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Systems thinking for service design: A natural partnership

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Systems Thinking for Service Design: a natural partnership to understand, manage and use Complexity

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Abstract

In this paper it is claimed that the design praxis in human centric problems is primarily influenced and directed by the degree of complexity of the design problem. It is becoming apparent that complexity should not be avoided but instead it should be utilized as much as possible. The consequence will be that as the complexity increases the designers should move from the expected Product Design oriented approach to Service Design in order to retain and utilize as much of the problem space as possible, which means that a holistic approach should be adopted. A natural way to achieve this is to tackle it with the use of Systems Thinking.

Two exemplars are used to demonstrate that when Complexity increases, designers are led to applying systemic thinking to the problem and the tenets of systemic thinking may lead the designers into designing services, in spite of them having been contracted to provide products. Also as complexity increases and the whole design space is considered, co-design becomes synonymous to design.

Therefore, as complexity increases, the problem is re-defined and there is movement from product, through to service, with perhaps sometimes the product becoming a by-product of the service design praxis.

Introduction

In the 1930s, nations' economies broke down their figures into three main sectors. These were, in order of economic importance, Agriculture, Manufacturing, and whatever was not either of these was grouped under the title of Services. Today, the growth of what is traditionally called the ''service sector'' can be seen in the gross domestic product (GDP) statistics of nations. As currently measured, developed countries have 70–80% of their GDP in the service sector (government, healthcare, education, retail, financial, business and professional, communications, transportation, utilities), with 15–25% in the manufacturing sector, and about 5% in the agricultural sector (Spohrer et al. 2010, Maglio et al, 2009). That is also reflected in their employment statistics.

Traditionally the academic disciplines that worked on services were those of management and marketing, operations research and engineering, but not only (Bitner, 2006). Other specialists were also active in this area. With the move to self-services and more recently e-services, also required were information systems and computer science researchers. Moreover, it is not an area that can be broken up easily. It is currently understood and promoted as representing problem spaces that are complex and require this multi/interdisciplinary treatment. Indeed, recently, IBM, understanding that its core business is no longer in hardware manufacture, but in services, has championed the understanding of services as 'complex systems' (Maglio et al 2008) in which specific arrangements of people and technologies take actions that provide value for others.

Designers for the last two decades have been realizing a shift in working practices and output from product to systems design: that is, understanding the wider complex system in which the designed product is to function. This incorporates the users, producers, (including the designers themselves) the activities and functions expected, as well as the context of use, and constraints and freedom offered by technologies used in the product. Such work has recently gone on under other labels, such as interaction design and/or user experience design (UX). Lately, systems have begun to incorporate services, and service design has taken hold, as evidenced by a number of researcher[1] and practitioner[2] networks and courses in Universities, as well as other research activities (Glushko, 2013; Gotzen et al, 2014)

Given this, what do these services look like; what are their common features and how do designers design them? A striking characteristic of the movement from product to services, is the emphasis on service outcomes or what the customer wants from a product or a service: "A customer does not want a drilling machine, he wants a hole in the wall ". An example is that of Rolls Royce's "Power-by-the-hour" where the continuous maintenance and servicing of the engines is paid by how many hours the customer obtains power from the engine, rather than by paying for spares and repairs (Ng et al, 2009).

Background

Against this understanding of an emergent design area, that of 'Service Design', and the realisation that such problem spaces are characterised by high complexity, this paper offers a view of Systems Thinking which can support Service Design towards its grounding for research, education and praxis. This is timely since Service Design is occupying more and more space in the human centric problems of the Design world. Further it is also posited that the inherent complexity of these service design related problems is, in general, increasingly acknowledged by researchers and practitioners. That complexity is becoming a driving notion in design and it owes this position to the increasing realisation that it is not easily decomposed, but must be utilized and indeed welcomed, as it reflects more completely real-world situations.

That complexity, reflected in service design situations, has introduced new designer roles such as that of the facilitator, as well as methods, approaches and techniques. These are actually doing collaborative design (co-design). In this is the recognition that the nature of service design is not to

[1] Service Design Research http://www.servicedesignresearch.com/
[2] Service Design Network gmbh http://www.service-design-network.org/

produce a product, but to 'co-create value' for customers, service providers and other involved stakeholders. Systemic oriented designers are using as much as possible of the holon that can be identified and understood. Seen as a problem space, the service to be created carries high complexity and. acknowledging that complexity means moving from a product dominant - of the design praxis could be, apart from the service(s), also product(s).

