

OnOff: Creative Method Integration: from Physical to Digital and Back, in Mechanical and Product Design Learning

Prof. Iko Avital¹ , Dr. Gedalya Mazor²

¹ SCE-Shamoon College of Engineering, Israel
ME Product Design Dept.
ikoavital@gmail.com

SCE-Shamoon College of Engineering, Israel
² Mechanical Engineering Dept.
mazorg@sce.ac.il

Tell me and I forget.
Teach me and I remember.
Involve me and I learn.

Benjamin Franklin
1706-1790

Abstract

The principal objective of this paper is to demonstrate the capability of a smartphone being a useful learning sources tool in product design, rather than being a hindrance in class. OnOff is an interactive teaching and learning method, in our SCE program of Mechanical Engineering in Product Design (MEPD); it is a mixed creative process that combines abstract and concrete creative thinking in two levels of experience, when a smartphone becomes a 'personal workbench', together with existing experience of hands on labs, such as wood, metal, plastic, color, 3D printers, and varied machinery. OnOff method is designed to face teaching challenge with two main problems. The first, low and scattered attention: how to deal with the growing disturbance of using smartphones during class. Second, generational gap: how to bridge design teaching by X or Y Generation faculty, versus digital addiction of Z-Generation students. OnOff, this mixed of Offline and Online teaching method, is based on qualitative research of self-learning experience; it was tested on 120 undergraduate students; every student spent two academic years (four semesters), in Project Oriented

Courses (Avital, Mazor, 2014), when Smartphones, some apps, and social network were always in use during class session. Our MEPD program consist three courses' categories: four practical and theoretical Creativity and Innovation courses, four POC, and three courses of Art and Design: Free conception drawing, Creative work with paper, and Design History and Philosophy lecture and roundtable discussions. The results of using this method indicates a great change (Brown, 2009) in positive mood of participants and general class atmosphere, high readiness to cooperate even with overseas teams, motivation of most individuals to search and explore in depth images and texts, better self-ideation, WhatsApp team-brainstorming, Skype presentations, and varied prototypes outcomes: preliminary, Digital, and 3D printed. Results also showed that a free use of digital screens, especially smartphone, facilitates the ideation stage, and particularly improved attention, and performance of inventive products, and creative problem solving tasks as well; when personal smartphone became "legal" in class, its presence became a breakthrough and creative learning tool for searching, documenting, communicating, and much more. It also facilitated students to experience cross-team projects in engineering and design with overseas institutes, which focuses on Cross-Campus and Cross-Function Learning.

Keywords: Tangible versus intangible, Z- Generation students, Smartphone Addiction, On - and - Off process

Introduction

Discoveries, scientific innovations, and technological inventions have always shaped the life style of a person and determined his life span (Harary, 2017): spoken language, fire detection, tool design, written language, mass printing, industrial revolution, machinery, communication, and big data. The first train locomotive, created thirty years after the invention of the steam engine (James Watt, 1774), was a historic milestone for public change in all aspects of demographic, socio-economic and cultural life – Smartphone, the same, created a dramatic revolution of personal life; the individual towards himself, toward the other, and his lifestyle environment. The Smartphone is certainly one of the most sophisticated products that technology and design thinking has created (Grant, 2016); a product which wraps and contains the story of every individual, and stores significant moments and memories of his daily life, along with vital information and details from his personal world to his everyday functioning. It also constitutes an individual's pipeline to the external environment, a platform through which the individual manages and packages his family, social, and economic relationships. The smartphone has become a kind of "the best friend of man", so perhaps for the first time the deep psycho-pathological connection was created, to the point of total interaction and dependence between product and user. This dependency creates many experience anxieties, such as losing touch with the device, fearing not to be ready and available to chat - in the so-called Nomophobia (No Mobile, Phobia).

