Meaning, Knowledge And Artifacts, giving a voice to tacit knowledge

Spyros Bofylatos*, Thomas Spyroua

aDepartment of Product and Systems Design Engineering, University of the Aegean
*Corresponding author e-mail: bofy@aegean.gr

Abstract: The purpose of this paper is to describe a co-design methodology aiming to incorporate, synthesise and co-create different kinds of knowledge in the design process. Artifacts are creations of body/mind/thing assemblages (Latour, 2007); their physical structure prescribes technical functions existing within a context of human action (Kroes, 2012). The material, the social and the practical exist within a threefold design semiosis (Zingale & Domingues, 2015). The artifact, a “semiotic organism”, acts as the transmitter of values and as a catalyst in shaping cultural systems. The mediation of each of the facets of the artifact produces different types of knowledge, namely tacit, empirical and scientific knowledge while shaping and being shaped through said mediation.

Modernity brought about the rise of scientific operationalism and the adoption of scientific knowledge as the sole bearer of truth. Recent reactions to this modernist doctrine have included in the design semiosis other structures of knowledge sprawling around tacit, embodied, experiential and empirical. The aim of the proposed methodology is to bring the structures associated with tacit knowledge to the forefront and holistically synthesize the three different types of knowledge towards a new, more robust artifact that is the means, not the end, of co-creation of meaning through this threefold design semiosis.

In order to achieve this, we expand on the idea of layers of abstraction of information appropriated towards knowledge. By understanding the processes of deduction, induction and abduction, we can co-create shared meaning between all the stakeholders of the design project. These three different ways of knowing, in combination with the designer’s intentionality, work together to bring something into appearance, engaging in a process of “poeisis” (Heidegger, 1977).

Keywords: Tacit Knowledge, design, craft

1. Introduction

In this paper, we present the outline of a design methodology that aims to incorporate tacit knowledge in the design process. Design is seen as an activity that aims to bring about new
assemblages of humans and sociotechnical artifacts. In the first section, we discuss the theory of the sociotechnical artifact, the facets and the relation to Action Network Theory. In the following section, we present the pragmatistic view of semiotics and underline their application in design. In the third section, we argue for the need for an epistemological and ontological shift from the ideology of scientific naturalism. For sustainability to truly emerge through design, the need for understanding, adopting and utilizing all forms of knowledge equally is underlined. In the final section a methodology structured around all the aforementioned concepts is presented. Finally, conclusions and future research directions are discussed.

2. The sociotechnical artifact

Creating a sociotechnical artifact is an indistinguishable part of any design process. These artifacts can take the form of products, digital systems, services or any assemblage between these. This view has been central in the design discourse since Herbert Simon published ‘the sciences of the artificial’ in 1969. For Simon, the idea of a technical artifact has a dual nature. On one hand, it is a physical object that can be used to accomplish a specific goal; on the other, it is an intentional object, whose function has meaning only within the context of a goal-oriented human activity (Simon 1996). Therefore, not all physical objects are technical artifacts; it is their function and intentionality that creates this dual nature between physical structure and technical function. This very basic ontology leaves the social mediation of the artifact in the general scope of the environment; however, one can argue that in specific social systems, such as services, the social function of an artifact is more important than its technical function.

Peter Kroes proposes a shift from the view proposed by Simon and puts forward the idea of the technical artifact as a creation of mind and matter (Kroes, 2012). Firstly, the artifact is made up of a physical structure, without which it would be impossible to perceive it. Secondly, the artifact possesses a technical function, a conceptualization of the intent of the designer, as it was made with the intent to do something. For instance, a rock is a physical object but it does not have an explicit function. Finally, the artifact exists within a social context of human action; e.g. a wedding ring has no meaning in a society that has not adopted the institution of marriage.