The main understanding here is that the acknowledged complexity of Service Design problematique uncovers the need for methods, methodologies and approaches, which are able to deal with that complexity without destroying the richness it offers. That is, to keep and use it while managing to avoid the destructive decomposition of the problem space, and consequently of the application of reductionist approaches. This thesis has been, in various ways, presented in previous work (Darzentas et al, 2014), and supports the premise that this inherent complexity can be dealt with and utilized with the aid of systemic based approaches (Nelson et al, 2012). Design is being called upon to deal with problems of increasing complexity and interdependence, e.g. services, sustainability, social innovation. These are problems that involve individuals and society and the world, and they refer, for instance, to the interaction of:

- humans with natural systems, such as the environment
- human involvement with technological developments such as nuclear power
- humans between them where there are elements of value and culture, such as ageing, healthcare; (Jones, 2013), nutrition, etc.

It is particularly this last category of human centric problem spaces and therefore more complex spaces where the design of services is proving to offer opportunities for co-designing and as a matter of course incorporating and utilising complexity. Of course not all designers involved in service design are aware of systemic approaches. The following questions could be posed to bring up the issue of the need to talk about complexity in design and the need to look for tools such as Systems Thinking to deal with it:

- Is service design a new name for the evolving kind of design praxis?
- Is the 'product' in Service Design, in fact 'a byproduct' of the design process?
- Does it need to welcome and to incorporate complexity?
- Does it need to consider more of the problem space than before?

If Systems Theory is posited as contributing towards a theoretical framework for emergent directions in Design Culture, as well as a methodology for Design Practice, then it must acknowledge the power and allot the appropriate role to complexity in design. Finally we subscribe to the view that the more complex a system appears to be, then the 'healthier' (Darzentas et al, 2014) it is, because if understood, it offers more ways to deal with problems than a less complex one.

Uncovering the activity of supporting complexity. Two exemplars.

To demonstrate the role of complexity in supporting service design, we consider two exemplars. In the first, the case of a requirement to design for future transport services impacts the openness of the design of an information system based on service design for shipping. In the second, the brief to design fire-fighting equipment and vehicles for an island town is challenged, to see whether the requirements are for design of such equipment or for fire prevention services and innovative fire management techniques.

Technology is offering the possibility for new modes of transport such as intelligent cars and smart roads/tracks, where vehicles can track other vehicles traveling to the same destination, so that one driver drives the "train", On the other hand, users are valuing mobility sharing systems, such as car share, or rent a bike, or other modes of travel, than those we know of today. Systems oriented design thinking applied to transportation systems for future mobility means that the transportation means (e.g. a vehicle), will be designed as something which will emerge from the Design of the transportation system, which of course will include other subsystems/parts of the overall problem space of transportation. That in turn means that the complexity of the transportation system, which will transport its users from A to B, will be much more than designing a vehicle. In other words designers will have to consider a much wider problem space (transport system). At the same time, vehicles for fire-fighting may benefit from a more holistic approach to their design

Exemplar 1: Marine Traffic

We take as example of Service Design, information services for transport services, such as "Marine Traffic"[3]. This has proved to be a very successful crowd sourcing application which is tracking shipping through their Automatic Identification Systems (AIS), which is compulsory for every vessel including even recreational ones above a certain size. Technically, the system is based on specially designed aerials which are positioned all over the world by users following simple instructions and at a very low cost. An information system developed using Google Maps shows the position of the Ships at any time and also shows as much additional information about the vessel as their owners have included. Due to its large coverage, its potential for designing and developing various services / applications is considerable. However it is also apparent that because of that rich potential and the fact that most services which come to mind are human centric, they are highly complex.

