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Integration of Hacking Mindset and Practice to Industrial Design Education

Seda Duman

Department of Industrial Product Design, Istanbul Technical University, Istanbul, Turkey

Seda.duman@yahoo.com; dumansed@itu.edu.tr

ABSTRACT

The most conventional meaning of the term 'hacking' is an illegal activity performed by computer experts who trespass into closed systems of electronic communication and sabotage their security and convention. However, this article examines hacking in terms of customizing and modifying existing products to improve their functionality, to repurpose or just for fun. The intention is; acknowledging there are more design opportunities, potential areas and problems to be discovered rather than the ones which have been addressed by professional designers alone. Informing new generations of designers about the contemporary design sub-cultures, their philosophies and practices and the different roles of the designers will open them alternative routes and enrich their education. Implementing hacking mentality and practice as a part of formal design education enables students to review tensions between people and artefacts, technology and play, creative use of readily available resources, use of collaborative networks, and realities of corporate design practice. This paper attempts to explore the potentials of hacking practice for improving pedagogical practices in industrial design programs and proposes alternative methods for application.

Keywords: Industrial Design, Education, Hacking, Open Design

INTRODUCTION

The word 'hacking' has many different definitions. The most conventional meaning of the term is an illegal activity performed by computer experts who trespass into closed systems of electronic communication and sabotage their security and convention. Yet, a new definition of the term is slowly taking over which has also entered the argot of design criticism. This new form of hacking is not done by digital criminals but is in fact done by everyday people. New terminology of hacking refers to the act of customizing and modifying existing products to improve their functionality, to repurpose or just for fun. Anyone who has modified a bike or repurposed an empty jar could be considered hacker. The idea has been around for a long time. However, the internet has served a mechanism to amplify it. Hobbyists post pictures, videos, tutorials on several DIY websites, blogs and forums to make it easier for anyone to practice design and to customize their products according to their own needs. Product hacking cultivates reciprocity between users and designers and supports transparency and graceful responses to unanticipated uses (Galloway et al., 2004).

The hacker culture originally emerged in academia in the 1960s at MIT, where the ‘hacker’ title was adopted by a group of artists, computer scientists, and engineers who believed innovation stemmed from taking things apart, seeing how they worked and using that knowledge to create new, innovative things (Levy, 2010). These kinds of sub-cultures had been generally observed in university campuses. The MIT Artificial Intelligence Laboratory, University of California and Berkeley have been the headsprings of early hacking culture. All activities done in a spirit of exploration and playfulness can be called hacking. The specific characteristic of a hacker is not the activities performed, but especially the way they are done and whether it is something exciting and meaningful. Playful intelligence can be said to have ‘hack value’ as in the early examples of MIT pranks used to demonstrate their technical capabilities and intelligence through hacking (Stallman, n.d.). Hacking can be found in all of the tinkering activities where purposeful changes are done to something in an attempt to repair or improve it. These activities reveal the internal functioning of physical artefacts and provide transparency in the underlying systems, structures and functions for subsequent modification and improvement (Knott, 2013).

Although it is possible to observe examples in many fields that come to mind, this article examines hacking in terms of making and modifying three-dimensional objects. The purpose is not to question the legitimacy of the professional field and holding an anti-professional side. The intention is; acknowledging there are more design opportunities, potential areas and problems to be discovered rather than the ones ever been addressed by professional designers alone. Informing new generations of designers about the contemporary design sub-cultures, their philosophies and practices and the different roles of the designers will open them alternative ways and enrich their education. In 1972 Victor Papanek argued that the professionalization of design had separated from the “real world”. Design cannot be separated from everyday life, he wrote, and by elevating its trained practitioners as professionals from those who are not so trained (amateurs), design begins to reference only itself and fails to address real problems faced by real people. In this process of professionalization, trial-and-error creativity has been lost (Papanek, 1972). Hacking finds a place in this gap between real life and the designed products and puts them back into the equation. Therefore it merits a deeper exploration.

Hacking is not an unfamiliar concept to the design field. On the contrary, hacking behaviour is at the essence of designing. Designers who need to design an equivalent product besides the competitor's best-selling product, examine its features, pros and cons, and develop a new product by hacking its physical properties, usage, production and marketing strategies. Again, every designed object carries a conscious or subconscious hacked features of a previously manifested material or immaterial idea. Biomimicry is a type of hacking too. It is the science of mimicking life and hacking nature (Sagarin, 2014). It is important to remember that the main motivation and essence of hacking activity is the curiosity of understanding how something really is.