The idea of the sociotechnical artifact offers an ontology that better integrates the idea of the artifact as “a semiotic organism in the centre of a threefold design semiosis” (Zingale & Dominguez, 2015). In essence, it underlines the importance of the social sphere in the ontology of an artifact. This idea exists within the broader framework of Actor Network Theory (ANT) proposed by Bruno Latour (2007). In an attempt to move away from the modernist ‘I-thou’ relation (Buber, 1929), ANT proposes a distinction between humans and non-humans, sociotechnical artifacts and natural objects which are considered non-humans. In this view, technical artifacts and humans exist as nodes in networks of relations. By realizing the agency of non-humans, we are able to see them not as simple intermediaries within networks of humans, but as mediators in the collective uncertainty management (Latour, 2007).

This understanding of the different facets of the artifact puts forward questions that aid the designer in taking more issues into account when designing and getting to a more robust understanding of the problem space that the designed will come to transform. At the same time, the idea of assemblages that lead to sociotechnical systems provides a designerly way of seeing the world that can incorporate all different fields of application of design, less preoccupied with the physical, such as human computer interaction (HCI) and service design. In this view, design is preoccupied the creation
of new assemblages, and this process can be one of simply adding a new non-human in an assemblage (product design), rearranging existing networks into novel assemblages (service design) or even creating a completely novel assemblage.

3. Design as semiosis

The pragmatistic view of semiotics (i.e. the branch of semiotics looking at design), examines the meaning of every artifact through the sensible effects. Design is a process of identifying an array of possible futures and selecting the most appropriate one. The artifact, its intended function and consequences are ways of shaping the present into the future, passing from a state of doubt deriving from uneasiness and dissatisfaction, to a state of belief (Zingale & Dominguez, 2015). In design terms, we refer to this as a transformation of the problem space into a more desirable one.

The idea of the Peirceian macroargument can be seen as the outline of every design process, an iterative process marked by the abduction deduction-induction movements visualized in figure 1. This is an open-ended process, a potentially unlimited semiotic cycle (Bonfantini, 1980). A recursive inferential cycle destined to start and restart all over again, until at least one design hypothesis “shall resist all tests”. The main characteristics of the idea of the macroargument are evident in a plethora of different design methodologies that in turn view design as an iterative process of divergence and convergence of the problem space. The number of steps or the names chosen for each step might change, but at its core all design processes, implicit or explicit, can be modelled as this macroargument.

Thus, the meaning of an artifact can be neither solely embodied by the artifact itself nor inside the assemblage to which it belongs, but it rather lies in all the possible practical or mental actions that the artifact is able to involve. The meaning of a design continues and completes itself in its use (Rabardel, 1995; Bonfantini & Zingale, 1999; Zingale & Dominguez, 2015). The user completes and continues the design because the use phase is conceived as a form of design activity as well. This cycle is not a one-way street; the user logic must come back as feedback and inform the designer in order to bridge the gaps between designer and user logic.

As a matter of fact, to consider the use of an artifact as a continuation of the design implies the expansion of the concept of “design logic” and its dialogic relation to the “user logic”, or
interpretation of use, to the way the user will interact with the artifact. Here, the dialogic process is a
game that involves the designer in the first instance, performing the opening action from the initial
idea to the production of the artifact secondly the user, who is the subject of an action performed by
the artifact. The two logics should infer the actions of one another. It is precisely at the intersection
of the mediation between design and user that the artifact is found: an entity into which the
designer inscribes value and from which the user infers value. The artifact plays a mediation role in
the threefold process of design semiosis (Zingale & Dominguez, 2015).

![Diagram of User logic and design logic](image)

**Figure 2 User logic and design logic. Diagram by Luna Gasparini. Source: Zingale & Domingues 2015**

The diagram should be interpreted as representation of a dialogic process where the design action
originates in the designer’s mind and is addressed to the user’s mind, having the artifact as keystone.
The process is therefore triadic, with the artifact as mediator between design aims and effects on the
user. The artifact – or more generally, every artificial reality in which we live – is thus to be conceived
as a place where a “common mind” is shaped: a place of shared behavioural and cognitive habits,
beliefs and opinions, compared and contrasted viewpoints or values, the place where shared
meaning resides.
Meaning, knowledge and artifacts, giving a voice to tacit knowledge

All of the six different modes of interpretation uncover different types of knowledge embodied in the artifact or create the knowledge necessary to achieve the goals and consequences set by the designer. In the previous section, we analysed the artifact and identified three interconnected and inseparable facets of it. The physical shape and structure, the technical function and the social context within which the artifact exists. Each of these facets is mediated through the aforementioned process in its own accord. In the following section, we will expand on how to understand and synthesise these three entangled processes.