[3] Marine Traffic: https://www.marinetraffic.com/en/

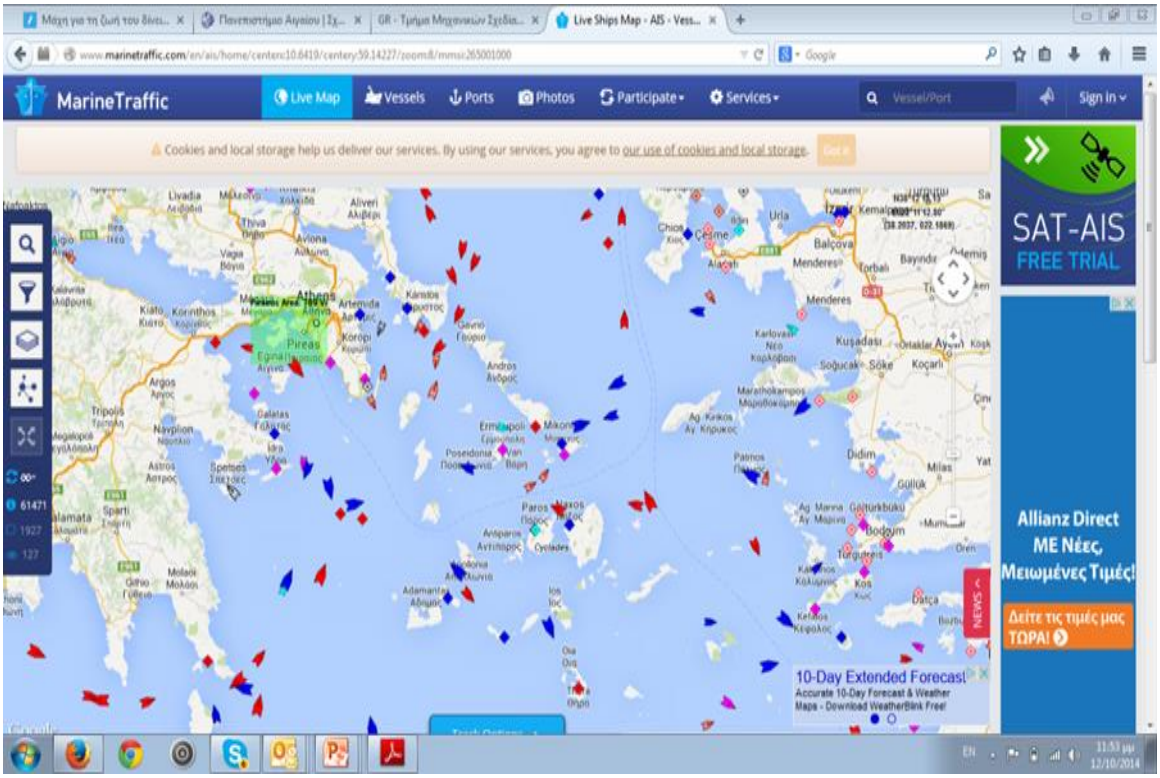

Fig. 1: Showing the positions, in real time, of various types of vessels, and additional information about the boats, as well as ETA, speed direction etc.

Its primary use as foreseen by its designers was for providing information in real time on passenger ferry movements and other vessels, as well as information about the movements of amateur sailors. Since then, there have been a number of emergent uses by different sets of users, looking for information gained from the same data, for example:

- by the public: such as tracking their loved ones who are travelling
- by travel agencies: to give information to their customers;
- by government agencies for:
    - surveillance (smuggling, illegal dumping of waste, illegal bunkering, and suspicious movements);
    - for safety operations (collision avoidance and search and rescue);
- by insurance companies investigating claims: use Marine Traffic for logged ship movements.