Hackers are motivated, resourceful, and creative. They get deeply into how things work, to the point that they know how to take control of them and change them into something else (Herzog, Barcelo & Monroe, 2017). This allows them to rethink even the complex ideas because they enjoy digging into closed systems. They are not afraid to make the mistakes repeatedly, and see failure as something to be learned for progress and as a part of their scientific curiosity. Hacking is open-ended, error-friendly (Manzini, 2010), wabi-sabi (Juniper, 2019), and context-dependent. It is flexible for future alterations and carries an awareness of natural imperfection and evolution of man-made creative processes. Hacking practice can be performed individually or as a part of Commons-based peer production (CBPP). In the second context, the CBPP can be thought of as an early seeding phase of a new mode of information production enabled through Internet-based co-ordination, where decisions originate from the free participation and cooperation of people trying to create common value without demanding monetary compensation (Orsi, 2009; Kostakis & Papachristou, 2014). This participatory, co-design process fosters resourcefulness, and creates rich sources of information both for the designers and users, and for the companies who are looking for alternatives to improve their products. IKEA hackers website is a well-known example (figure 1) of how members of participatory communities find creative expression through sharing their personalized design practices, commenting on each other’s ideas, and building social capital through the merger of personal and collective intelligence (Dodd, 2017).

Figure 1. The range of IKEA hacks available on the Web site varies widely: from simple color or material changes, to the complete redesign and reconstruction of furniture parts, and even whole room installations. (Source: https://www.ikeahackers.net/)

RELATED CONCEPTS AND SUB-CULTURES

Understanding the motives and socio-economical structures behind the contemporary production and design sub-cultures could help us to explore new modes of designing. Internet communication, recent developments of affordable digital fabrication tools such as laser cutting, CNC routing, and 3D printing make possible not only the independent production but also create knowledge-based social networks enabling peer to peer (p2p) collaborations. The combined effect of all these new technologies, and particularly the digitization of the manufacturing process, is the opening up of industrial design to independent makers (Felderman, 2018). Rhoades claims that the impact of rapid manufacturing will be so profound, changing the way products are designed, manufactured, and distributed, that it can be described as the next industrial revolution (2008).

There are some other related concepts proliferated throughout digital and socio-economic developments with a similar background. Open design, citizen product design, co-design, desktop manufacturing, crowd-source design are some of them. These concepts are not completely different from each other, there are small differences between them in terms of modes of design and production. Nowadays, with the influence of technology, design and production practices no longer belong to a single company or designer and it is becoming transdisciplinary and collaborative. Again, thanks to different computer-aided production technologies, products can easily be produced with customizable and unique features rather than generic production that fits for all. As can be seen in figure 2, hacking is in the midst of all these changes and provides an important discovery area in terms of facilitating the transition. In hacking with the modification and improvement of mass produced objects, specialistic and collaborative modes of design and production are merged together. As in Linux operative system, and the Firefox browser examples, products and applications developed by different hackers can become available for generic users (Burnham, 2009).