4. Structures of knowledge

Knowledge is sometimes described as "the subjective 'perception of the world and one's place in it' (Boulding 1955), while Zeleny claimed that knowledge "should refer to an observer's distinction of 'objects” (Zeleny 1987). Knowledge is a thought in the individual's mind, which is characterized by the individual's justifiable belief that it is true. It can be empirical and non-empirical, tacit or explicit. Design can be seen as a process that revolves around knowledge acquisition with an end goal of embodying all the appropriate knowledge into an artifact. For example, a calculus textbook is a designed artifact that embodies scientific knowledge in the domains of mathematics. The end user will engage in the aforementioned threefold design semiosis with the artifact aiming to re-contextualize and internalize this knowledge.

Any human activity with a high degree of using the hands or the body, for example craft processes, has a common thread in connecting them; it is impossible to put into words what happens in its entirety. For example, everybody breathes, but it is impossible for most people to explain how they...
do it. This kind of experiential, embodied knowledge is referred to as ‘tacit knowledge’ (Polanyi, 1958; Nieder, 2007; Biggs, 2004). In the context of design and the creation of artifacts, craft has been mostly associated with it. The majority of knowledge held by craftsmen is tacit. The artisan work establishes a skill and knowledge sphere that may exceed the explanatory verbal abilities of man (Sennett, 2008; Pallasmaa, 2009; Wilson, 1998).

Fry argues that contemporary practices of design and manufacture, including fashion design, planning, architecture, industrial design, visual communication and craft practices engender unsustainability as a particular mode of being (Fry, 2007). In this line of thought craft is an important stepping stone in the transition towards sustainability. Certainly, not all craft is conductive to sustainability and not all the values of modernity are conflicting with sustainability. In being both directional and political, craft contains the power to either prolong or transform conditions we acknowledge are unjust and damaging to the health and flourishing (Ehrenfeld 2014) of human and non-humans. The emancipatory characteristics of craft are significant, but using it within the set of constraints and values of modernity negates its transformative force. For Sennett (2008) craft lies beyond a state of mind, as it possesses the capacity to address societal issues.

In his book "The Craftsman" Sennett (2008) states that "When the hand and mind, art and application, technique and science are separated, it is the mind that loses in both expression and understanding". The designer’s contact with materials, tools and processes enables the emergence of knowledge that is impossible to get otherwise, and without which design thinking is incomplete. For the pragmatists, the praxis is the basis of any new knowledge and Research has a central role in the production of meaning and constructing reality based on this new knowledge (Dewey 2003). Practical research is as an element central in the process of craft and it highlights its holistic nature. Thinking and practice, mind and body are inseparable and integrated in the practice of intelligent making. These ways of looking at the world have been cast aside during the emergence of modernity but are finding their way back.

Naturalistic materialism is an ideology strongly associated with the post-traditional understandings and philosophies of modernity and late- or post-modernity. As the principal ideology of modernity, its critics have included Thoreau (1854), Horkheimer and Adorno (1947), Schumacher (1973) Lyotard (1979) and Habermas (1981). It is related to forms of modern secular humanism in which human interests and values are based on reason, scientific investigation and experience, and where human fulfilment must be found within the physical world. Thus, naturalistic materialism is an ideology that is linked to the physical sciences (Hick, 2002) and is seen as the only belief system that is compatible with them (Taylor, 2007). It is also an ideology that seeks to mould the natural environment and human society to suit human purposes and is characteristically interventionist, functionalist, and grounded in instrumental reason (Taylor, 2007). It is also important to recognize that the ideology of naturalistic materialism cannot rule out humanity’s traditional understandings of reality. Just because science reports only on findings concerning the physical universe, it does not follow that the physical universe is the totality of existence. Nevertheless, this illogical conclusion is one that has become prevalent. It is a conclusion that is also unscientific; therefore, critique is not aimed at science but at the scientistic ideology that we have built from its findings (Smith, 1996). John Cottingham (2005) usefully distinguishes between notions of naturalistic materialism that are essentially methodological and those that are ontological. Methodologically, naturalistic materialism represents an attempt to explain the totality of existence via physical phenomena, with no reference to notions of a transcendent reality; as such it represents a set of investigative and exploratory aspirations. Ontologically, however, naturalistic materialism claims that the physical, phenomenal universe is the totality of existence – a claim that clearly lies beyond the realm of science.
Meaning, knowledge and artifacts, giving a voice to tacit knowledge

