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From Product to Service Design: A Thinking Paradigm Shift

Abstract
Society, industry and the economy are all experiencing changes caused by a shift from products to services. While a "problem-solving" approach is commonly used for the development of products, new design approaches are needed as the primary unit of exchange moves from goods to services. This research argues that a fundamental transformation in the design world is taking place, manifested in a thinking paradigm shift from problem solving (designing products) towards systems thinking (designing services). This paper draws on design literature to identify concepts of systems thinking and problem solving to help understand core elements in the shift from product to service design. It also reports on a series of semi-structured interviews with designers working in five design consultancies that have moved from product design to services design. The results show a change in the way designers think and approach projects when facing the challenges of designing services, confirming a movement from problem solving to systems thinking. However, systems thinking is not replacing problem solving but complementing it. The results also indicate that the growing complexity of the issues designers deal with influences the adoption of systems thinking in responding to service design challenges, as well as current changes in people's ideas about sustainability and society.

Keywords: Service design, product design, systems thinking, paradigm shift, innovation, problem solving

Introduction
Society, industry and the economy are all experiencing a shift from products to services. As a result of this there is an on-going 'conceptual shift' in business and industry characterised by a movement from traditional goods-centred dominant logic (G-DL) to emerging service-centred dominant logic (S-DL) (Vargo & Lusch, 2008).

While a "problem-solving" approach is commonly used in the design of products(Cross, 1990; Taura & Nagai, 2011; Rogers et al., 2005; Dorst & Dijkhuis, 1995) the primary unit of exchange is moving from goods to services (Vargo & Lusch, 2008) evidencing that new design approaches for the development of services are needed. This need becomes even more critical as on the one hand, the very nature of products that might be related to services has changed from being purely physical and tangible to become a mixture of both physical and virtual (or intangible) attributes (Rodriguez, 2010); while on the other hand, goods are being absorbed or replaced by services, which are now considered to be specialised competences such as knowledge and skills that people can acquire and exchange (Vargo & Lusch, 2008).

These changes have direct implications for the work of designers and the way they approach problems and issues. Designers are moving from product-centred design activity to product-service or service-centred design activity. As Young (2008, p. 43) explains, "The shift in focus from product- and artefact-centred design theory to system- and service-oriented thinking has followed the advent and growth of services in our economy and society accompanied by corresponding changes in technology".

This research seeks to understand if a fundamental transformation in the design world is taking place, manifested in a thinking paradigm shift from problem solving (designing products) to systems thinking (designing services). Bearing in mind the increasingly complex issues designers face while designing services, systems thinking would appear the most appropriate approach As Hugentobler et al. (2004, p. 2) argue, while discussing the implications of systems thinking as an answer to complexity as a problem, "If we really want to support the shift from designers as executants to designers as executives, who originate ideas and plan

processes to put these ideas into practice, then systems thinking has to be considered an essential part of this programme."

Literature review

A literature review has been conducted in order to identify the two main concepts of this research, problem solving and systems thinking, and how they relate to product and service design. This has been embedded in a narrative that describes the transition from product design to service design in current design practice, articulating the adoption of systems thinking by service designers in response to the increasing complexity of services. This literature review covers the areas of design (product design and design thinking in particular), service design (mostly from the design point of view and occasionally from the management perspective), systems thinking and complexity. The narrative has been developed around 5 main headings:

-Moving away from problem solving in product design
-The shift from product to service design
-Services as complex systems
-Designers dealing with services are designers dealing with systems
-Systems thinking in the design of services

Moving away from problem solving in product design

Problem solving is regarded as a main driver for design activity (Lawson & Dorst, 2009). Designers tend to develop products in response to phenomena framed as "problems". This way of dealing with a world they are supposed to modify and improve gives designers the means to focus their activities towards an end. Also, it provides a pattern to measure the success of their design proposals against, since "problems solved" can often be seen as an indicator of "good design solutions".

In addition, the problem-solving approach can also define the design process in full. Johansson-Skoldberg et al. (2013, p. 125) suggest that the design process is a problem-solving activity framed by analytical and synthetic thinking, and present Buchanan's idea that design activity is related to a "step-by-step model of the design process with its two distinct phases: an analytical step of problem definition, followed by a synthetic sequence of problem solution". As the problem-solving approach helps designers to focus, to measure the success of their creations and to undertake design activity following a suitable design process, it seems to be sufficient as an overarching principle for product design activity.

However, the problem-solving approach seems to be associated with a model of design that may be becoming obsolete. On the one hand, as suggested by Jonas (1996), this approach seems to be based on the assumption that problems can be well-defined and solved through a good knowledge of people's needs and desires, and that it assumes the designer's ability to know what is "good for people". This renders design as an activity almost exclusively driven by the designers' own understanding of the issues they are dealing with. However, user involvement through participatory design methods is increasingly becoming standard practice in design. As a consequence of this, the problem-solving approach model coming from the "design methods movement" underpinned by cybernetic thinking from the 60's and 70's (Jonas, 1996), seems to be at odds with the idea of a design process in which users take an active part in the formulation and resolution of issues through design.