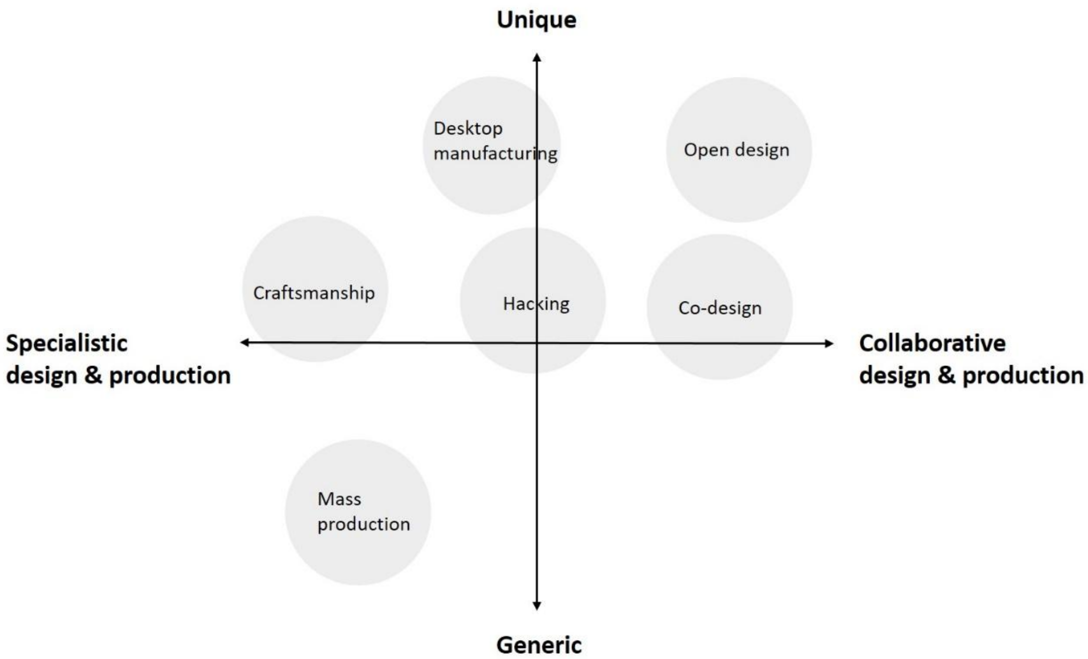

Figure 2. Hacking in the midst of related design sub-cultures.

These concepts represent a cultural shift towards new kinds of democratic and economic participation that we believe are sowing the seeds for a more sustainable, egalitarian future (P2P Foundation, n.d.). Online sharing platforms such as Instructables and web magazines and foundations such as Makezine, Ponoko, and P2P Foundation spreads the commons-based approaches and make them visible. Besides online sharing platforms fab-labs, hacker spaces and maker spaces bring together enthusiasts with similar interests and provide them an environment for (one to one, face to face, physical?) collaboration. All of these p2p activities have certain common values and characteristics. The most prominent ones are:

1. Using science and engineering to help environmental and social problems to raise the standards of living.
2. Being error-friendly and open to change. Collaborative practices are incremental by nature and amateurism is one of the central values.
3. Hands-on creative production
4. Democratization of design and production. Creating prosperity for all. The motto of P2P Foundation is “together we know everything, together we have everything” (P2P Foundation Wiki, 2017).

5. Being inclusive. No matter their age, level of expertise and initial skills – everyone can engage in collaborative productive processes of designing, programming and manufacturing (Kostakis & Papachristou, 2014).

DIFFERENCES BETWEEN PRODUCT HACKING AND INDUSTRIAL DESIGN

In this research paper, 'product hacking' is defined as any local design and production process frugally customizing everyday objects with local resources to improve their adaptation to a specific context and use. This definition already illustrates the various differences between product hacking and professional design. First of all, industrial design is mainly about designing products for the masses, while in hacking and in open design masses themselves are seizing the chance to design, manufacture and distribute products (Micklethwaite, 2012, p.17). The industrial design profession has always been strictly linked to the objectives of the corporation, either in a direct way (cost, efficiency or brand identity requirements) or indirectly by focusing on market trends and consumers' wishes (Hoftijzer, 2017). It is exclusive to established companies and professional designers with access to manufacturing tools and information. Therefore, new product development for industry is an isolated, expensive and slow process. On the other hand, hacking solutions are done in a fast and frugal manner by only focusing on the core aspects like available materials and the desired purpose. It is not looking for creating a finished and sophisticated design. If it is 'good enough' to do its job from the user's perspective it means the design has achieved its purpose. Consequently, while mass produced objects are identical, each product hack carries an idiosyncratic character due to the available resources, purpose and capabilities of the maker.

Another feature that makes hacking different from industrial design is the main motivations behind the action. As open design trend, the central drives of hacking is for transparency, and a democratization of participation in and ownership of design practice. It challenges the hegemonies of the dominant industrial system and cultural, capitalist production (Micklethwaite, 2012). As an unauthorized and post-production activity hacking aims not just to understand, modify or personalize products on the market but also to de-alienate and demystify the Latour's 'black box' (1987). In this sense, the combined effect of new communication and digital production technologies enabled distributed, scale-free manufacture and opened up alternative design and production opportunities for independent makers. Unlike the first industrial revolution, which led to a migration to population dense cities, these innovations enable people to live where they like and produce what they need locally (Rhoades, 2008). Hackers are not bounded to an established production plant or a distribution network.

Professional designers working for industry have to follow a strategy to address more universal needs to reach a larger market segment and procure more profit. Evaluating all users according to universal norms excludes people with different needs and leaves them dissatisfied. In this sense, hacking enables customization of the mass-produced commodities according to various personal needs without limitations. Thus, users evolve from being merely passive consumers selecting what is already available on the market to being active influencers of the design and production processes of their belongings. Hacking makes everyday people become designers without the need of any proficiency, just with the experiential knowledge they have with the objects they use and their environments. Social and psychological researches have indicated that it is one of the fundamental needs of human beings to exert their creativity and express their identity driven approaches (Max-Neef, 1992).