(Cottingham, 2005). The latter, still-prevalent ideology, not only narrows and shallows humanity’s notions of meaning and reality, it is also indelibly tied to stripping the planet of its resources at unsustainable rates while simultaneously eradicating the complex interdependencies of biodiversity on which all life depends. However, while it remains a widespread ideology, it is also one that, today, we seem to be emerging from (Smith, 1996), and many contemporary theorists regard moral values as falling outside naturalistic explanation (Cottingham, 2005). In moving beyond naturalistic materialism we have the opportunity to bring us in closer accord with the social and environmental challenges of our time.

Since design artifacts inevitably embody and reinforce values, it is important to pay close attention to what kind of values design should seek to strategically promote and legitimise in order to accelerate a transition towards human flourishing and sustainability (Ehrenfeld, 2013). At the same time, we have seen how the designed artifact sits in a middle of a threefold design semiosis where each of its aspects leads to the creation and embodiment of new knowledge associated with each of its facets. Naturalistic materialism has shaped design as we began moving away from modernity; at the time, approaches to design began to include other sources of knowledge compared to traditional scientific knowledge used in industrial design engineering.

5. The design process

In order to reconstitute the types of knowledge and their place in the design process, we propose a taxonomy associated with each of the three facets of the artifact. Firstly, the artifact is made up of a physical structure, to engage in a meaningful dialogue with the material; an amalgam of visual, haptic and embodied knowledge is required (Sennet, 2008). Secondly, the artifact exists within a social context of human action, knowledge about society and human communities are based on empirical models grounded on experiential explicit knowledge. Finally, the artifact possesses a technical function, a conceptualization of the intent of the designer. This was made with the intent to do something practical; this third aspect is rooted in the application of practical scientific knowledge.

All artifacts exist in the intersection of the three types of knowledge and act as mediators for the emergence of new knowledge in each category. However, in most cases this is not explicitly undertaken by the designer; in fact, knowledge can be implicitly embodied in a designed artifact. Most industrial goods explicitly embody scientific knowledge in achieving their goals. Other symbolic artifacts tend to embody empirical knowledge with little or no practical function. In order to create a holistic artifact that challenges the modernist way of making and enable the transition towards sustainability, we need to reconstitute the role of tacit knowledge in the design process. A multidisciplinary research, aiming at a holistic approach to the context, extends beyond the manifestations based on scientific and objective knowledge, through personal experiences (Niedderer & Townsend, 2016). Experiential and tacit knowledge found on craft disciplines, provide understanding for the relationship between material manipulation and embodied mind (Groth, 2016). At the same time, we cannot turn a blind eye to the technological and social transition that modernity brought around. Striking a balance between the three aspects of the artifact and the types of knowledge associated with each of them can provide a platform that challenges past assumptions whilst moving forward not in a luddite or primitivistic way. The proposed model is pictured below; in the next section, we discuss its parts and the interactions between them.
Looking back at the facets of the artifact it is clear that the material aspects of the artifact embody tacit knowledge, the social context embodies empirical knowledge, and finally the practical aspects of technical function embody scientific knowledge.