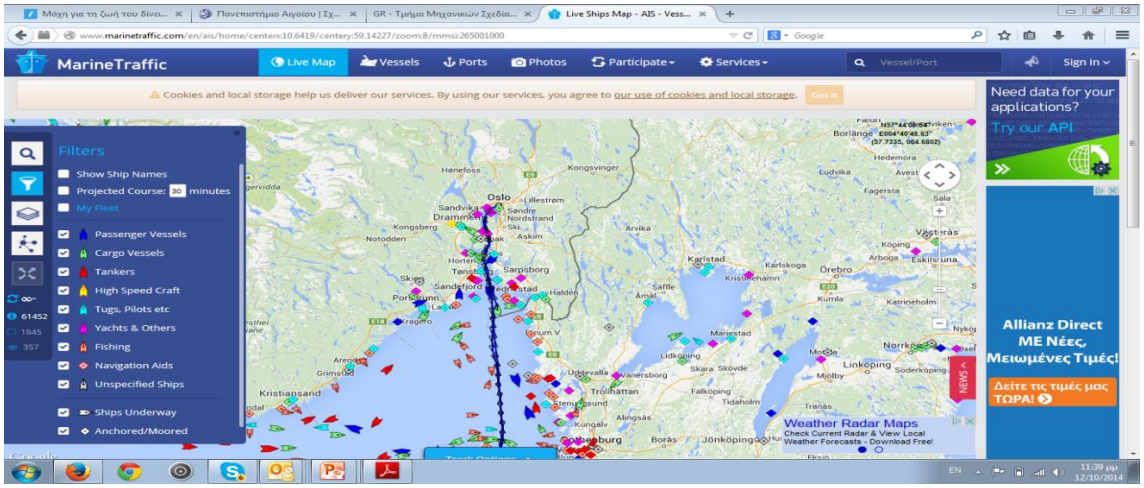

Fig. 2: The trace of vessels' movements can be recorded

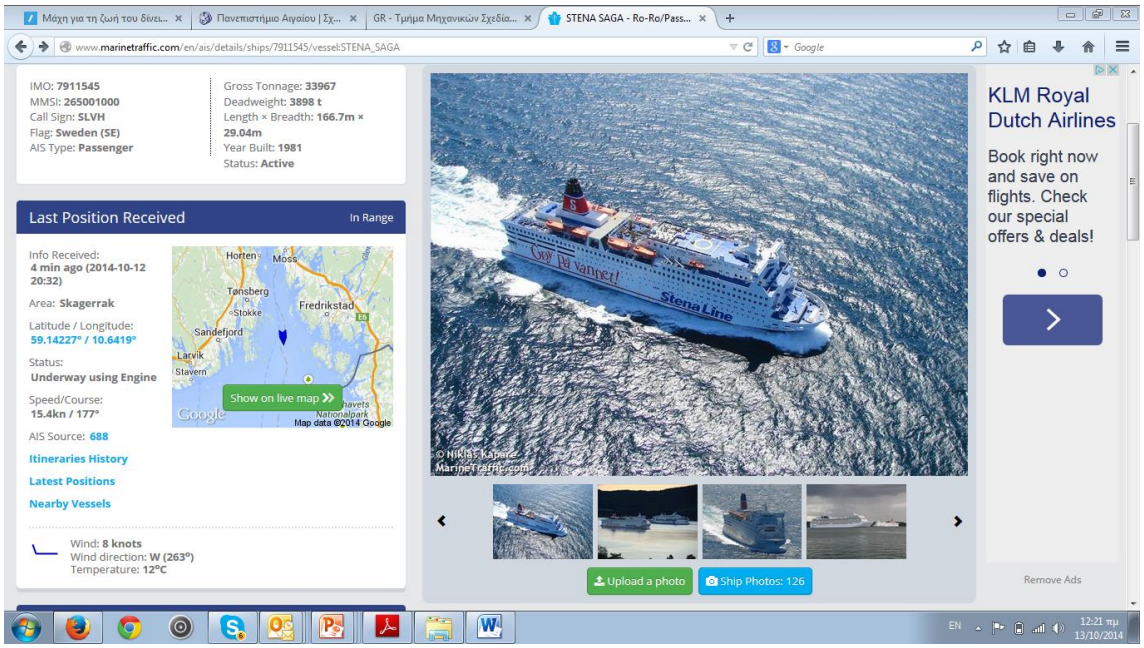

Fig3: A small indication of the type of information which can be provided by Marine Traffic

Nearly every day, some new use or new layer of service is required from the system, to meet the needs of various groups of users. Some of these have evolved out of opportunistic use of available data, however others have been further developed to meet what emerged as needs of users (including mobile platforms to view the data, requests to the data, etc.). The above transportation examples have demonstrated the complexity and the richness of the problem space in this case, some of which are unexpected and emerge requiring extended re-designing. That emergence which is due mainly to the complexity leads to the introduction and use of a systemic perspective.

Experience has shown that Information Systems designed and developed as a product may, and usually do, require reductionism. However in real life, complexity will lead from product design to service design to cover emergent results and utilization. In this case systems oriented Design Thinking has brought to the process what was not available in the existing methods and methodologies of designing and developing the relevant products, namely the relevant Services to which these products belong and support. In addition, one can afford to consider and propose some possible complex transportation scenaria as services and not as mere innovative transportation-related products. That way Systems oriented Design Thinking may offer a more robust approach to the problem of future mobility services.

The emergence of the various scenaria and user demands lead to the realisation that most of them overlap and share common problem spaces, which means that they make up a common problem space, i.e. a whole, a System to which they all belong. Hence these scenaria are identified as Services which require to be designed. Their inherent complexity is mainly due to the fact that designers are forced to consider a substantial problem space which leads to a corresponding whole. The System (holon) which captures and describes the problems of the users is correspondingly complex. Designers seek co-designing approaches, but it is naturally claimed here that systemic thinking should be used to Design the corresponding Services. It will acknowledge the complexity of the system in question, and the emerging properties which will otherwise be lost if the Services are considered separately and are added as they are discovered.