Conversely, as social change and technological developments mean that society is becoming more interconnected, and new ways of interaction and organisation lead to new experiences and ways of being, so the nature of the issues that designers deal with are changing, as is the way in which designers deal with them. Jonas explains how a problem-solving approach is becoming less central in design, as designers have to deal with issues that are complex, fuzzy, non-predictable and pluralistic in values. He describes them as "ill-defined"

problems, arguing the need for design tools and methods for "the description and analysis of complex problem fields" (Jonas, 1996, p. 4).

The shift from product to service design

While dealing with increasingly complex issues, product designers have expanded the scope of their activities beyond the design of objects within their "traditional" boundaries of form, function, material and production (Miettinen, 2011, p. 56), moving into the realm of interactions, systems and environments. Consequently, the conception of product amongst product designers has departed from its material existence, becoming activities, services, and policies (Buchanan, 2001).

This expansion in the activity and scope of product designers, framed by the economic and industrial shift from G-DL to S-DL, has enabled them to move into the design of services. Additionally, specific product design perspectives such as "a user-centred design approach, a variety of qualitative and quantitative research and data gathering approaches, and visualisation techniques such as sketching, imagining and prototyping" (Miettinen, 2011, p. 60) has allowed product designers to champion the development of service design as a new design discipline heavily underpinned by research and user involvement. For example, this can be noticed in the UK in the creation of pioneering services design consultancies by product designers such as Live Work (2001), or Engine (2000), or by innovative curricular shifts in product design courses towards the design of services such as took place at the Glasgow School of Art in 2005. In this context, service design can be thought as an enquiry rather than a problem-solving activity, situated in the realm of non-engineering design and based on the conception of services as the basic unit of economic exchange instead of something distinct from goods (Kimbell, 2011). Diagram 1 shows Kimbell's graphic synthesis of this concept.
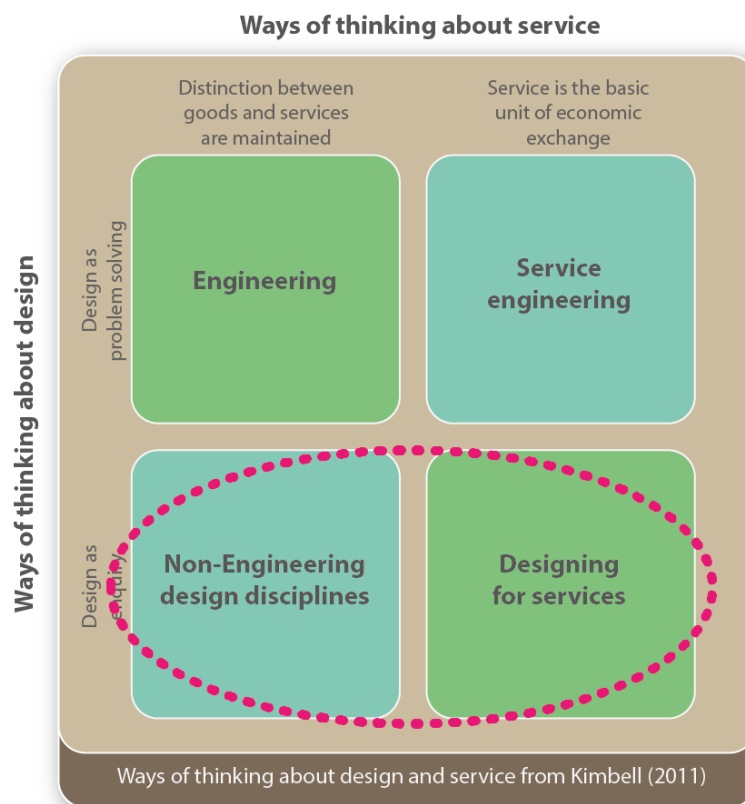

Diagram 1 (Redrawn from (Kimbell, 2011)

Services as complex systems

Services often involve complex interactions between users, service providers and other stakeholders. Furthermore, they mediate the exchange of information and goods between people. Services are regarded as "complex and multifaceted phenomena" that comprise interrelated aspects as diverse as: "Environment, domain, activities, tools and artefacts, goals, agents, collaborations and group value(s) and Effectiveness" (Wild, 2009, p. 25).

Making such reference to the complexity of services, Polaine et al. (2013, p. 81) justify the use of the 'ecologies metaphor' used to describe how services often "harbour a complexity that can be compared to systems in nature". As systems, services can 'interact' with other services creating networks of services, becoming service systems. Also, as the provision of services from companies and organisations are often interlaced with the provision of products, they become product service systems (PSS) (Morelli, 2006).

Designers dealing with services are designers dealing with systems

It seems that while designing services, designers need to deal with the "complexity and multiple stakeholders that are inherent in services Polaine et al., (2013, p. 187) and with 'systems' that "present a different type of complexity than industrial products" p. 85. Additionally, Clatworthy (2011, p. 80) identifies services as systems in which "customers and services interact through many different touch points during the customer journey". Also, alluding to the services dynamic nature, Clatworthy (2011, p. 85) argues that "services require us to design systems that adapt well to constantly changing parts". Following Polaine and Clathworthy's connection between the design services and the development of systems, and their consideration of services as complex dynamic systems, it seems natural that there is a need for designers to use a systemic approach when facing the challenges of designing a service.