Figure 4 The proposed model

5.1 Tacit Knowledge

On the basis of the model we discuss the mediation of knowledge through the artifact in regards to its first facet, i.e. physical structure. The material plays a quintessential role in both the user and the designer logic as it provides the trigger to create tacit knowledge. This semiotic cycle starts on the side of the designer/craftsperson who is in an open dialogue with the material. In the context of craft, you do not get to create what you want but what the medium allows to create. You can’t make the same thing you would make out of wood with marble, every material has its own life and as such we should not force them to speak our language but try to engage in a dialogue that will lead to the shared space between the material, the designer and the user (Pallasmaa, 2009). By engaging in this process with the material, the designer can use abduction by engaging in what Pye refers to as “workmanship of risk,” a frame of mind where the craftsperson will try new things without being afraid of failing or destroying the artifact. (Pye, 1968).

The biggest challenge in the proposed model lies on this layer for two reasons. Firstly, tacit knowledge, due to its nature and close relationship with the material, it has to be co-created as it cannot be communicated in explicit ways (Pallasmaa, 2009; Kiem, 2011). Secondly, the worldview and value system of modernity has pushed such ways of knowing out of the decision support process. In the first case two paths can be taken, the first is to have the user engage in an apprenticeship and create the necessary knowledge with the material. In this process the design logic is focused on creating propositional artifacts (Walker, 2012) that aim to engage the user in the creation of said knowledge. The second way to integrate tacit knowledge in the user’s logic is through traces, “the perceptible enduring marks that are brought about through people’s engagement with the material (Ingold, 2012; Robins et al., 2016). These traces act as carriers of tacit
knowledge and can, in some instances, cause the emergence of tacit knowledge in the user logic side of the mediation.

5.2 Empirical Knowledge

Design is the science of the particular (Burchanan, 1992). As such, it uses quasi-subject matter and the body of the science of design is constructed in relation to its subject matter. We have already discussed how post-modernity challenged scientific operationalism and opened the door for the inclusion of empirical knowledge in the design process. HCI and design ethnography (Gunn, Otto & Smith, 2013; Clarke, 2010) have adopted methods that aim to create and use empirical knowledge in the design praxis. This empirical knowledge is in a constant process of mediation between user and designer. These context specific field research approaches enable designers to “move along the lifelines” (Ingold, 2007) and engage in a design practice characterised by reflection in action (Schon, 1987). These designerly approaches allow us to respond through a dialogic engagement with people, objects and environments that would be impossible in the rigid framework of scientific knowledge.

5.3 Scientific knowledge

Epistemology, the science that analyses how science is structured, has in the past century gone through a process of providing an answer to the question of ‘what science is’ and, by extension, ‘what knowledge is scientific’ and ‘what is not’. In the 1920 Karl Popper claimed that a theory can never be proved to be true. All you can ever do is to fail to prove a theory false, for example by never observing the sun rising in the west and setting in the east (Popper, 1959). In the 1960s Thomas Kuhn, a Harvard physicist and historian of science, introduced the idea of scientific revolutions. Science didn’t progress brick by brick with each theory building on the one before. Instead every so often a whole theory was torn down and completely replaced by a new one. The new ‘paradigm’ (meaning the way of looking at the world) may not contain any of the ideas of the old one. For Kuhn, the ultimate test of a scientific theory is whether it was accepted by the relevant community of scientists (Kuhn, 1962). This idea was taken to its logical conclusion by the Austrian philosopher, Paul Feyerabend. For Feyerabend there was no ‘scientific method’ that could guarantee scientific progress. Feyerabend argued that it was unfair to assume that science was superior to, for instance, voodoo without seriously examining voodoo’s aims and methods (Feyerabend, 1970). Hence, Feyerabend and Kuhn placed greater stock in the people who held theories than in the theories themselves.

The Hungarian philosopher Imre Lakatos tried to rescue the notion that scientific theories could be true, even if nobody believed in them. He extended Popper’s ideas about falsification with what he called ‘scientific research programmes’. At a first glance, a research program looks a bit like what Kuhn called a paradigm. A research programme consists of a ‘hard core’ island of certainty from which scientists can set off and do research. The hard core is protected from falsification by the assumption that experimental details cause problems and not the core itself. Lakatos proposed that research programmes could be judged by the number of new facts predicted. Eventually a growing ‘progressive’ research programme would replace a shrinking ‘degenerating’ one (Lakatos, 1980).