The principle of the multiplicity of features and uses of smartphone design was consciously or unconsciously evolutionary created and design on the basis of the Swiss Military Knife (Derek, 2016) that was invented in the last decade of the 19th century

by Carl Elsner, 1891. The development of a special spring mechanism made it possible to fix folding blades on both sides of the handle - thus doubling the number of useful tools that included the pocketknife. This handy and compact tool could be carry in any pocket, with any container to assist in any problematic situation: blades, screwdrivers, bicycle repair tools, hacking keys, toothpicks, corkscrew, can opener, and more. This product contains many uses, and largely is a successful replacement for many other products that already used. This principle of multiplicity features and uses is widely available in the smartphone, thus transforming what was a just 'mobile phone', into a fascinating all-in-one and easy -to –use product - but also became an obsessive-compulsive lifestyle product for so many people, and a trendy product of every age and socioeconomic stratum. The smartphone got a list of so many features; including camera, video, radio, recorder, notebook, reminder, photo and video; besides, albums, musical instruments, navigation device, mailbox, books, games, and movies. Also, tourist interactive information of flights, hotels, buses, trains and taxis, etc. There are indie stages for amateur and professional shows, and a free platform for personal presentation of every kind and level. There is no doubt that the smartphone, apart from being a global social phenomenon that has changed the ways of communication dialoguing and the acquisition of knowledge, is a product design of intelligent technological innovation of great impact, just a kind of "Swiss **digital** pocket knife" in every pocket and every hand. This smartphone has the ability to locate a GPS receiver, heat, light, humidity, motion, and of course, WIFI and Bluetooth. Hence, the natural technological process is the Internet of Things (IoT), the communication network of ordinary products that we all use every day and every way. For example, two products that can hint at the very near future in product design: Nike has created IoT- based running shoes that contain a sensor that allows to transmit the athlete's personal performance - the distance, the time and the pace. Another example, integrated electronics fabric, E-SKIN, T-shirt, which is also a wearable monitoring, means for monitoring the movement, proper posture, breathing. Current technologies deal with wearable devices, smart environment, design and self-production of products using personal 3D printers, products and autonomous objects (scooters, cars, robots, medical devices, weapons). Along with all this, it is clear that the design of the smartphone and its use will certainly change because of the rush of technological progress, which combines inventions and technological approaches to create and design more innovative products. Artificial Intelligence (AI), autonomic technologies, methods, processes, and systems - all create new and sophisticated industries that can take advantage of the qualities and features of these technologies into innovative methods of storing and monitoring information, such as in Blockchain, which enables secure business operations without the need for a central management entity. All these creates crucial opportunity for product designers to integrate 'ON' smart combination of the smartphone bone knowledge with 'OFF' hands on processes, industrial production methods, and logistics systems. Therefore, we should teach our students to adopt and use the 'ON' digital technologies during class. On the other hand, faculty must change and redesign our classes, studios, and labs; also, and more important, there is a crucial nowadays need to review our very old pedagogic methods in design education that will suit our 'OFF' lifestyle, industries, and the economic demand for innovation in product design.

Smartphone Addiction

The term Nomophobia (Elmore, 2018) is short for "anxiety without a mobile phone", No Mobile Phobia; Psychological definition of an anxiety disorder that may arise from fear-of-losing (calls, chats, news), to the battery-anxiety. Always, staying alert, in a situation of constant presence near the smartphone and its contents. Nomophobia became a heavy common contemporary addiction, just like cigarettes, alcohol and drugs. On the one hand, this is an exceptional of Aha device with so many excellent uses and qualities; On the other hand, this attractiveness magnetizes users, and creates the psychological need for continuous use.

Israel is a 'Smartphone State', where every child from the age of six to the elder age uses smartphones, when they consider it as a personal must to get, and required pocket-product, status branding, and highly useful. This device represents a herd phenomenon in marketing, symbolizing the image status of innovation, a social epidemic characterized by the need to acquire the most innovative device, voluntary slavery to the device, overuse and the need for constant communication. Public spaces in Israel interrupted by smartphone users; including noisy conversations everywhere, anytime - in streets, shopping centers, public transportation, theaters, restaurants, in the elevator, in pedestrian crossings, and ... in classrooms as well. A special study conducted in Israel for "Globes Tech" (Sarid Institute 2017) , reveals the numbers behind this phenomenon: At the age of 6, the Israeli child get his first smartphone; 83% of the children have smartphones; 97% of teens are more likely to sleep with their phones; otherwise they feel depression, restlessness, insomnia and anxiety.

Other studies conducted on psychological effects of smartphones overuse. For Example, The MasterCard Innovation Index (MII, 2017) surveyed 23,000 consumers in 23 countries in Europe, Africa and the Middle East including in Israel, regarding their access to digital technology. This survey revealed that more than 90% of Israeli consumers use a smartphone and use it for 7.4 hours a day, which means most hours of the day.