Exemplar 2: Firefighting in special urban environments

The other exemplar design problem presented here which demonstrates the importance of Systems Thinking in Product and Service Design is that of designing fire engines for a small historic town with difficult accessibility. The brief was to design fire engines for the town of Hermoupolis, Syros. The roads are narrow and steep, and some change into steps, something not uncommon in such terrains. Conventional fire engine designs are not suitable. As can be seen from Fig 4, the houses are built close together, and clustered on the hillside overlooking the port.

Fig 4: A view of the town for which the fire engines were to be designed

The product requested by the problem owners was the design of vehicles capable of extinguishing fires in a difficult terrain.

Fig.5: A proposed vehicle, small and flexible for the narrow streets

A more accurate description of the real problem space could be “ways to deal with a possible fire breakout in a very special urban environment”. The problem description above and beyond the brief,

is actually there as a 'cloud' which contains and displays the high complexity of the actual problem which would lead the Designers to adopt an approach towards Service Design. In other words looking into the service of avoiding the fire or offering more efficient ways to deal with it.

The questions to be asked could start with "Can we really intervene in the design space "before the brief"? It basically asks questions such as:

- what is the actual design space?
- what is the range of stakeholders?
- at what stage should a vehicle be activated given the necessary infrastructure which must be provided by permanent firefighting equipment to support the vehicle in the narrow streets and the steps?
- what is the role of fire prevention measures, stopping fires happening in the first place?

A main observation here is that of the increasing complexity as the considered problem space increases towards a whole which contains the parts and their relationships relevant to that problem. That is the System which could be described as "dealing with a fire situation in the town".

Discussion and conclusions

It is posited here that complex design problems will inevitably lead to acknowledging the need for understanding, analysing, describing and dealing with the big picture. In this case that picture of the actual problem space will require the design of one or more services which will contain products which will have to be designed for those services. In some cases one might be able to claim the these products are 'by-products' of the service design

The higher the complexity of the design problem space, the greater the need to face and answer basic 'wh'-questions like 'why' 'whom' and other general questions to try to understand the services associated to the design brief given by the problem owners and other stakeholders.

The complexity of the design problem must be retained as much as possible and utilised to produce robust solutions. As a result tools for thinking are necessary for capturing and encapsulating that complex knowledge offered. Holistic thinking, that is working with as much of the 'holon' of the problem space as possible, leads naturally to the use of Systems Thinking in Design as a tool for retaining and using complexity. And of course one must remember that if reductionism is applied to complex systems then they die, which in turn means that in human-centred problems the produced solutions are very often not the appropriate ones, or do not cover enough of the problem space.

In the examples presented and discussed here, the design of the fire engine is dealing with the design of a product, with constraints and requirements. The designing the service(s) of dealing with and/or preventing fires are very different from what the problem owners thought originally would be solutions, but perhaps they are more appropriate.

In the case of Marine Traffic the 'product'- referring to the Information System- is again very different to designing a range of services towards which the Information System should be tuned.

The acknowledgement of complexity demonstrated via the examples given in this paper requires the type of treatment offered by Systems Thinking. This general thesis has been presented and discussed

by the authors in (Darzentas & Darzentas, 2014) where the rationale and justification for why and how Systems Thinking should be introduced and used in complex design problems was given.

Here we claim that the design praxis in human centric problems is dependent and is formed as a function of the degree of complexity of the design problem. The consequence will be that as the complexity increases the designers should move from the expected Product Design oriented approach to Service Design in order to retain and utilize as much of the problem space as possible. To achieve that, one natural way to tackle it is the adoption of Systems Thinking.

When Complexity increases, what is needed in design is not only products, but services. Complexity leads to applying systemic thinking to the problem and the tenets of systemic thinking lead the designers into value co-creation and services. Also it seems that as complexity increases co-design becomes a synonym to design.

Summarising as complexity increases, the problem is re-defined and therefore there is movement from product, through to service, with quite possibly the product designed being a by-product of the service design praxis.

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The screenshots are taken from www.marinetraffic.org which was developed by researchers from the Department of Product and Systems Design Engineering, University of the Aegean, Syros Greece

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