This brief discussion of the shifts in epistemology serves as a reminder that even scientific knowledge is in a constant flux. In general, we refer to scientific knowledge to widely accepted and proven knowledge that provides pragmatic results. Physics and mathematics provide the basis for design to solve technical problems. It is the knowledge that answers to the pragmatic technical issues.
6. Future research and conclusions
The pragmatistic route to design provides avenues enabling the creation of artifacts that holistically approach people, materials and practices. In addition, such artifacts embody and promote an alternative system of values compared to that of modernity providing a platform for the transition towards sustainment, the next era of human societies. The biggest change in the design practice necessary is the inclusion of tacit knowledge in conjunction with the other two types of knowledge already playing a major role in the process. The proposed model points towards a methodological direction that applies the pragmatistic ontology to design. There is the need for a shift from scientific naturalism towards a new system of values that foster and promote human flourishing. We are collectively facing a massive change in our environment, and unless we address the root causes of the damage done and come up with new sustainable alternatives, there is not going to be a tomorrow.

Future research is recommended to include a deeper understanding of how designers and craftspeople engage the co-creation of tacit knowledge with their users or clients, the use of the idea of traces to better facilitate this process of co-creation and the application of this view in areas less preoccupied with the design of the physical, such as service design.

7. References
Bonfantini, M., A., (1980) Introduzione – La semiotica cognitive di Peirce in: Peirce C. S. Semiotica. Torino Einaudi
Bonfantini, M., A., and Zingale, S. (1999) Segni sui corpi e sugli oggetti. Bergamo: Moretti & Vitali.
Bofylatos, S., & Spyrou, T. (2016). Supporting design dialogue through a communication framework using four layers of abstraction. The Design Journal, 19(2), 269-282.
Boulding, K. E. (1955). Economics Analysis.
Buber, M. and Kaufmann, W. (1971). I And Thou. 1st Touchstone Ed. Touchstone.
Buchanan, R. 1992. Wicked Problems in Design Thinking. Design Issues, 8(2), 5–21. doi:10.2307/1511637
Clarke, A. J (2010). Design Anthropology: Object Culture in the 21st Century . 1st ed. Springer Vienna Architecture.
Cottingham, J. (2005). The Spiritual Dimension: Religion, Philosophy and Human Value. Cambridge University Press.
Dewey, J. (1646). How We Think by John Dewey.
Ehrenfeld, J. R. (2009). Sustainability by Design: A Subversive Strategy for Transforming Our Consumer Culture. Yale University Press.
Ehrenfeld, J. R. and Hoffman, A. J. (2013). Flourishing: A Frank Conversation about Sustainability. Stanford Business Books.
Feyerabend, P. and Hacking, I. (1970). Against Method. 4th ed. Verso.
Groth, C. (2016). Design-and Craft thinking analysed as Embodied Cognition. FORMakademisk–research journal for design and design education, 9(1).
Gunn, W., Otto, T., and Smith, R. C. (2013). Design Anthropology: Theory and Practice. Bloomsbury Academic.
Habermas, J. and McCarthy, T. (1985). The Theory of Communicative Action, Volume 1: Reason and the Rationalization of Society. Beacon Press.
Heidegger, M. (1624). Question Concerning Technology, and Other Essays, The by Martin Heidegger (1977-07-30).
Meaning, knowledge and artifacts, giving a voice to tacit knowledge

Horkheimer M., Adorno, T. (1994). Dialectic of Enlightenment 1st (first) Edition by Horkheimer, Max, Adorno, Theodor W. published by Continuum (1969). 57989th ed.

Ingold, T. (2007). Lines: A Brief History

Kiem, M. (2011). Theorising a transformative agenda for craft. Sustainability in Craft and Design, 33.

Kroes, P. (2012). Technical Artefacts: Creations of Mind and Matter: A Philosophy of Engineering Design: 6 (Philosophy of Engineering and Technology)

Kuhn, T. S. and Hacking, I. (1962). The Structure of Scientific Revolutions. 4th ed. University Of Chicago Press.

