Sanders, Elizabeth B-N. 2006a. "Scaffolds for building everyday creativity." Design for effective communications: Creating Contexts for Clarity and Meaning:65-77.

Sanders, Elizabeth BN. 2006b. "Design serving people." Cumulus working papers Copenhagen 15 (05):28-33.

Schön, D.A. 1984. The Reflective Practitioner: How Professionals Think In Action. New York: Basic Books.

Schreier, Martin. 2006. "The value increment of mass-customized products: An empirical assessment." Journal of Consumer Behaviour 5 (4):317-327.

Schumacher, E.F. 2010. Small is Beautiful: Economics as if people mattered. London: Blond & Briggs Ltd. (ori.). Original edition, 1973. Reprint, Harper Perennial.

Seldis, Dominic. 2017. Tren van Eckevort. In De Nieuwe Stradivarius. The Netherlands.

Shove, Elizabeth, Matt Watson, and Jack Ingram. 2005. "The value of design and the design of value." Joining Forces', Design Conference, Helsinki.

Sparke, Penny. 1987. Design in Context. London: Bloomsbury Publishing PLC.

Thorpe, Ann. 2010. "Design's role in sustainable consumption." Design issues 26 (2):3-16.

Toffler, Alvin. 1989. The Third Wave. New York: Bantam Books.

Tukker, Arnold, Maurie J Cohen, Klaus Hubacek, and Oksana Mont. 2010. "The impacts of household consumption and options for change." Journal of Industrial Ecology 14 (1):13-30.

Van Abel, Bas, Roel Klaassen, Lucas Evers, and Peter Troxler. 2011. "Open design now." Amsterdam: Waag Society. Retrieved February 11:2014.

Verbeek, Peter-Paul. 2015. "Beyond Interaction." Interactions (IX) XXII.3:26-31. https://dx.doi.org/10.1145/2756410.

Vossen, Christina, Robert Kleppe, and S Randi. 2013. "Ship design and system integration." no. September.

Weisser, Tina. 2022. Successfully Implementing Service Design Projects Accessed 30-1-2022.

Wirth, Marco, and Frederic Thiesse. 2016. "Shapeways and the 3D printing revolution." Eduglopedia, accessed March 1st, 2021.

Wolf, Marco, and Shaun McQuitty. 2011. "Understanding the do-it-yourself consumer: DIY motivations and outcomes." AMS review 1 (3):154-170.

Wong, Hartanto, and Dharma Lesmono. 2013. "On the evaluation of product customization strategies in a vertically differentiated market." International Journal of Production Economics 144 (1):105-117.

Wynn, David C, and P John Clarkson. 2018. "Process models in design and development." Research in Engineering Design 29 (2):161-202.