OnOff: The Method

Our qualitative research with the problem of our students' addiction began with a very simple statistic: For the past five years, we have asked all the students in the classes we taught, one question only, "Do you have a smartphone?" Always, the answer was uniform. There was not a single student, along these years, who answered this question negatively. This did not surprise us at all, and this answer known in advance, as well as overuse 24/7. The presence of a smartphone in the classroom has become a factor that interferes with the class time and the quality of teaching. On the one hand, the student's attention during lectures and discussions usually directed towards the device very next to them, and the need to rummage through the device.

The need to physically close the device next to the user, the need to turn it on from time to time to intensive search for incoming mail or chats of any kind, a strong desire to use smartphone, to call or send text messages, which are expressed in constant preoccupation with those activities (Tomeels, 2011). The need to increase the frequency and time of making phone calls and sending text messages, using a smartphone as a way to escape from real problems, such as improving mood, for example in boring

lessons, or to ease social loneliness, anxiety, depression or guilt. In addition, the students' accumulated experience in laconic writing and the use of funny symbols in various applications have led to the hit the quality of normative writing, and the loss of the ability to formulate ideas deeply to the quality of shallow and flawed academic writing. Reading books that attached to the syllabi has also become much less intense than before. In addition, students do not summarize what said in the lecture in their notebooks, but instead they snapshot what the lecturer wrote on the board.

The presence of smartphones in the classroom was always a challenge to face. In the not-so-distant past, we have taken measures that were predetermined to fail. We insisted on shutting down the devices and putting them in the bags. We were tensed and angry at sudden application ringtones sounds, and phone calls. We use to note cynically to those students who had hidden the device from our eyes and continued to use it - but it did not help in dealing with the need to make deliberate or occasional use of a smartphone. These were days of frustration, and the search for methods of regulation and punishment to ensure the attention required during the lessons. All these created human and pedagogical conflicts between faculty and students. The problem widened when some of the students testified to us that some lecturers who also used smartphone to look at their "news" during teaching. We were also interested in knowing what the lecturers think. We randomly gathered four opinions among some faculty members:
"This generation is connected 24/7 to their smartphone, but emotionally disconnected."
"This is the generation of screens affected by reality shows and just wants to be famous, Only textual and non-vocal",
"Talking in shorthand and staring",
"Not interested or talking".



Initial Research in Product Design through smartphone application and chats.

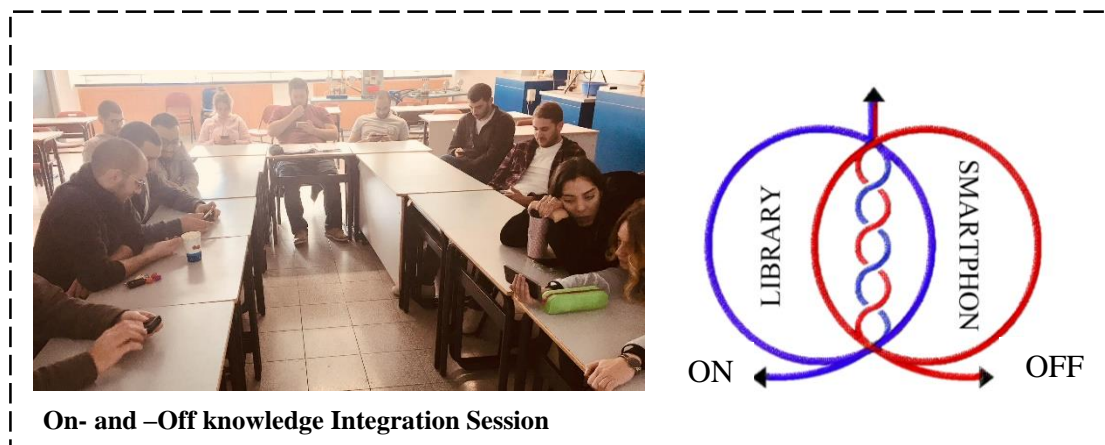
An important part of the problem analysis was the realization that there was a large gap between the Z-generation students and the X and Y generation faculty. This stage was critical in gaining the central insight that the generation gap existing in the technological and cultural context is significant.