Lakatos, I. (1980). The Methodology of Scientific Research Programmes: Volume 1: Philosophical Papers. (ed. Worrall, J. and Currie, G.) Cambridge University Press.

Latour, B. (2007). Reassembling the Social: An Introduction to Actor-Network-Theory (Clarendon Lectures in Management Studies). 1st ed. Oxford University Press.

Lyotard, J.-F., Bennington, G., Massumi, B. and Jameson, F. (1984). The Postmodern Condition: A Report on Knowledge (Theory and History of Literature, Volume 10). 1st ed. University Of Minnesota Press.

Pallasmaa, J. (2009). The Thinking Hand: Existential and Embodied Wisdom in Architecture. 1st ed. Wiley.

Peirce, C., S., (1931-1958) Peirce, CP of Charles Sanders Peirce. Cambridge: Harvard University.

Polanyi, M. (1997). The Tacit Dimension. In Knowledge in Organisations, pp. 135–146. Elsevier.

Popper, K. (1959). The Logic of Scientific Discovery . 2nd ed. Routledge.

Pye, D. (1968). The Nature and Art of Workmanship Cambridge UP.

Rabardel, P. (1995) Des hommes et des technologies – Approche cognitive des instruments contemporains. Paris:Armand Colin

Robbins, H., Giaccardi, E., & Karana, E. (2016, October). Traces as an Approach to Design for Focal Things and Practices. In Proceedings of the 9th Nordic Conference on Human-Computer Interaction (p. 19). ACM.

Schon, D. A. (1984). The Reflective Practitioner: How Professionals Think In Action. 1st ed. Basic Books.

Schumacher, E. F. (2010). Small Is Beautiful: Economics as if People Mattered. Reprint. Harper Perennial.

Sennett, R. (1611). The Craftsman by Richard Sennett

Simon, H. A. (1996). The Sciences of the Artificial - 3rd Edition. 3rd ed. The MIT Press.

Taylor, C. (1644). A Secular Age by Charles Taylor

Thoreau, H. D. (1854) Walden. CreateSpace Independent Publishing Platform.

Townsend, K., & Niedderer, K. (2016). The role of craft in creative innovation: skin, cloth and metal.

Wilson, E. O. (1998). Consilience: The Unity of Knowledge .

Zeleny, M. (1987). Management support systems: towards integrated knowledge management. Human systems management, 7(1), 59-70.

Zingale, S., Domingues, F., (2015). The Consequences of Things The Semiotics and the Pragmatistic Route to Designing. The Value of Design Research, Proceedings of the 11th International Conference of the European Academy of Design, Paris Descartes University, Institute of Psychology, Boulogne Billancourt, France, 22-24 April 2015. ISBN 978-1-84387-393-8
About the Authors:

Spyros Bofylatos is a PhD candidate in the Department of Products and System Design Engineering of the University of the Aegean with a degree in Design Engineering. His research interests include design for sustainability, social innovation, craft, coDesign, open design, service design, critical thinking and disruptive practices. His work is based on creating meaningful dialogue between the theoretical framework, physical artifacts, products of the design process and the society in which those ideas manifest.

Thomas Spyrou is an Assistant Professor in the Department of Product and Systems Design Engineering. His main interest is to research and to apply systems theories and approaches to real-world scenarios, especially in the case of information systems and services for human activity systems. He has over twenty years of teaching experience in systems design, theories and methodologies of design, as well as various areas of human-computer interaction. He has been director or executive member of technical committees for the design of large-scale network and services infrastructures such as University of the Aegean network, Greek Secondary Educational network, Greek Universities network and Greek Research and Technology Network. He has served as part of the Ministry of the Aegean’s Think Tank. He has directed and participated in a substantial number of projects both funded nationally, and by the European Union. He has published in scientific journals and participated in conferences, in the areas of information systems design, holistic systems design, artificial intelligence, decision support systems, intelligent tutoring systems, simulation and security.