Last but not least, while mostly new materials need to be used in industrial production, hacking allows the improvement and repurpose of old items that are already possessed. The parts and components of an unused or broken object can be used in the design of other products. As it allows reuse and repurpose, hacking also contributes to sustainability in terms of the uncertainties of how mass produced products are evaluated and recycled in their after-life.

INTEGRATION OF HACKING MINDSET AND PRINCIPLES TO INDUSTRIAL DESIGN EDUCATION

Industrial Design (ID) was traditionally thought of as a profession of constructing, designing and mass production of physical products (Mubin, Novoa, & Mahmud, 2016). Many educational programs prepare students for the mass production and mass consumption context where strict ownership procedures are valid. Therefore, art and design schools still nurture the image of the genius and originality is rewarded as a higher standard than communication, and copying is a sin (Abel, 2011, p. 173). Design students learn the fundamental knowledge about their future profession in industrial design studio courses, which they need to attend every semester. This course aims to provide specific skills such as how to conduct design research, generate a concept and present their ideas (Chen, 2015). While basic theories in this course are based on the apprenticeship model of the Bauhaus School in the 1920s, design studio pedagogy has shifted towards scientific and pragmatic theories with the design methods movement in the 1960s (Celani, 2012). New technologies and socio-economical structure have affected the content and methods used in studio education. However, these developments could not keep pace with contemporary circumstances. This backlog is due to the fact that universities are not as flexible as the private sector because of their structures, and the rigid boundaries that distinguish the industrial design profession from others cannot be easily exceeded. Over time, in addition to the hand drawing courses which were considered as a prerequisite skill for being a good designer, computer-aided drawing programs have been included in the design curriculums. Nowadays, in addition to learning about industrial production methods, students can have hands-on experience with the digital manufacturing tools available in university laboratories such as laser-cutters, 3D printers, CNC mills, etc. Since these tools and supportive software became increasingly reliable and affordable, alternative design jobs emerged and they changed the previously established paradigms of the industrial design discipline.

The complex structure of contemporary social and environmental problems necessitates collaborative design approaches. Seeking solutions to such problems has drifted design practice away from a single star designer's understanding of product design to an interdisciplinary and open, co-design process. It is important to inform students about the new roles of designers and introduce them new concepts that have emerged from these developments such as interaction design, service design, and open design. In addition to hard skills like technical drawing, proficiency of production techniques, soft skills- communication, collaboration, and ethical questioning- should be an essential part of design curriculums. As can be seen from Table x, hacking takes place in between the mass production and new design approaches and it constitutes a bridge between these two extremes.

Hacking is the cross-section of professionally designing and producing, and everyday consumption and use. In this sense, it is an important connection point for the design students who used to be merely in a consumer position until the beginning of their education and who want to practice design professionally. One of the primary objectives of industrial design education is to make students sensitive to the objects around them, to the use of these objects, and to help them develop critical thinking and problem solving skills across their personal observations. Before they start designing a new product from scratch, hacking an object that they actually use and critically evaluating it, will make an important contribution to nurture this sensibility. Hacking is a strategic position refers to the participation of the user to the post-design phase, or in other words it is 'design-after-design' (Redström, 2008). It is a type of design research and a deep examination where amateurs open up devices or artefacts to see how they work, what the components are and how to manipulate them creatively into something they want (Herzog, n.d.). The actions of purchasing, using, designing, producing and recycling which are normally performed by different people at different times congregate in one pot as in pre-industrial times.

Implementing hacking mindset and practice as a part of formal design education lets students discuss tensions between people and artifacts, technology and play, the creative use of readily available resources, subverting traditional functions and uses of networks, and the everyday realities of corporate design practice (Galloway et al., 2004). With easy-to-learn hacker and maker platforms like Instructables and Ponoko design students can follow tutorials, connect with other enthusiasts, manufacture physical items and trade them online.
Introducing students with the online platforms enables the exchange between product hackers, facilitates a sustainable peer-to-peer learning environment and extends the borders of institutional education (Abel, 2011, p. 173).This corresponds to the two layers of design and to the two different designer roles: first being a product designer, and secondly being a facilitator in a platform where members share and collaborate.