This Z gen, which we call "Swipers", are digital natives that was born and grew up into a virtual reality, and into an advanced technological world full of sophisticated hardware-software, and multimedia products that enable them to be connected and active on the web for almost any hour. They are multi-tasker, they are capable of simultaneous and multidisciplinary activities. Listening to their own music, playing video games, watching television, talking on social networks and doing homework at the same time (Seemiller, Meghan, 2016). This generation is fast, engage any kind

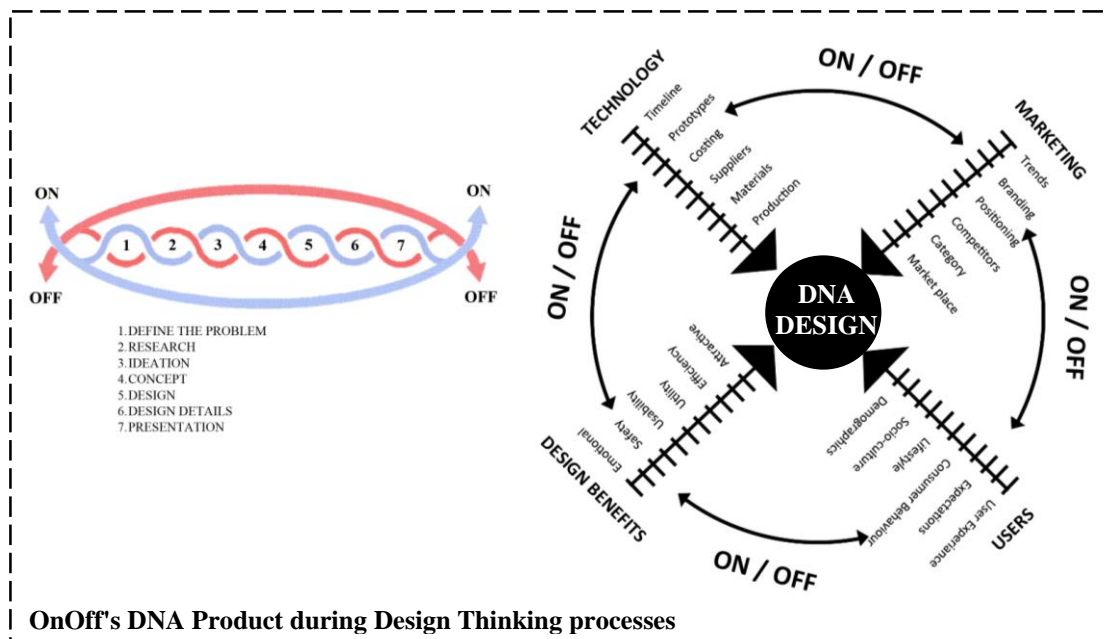
technological devices and can quickly adapt to the changing media and methods. Their world consists mainly of visual content saturated with multi-channel visual applications, they have tremendous ability to absorb and process information quickly. And know, much more than their parents and teachers, they can operate any digital device, while downloading applications at peak speed and immediately using them for immediate use. Their skills work according to visual shorthand, their eye perceives a situation in the second and they are impatient with the information presented at length and in detail because they need quick answers. It is important for them to document themselves during their self-day and pass on to friends, but use their social network as a learning source and preferred on print media such as books.

This gap between faculty and students, and this general situation of low attention and a decline in the quality of teaching and learning, were the main of our motivation to develop OnOff method. There was a crucial need to find a new way to reenergize learning atmosphere, by creating new experiences during design thinking. Also, designing teaching aids that will ensure learning quality. A central principle in the need to design OnOff method was to set a balance between the addictive tendency to overuse the smartphone, and return the students to the library and books reading. As it once said, if you cannot beat them, join them. This method is designed to create in a studio classroom a circled democratic learning atmosphere, which students' teamwork are involved in creating common knowledge while facilitator guides, rather than a frontal learning when teacher just lectures.

The method allows learning in several formats. In the first format, all students and mentors make extensive use of smartphones as a main source of inspiration, or diverse research on product evolution, product design in the appropriate category, competitors, users, production methods, raw materials, production, pricing, logistics. At the same time, part of the team brings from the library the same books or articles relevant to the given project. The collection of textual, visual and animated information creates current, up-to-date, accurate and comparative information about the planned product as a basis for conceptualization. Each team creates a presentation to the entire class, a stage that can improve the learning experience and expand the possibilities of self-learning and teamwork during this scene, while learning individually within each team. Another OnOff quality is E-Studio format of cross-campus, cross-culture and cross-function team in creative projects. All stages of discussions and sketches done within each team, divided between two countries (Israel SCE and IIT India), using smartphones applications for chatting, texting, and video calls - including Design Thinking, Conception, mid and final presentations.