There are already some examples of the implementation of hacking practice in the education sector and teaching the hacker mindset to the students. Some educational institutions, as in the case of Hacker High School, start these implementations at the middle and high school level. On the other hand, in the case of School Retool, which is created in collaboration with IDEO and Stanford d.school, hacking principles are used to train school leaders like to redesign their school culture by teaching them how to make small, scrappy experiments. One of their statements is " hacks may start small, but they're built on research-based practices that lead deeper learning, and can create the kind of big change you aspire to- namely, preparing your students for life in the real world." (School Retool, n.d.).

Hacking also being practiced at the university fablabs and makerspaces. Fablab concept is instigated in 1998 by MIT professor Neil Gerhenfeld and set up in 2001 (Liotard, 2017).Since then it has become widespread and has led to the constitution of a network of fablabs worldwide. These collaboration spaces, stemming from a desire to share knowledge and openings, call into question production (which becomes local), intellectual property (more open, based on open source files and pooling material), hierarchy (peer communities enable projects to be carried out, horizontal spaces), and lastly the role of the individual in a certain number of initiatives (Liotard, 2017). The primary aim of the fablabs at the universities is to teach students how to use digitally controlled craft and machine materials and enable a co-learning environment.

As an example of utilizing hacking and open design as a pedagogic method in design education, we can mention Mushan Zer-Aviv's projects with the students at Parsons the New School of Design. These applications were realized in two different ways. In the first one students are asked to create tutorials on something they already knew how to do and exchange tutorials in class. Pedagogical framework is based on construction, sharing, documentation and peer learning. All of the students had to follow the tutorials provided by their peers and report their experiences to the rest of the class. They used an e-mail list and blog post for communication and taking creative feedback. However, since the pool of knowledge created in each semester left abandoned at the end of the semester, lecturer passed to the second method where students get connected to an existing platform, publish their design publicly, and when semester ended they can maintain their own repositories beyond the context of class. ZeR-Aviv expresses that the second attempt worked better and months and years after they still receive thank-you comments from random users on the web (Abel, 2011, p. 174).

As can be understood from the examples mentioned above, while hacking mind-set can be integrated in design studios, it can also be applied in the overall development and update of a program curriculum. Design methods which are used in the idea generation phase are also in parallel with the hacker mentality. One of the most common one is the SCAMPER -Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, Reverse. SCAMPER method is based very simply on the modification of existing products, services and ideas by applying these seven different approaches. These prompts force the mind to think alternatively, and help to generate original and meaningful concepts that won't be easily created by a regular thinking flow. Emphasizing hacking mind-set and practice in the idea generation process suppresses secondary concerns such as ownership, originality, and marketing, and makes it easier to focus on the actual use, necessity, and production of the object. This increases productivity, and enables resourceful activities by eliminating the concerns that block creativity at the earlier concept generation phases.

Design instructors can benefit from SCAMPER like methods to introduce hacking approach to their students. Again, in line with the examples listed previously, they can arrange project briefs to contribute to the existing hacker projects on online platforms like instructubles, and lead their students to share their ideas openly. Design students can design a tutorial for something they already know how to make, or they can try online tutorials and rearrange them in a way they would think that will work better. Such applications will enable students to become familiar with new technologies and new design approaches such as open design, co-learning and peer to peer production. There are some considerations that should be taken into account while integrating hacking mind-set and practice to the design pedagogy. First of all, hacking is contextual activity and since each school has its own culture, structure and locality design briefs should be prepared accordingly. Secondly, rather than focusing on the final outcome of the projects and on the 'finished object', the process should be taken as a whole and perceived as a way of constructing 'socio-material assemblies' (Latour, 2000). In terms of participation, hacking process comprises not only designers, users, and other 'human' actors, but also participation of material and immaterial 'non-humans' connected with the project. Bruno Latour describes this socio-material assemblies as 'collectives of human and non-humans' (2000).

CONCLUSION

Design programs are having difficulty in keeping up with the pace of technological and social developments. The integration of new design approaches and sub-disciplines to design education will accelerate the process of closing this gap. Hacking mind-set and practice constitute a cross-section between professional design and everyday consumption and use. It also integrates newly emerged digital technologies and collaborative practices to design and production processes. Integrating hacking practices into industrial design education will not just nurture the creative processes of the design students but will also affect and change the overall structure of the design programs incrementally. This research paper attempts to explore the potential of hacking practice for improving pedagogical practices in industrial design programs and proposes alternative methods for application.

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