OnOff method was designed to create a democratic learning atmosphere in which each student is a dynamic part of design teamwork in creating common knowledge through guidance rather than a frontal lecture by the teacher (Avital, Monga, 2017). All the students and the facilitator make extensive use of the smartphone as a current source during redefine problem, research, ideation, design thinking, design details, prototyping, and manufacturing. All this using articles, books and magazines. The advantage of "ON" practice is gathering current, accurate, and accurate information (texts, images, videos, and so on) for all creativity and design all this using articles, books and magazines. The advantage of online, gathering current, accurate, and accurate information for all stages of planning and design. Its disadvantage lies in its credibility, doubt of misinformation, fake data. On the other hand, the OnOff learning of these two sources of knowledge makes it possible to consider and choose the relevant and contextual best data. This model of new design thinking that integrates OnOff data along product design processes creates a continuous interaction that deepens research and Ideation, while bridging the gaps between faculty and students, such as age, tech literacy, and attentiveness. In the course of these lessons, we also played background music and allowed to have some snacks and soft drinks. The result of these was similar to the professional design studio - free atmosphere in class, vivid team conversations, creative debates, faculty as a part of team not lecturer anymore, and so much enthusiasm that they always forget to take a break during class session.



OnOff's DNA Product

Each product at the point of sale (PoS) challenged by other products in the same category and shelves. Failure of this product can cause serious financial damage, and even threaten the existence of a company or enterprise (Scwab, 2016). For this reason, the main design purpose of a product is to create a user's authentic experience, strong identity that distinguishes it from others, and unique product visibility. OnOff processes ensures the product's DNA by nonstop weaving two kind of creative process factors: abstractive thinking through visual information integration and interaction; using mechanic lab facilities in order to set and reset an accurate problem definition and idea

generation in a preliminary prototype, and in the same time using varied smartphone applications to follow, check, and review. These creative processes are the product DNA, that emphasizes its practical and imaginal benefits over its competitors, and keep setting it positively in the user's mind.

Conclusions:

1. The use of this method has succeeded in changing the educational atmosphere in the classroom, from passive and linear classes to active and dynamic classes.
2. The integration and interaction of the intangible and tangible processes, through an open and free guiding approach, enriches the creative and design thinking, deepens the research, sketching, design detailing, and increases the innovative product outcome.
3. Faculty should prepare well each lesson to guide in an informed manner of creative Integration: from physical to digital and back - the transitions between swiping and hands on processes.
4. This method worked well when the facilitator nurtured leadership in each team, and was well involved in all phases of the various projects, including the involvement of each student in each team along OnOff process.
5. The large, permitted, and free use of the smartphone reduces disruptions in class, but some students still had some personal WhatsApp chatting, and Selfie snapshots.



The smartphone became an inexhaustible source of all kind of information that creates concentration and interest and returns (a little) the visit to the library.

References:

1. Avital, I., Monga, C. 2017, "*E-Studio*"- Cross-Campus Design Team, Singapore.
2. Avital, I., Mazor, G., 2014, *Circling The Square*, Stanford University Pub.
3. Avital, I., Monga, C. 2014, "*Insertix*"- *Grafting 'XY' Factor in Engineering Creativity*, Consilience and Innovation, Japan.
4. Avital, I., Monga, Turbovich, Z., 2014, *Śūnyatā Toolbox: From Spaceless Typography to Product Design*, TypoDay, India.
5. Brown, T., *Change by Design*, Harper-Collins Books, 2009.

6. Burke, B., *GAMIFY*, Bibliomotion Books, 2014
7. Dreyfus, H., *Mind over Machine*, Free Press (Macmillan NY), 2014.
8. Grant, A., *Originals*, Penguin, 2016.
9. Katz, B., *Make it New*, The MIT Press, 2015.
10. Klein, G., *the Power of Intuition*, Doubleday, 2004.
11. Singer, I., *Modes of Creativity*, the MIT Press, 2011.
12. Schwab, K., *the Fourth Industrial Revolution*, World Economic Forum, 2016.
13. Thomée1S, H. A. (2011). Mobile phone use and stress sleep disturbances, and symptoms of depression among young adults - a prospective cohort study. *BMC Public Health*, 11: 66.
14. Yen CF, T. T. (2009). Symptoms of problematic cellular phone use, functional impairment and its association with depression among adolescents in Southern Taiwan. *Journal of Adolescence*. 32(4):863–873.
15. <https://newsroom.mastercard.com/digital-press-kits/index-2017/>
16. <http://www.globes.co.il/news/categoryarchive.aspx?fid=594>