From a different perspective, Love (2003) problematises the "uncritical conflation of the activities of designing and systems analysis" as it can create confusion in the theoretical development of both fields, as well as leading to the hampering of design and system analysis processes and outcomes. In contrast to the systems thinking approach, Love suggests that the problem-solving approach provides "information that designers and design stakeholders can draw on to make better judgments about the compositional issues that are central to the core activity of designing" (Love, 2003, p. 4). Yet Love recognises that designers use "system methods and perspectives" as sophisticated tools for gathering information. However, using "system methods and perspectives" simply for gathering information seems to be insufficient to help understand the complex and fuzzy issues designers might be trying to address, and to unravel possible undetected areas with potential and relevance for design intervention. The scope of systems thinking can be wider, and encompass critical analytical, synthetic and creative aspects of the design of services. As Nielsen & Nielsen (2009, p. 5) explain, "having detailed knowledge about the service as a system opens up for experimentation with new innovations around how the service can be designed."

Systems thinking in the design of services

As services can be thought of as systems, and designing systems of services might offer scope for a service designer, the adoption of systems thinking seems to become essential for the practice of service design. Thus several authors recognise the importance of systems thinking in services design. For example, while Gloppen (2009, p. 89) describes systems thinking as a research area to "further develop the service design leadership role", Kwon & van Boeijen (2012) see systems thinking as one of the three service design focuses along with experience and time-based medium.

As the service design discipline emerges, networks of services grow and evolve, generating newer and wider networks of interdependent systems. Within these systems and their complexity lie the challenges for service designers. In this respect Polaine et al. (2013, p. 85)

explain, "These systems present a different type of complexity than industrial products. Products require designers to deal with many moving parts, but services require us to design systems that adapt well to constantly changing parts. Networks, organizations, and technology evolve on a daily basis, but the service still needs to deliver a robust customer experience".

Consequently, it is not surprising that systems thinking has been adopted by service designers, as the Design Council's RED paper 2 reports that "A number of design groups have broadened the scope of design to include disciplines such as interaction, experience and service design. All of these demand a holistic approach, a level of systems thinking, a focus on individual behaviour, and the orchestration of a range of different design inputs." (Burns et al, 2006, p. 10)

Nelson & Stolterman suggest a view of systems thinking with characteristics that seem to cohere with fundamental aspects of service design, and which opens up the possibility of being used beyond Love's concept of "gathering information". In their book "The Design Way", they outline a list of elements that characterise the systems approach, which coincides with the holistic, dynamic and complex nature of designing services (Nelson & Stolterman, 2012, p. 60):

Systems approach
- Interrelationships/compositions
- Interconnections/emergence
- Inclusive, unifying, and integrating
- Holistic inquiry
- Observer dependent
- Multidimensional
- Mutual:
  - Analytic and synthetic
  - Left and right brain
  - Rational and aesthetic
  - Objective and subjective
  - Individual and unified
  - Complex and simple
  - Similar and different
  - Thinking and acting
  - Big picture and details

Nelson & Stolterman argue the existence of two distinctive scholarly discourses around the idea of systems. They identify systems from an epistemological stance when they are an "embodied way of thinking" or from an ontological stance when a system is "the thing that is thought about". The ontological stance refers to the "understanding of systems as "real things" and is located within the confines of system science and the scientific method. The epistemological refers to a "systemic inquiry approach", which focuses on a way of thinking that enables different fields of focused enquiry to be related to each other". These authors emphasise the idea that systems thinking is "a stance that can be assumed by a change in mindset", one which relies less on the "mastery of a set of theories, methods, and facts". (Nelson & Stolterman, 2012, p. 64)

This study takes the view of systems thinking as a way of thinking about and understanding phenomena, embracing Nelson & Stolterman's elements of a system approach. Their systems thinking approach can help to understand relational aspects of otherwise fuzzy and complex issues, and become an instrument of analysis and synthesis. Rather than a collection of science-based methods, systems thinking should be read in this study as a world view that sees things as being holistic and interconnected (Maani & Maharaj, 2001).

Approach and methodology

As the literature review provides a theoretical framework for this study, it also contextualises a series of one hour semi-structured interviews with designers from five different design consultancies (Table 1) who have moved from product design to services design.

Co-founder	UK	livelwork
Director, Co-design	Australia	BOLD IDEAS. BETTER LIVES. THE AUSTRALIAN CENTRE FOR SOCIAL INNOVATION
Director, User Experience	UK	cisco
Co-founder and Director of Design	UK	SNOOK™ transforming people
Founder/Director	Netherlands	EXCEPT INTEGRATED SUSTAINABILITY

Table 1

These designers have been chosen as they are regarded as protagonists in the shift from product to service design, mainly in the UK. Table 1 shows primary information about the interviewees. Diagram 2 presents a timeline illustrating some of the interviewees' relevant landmarks within the context of product and services design during the last 20 years.
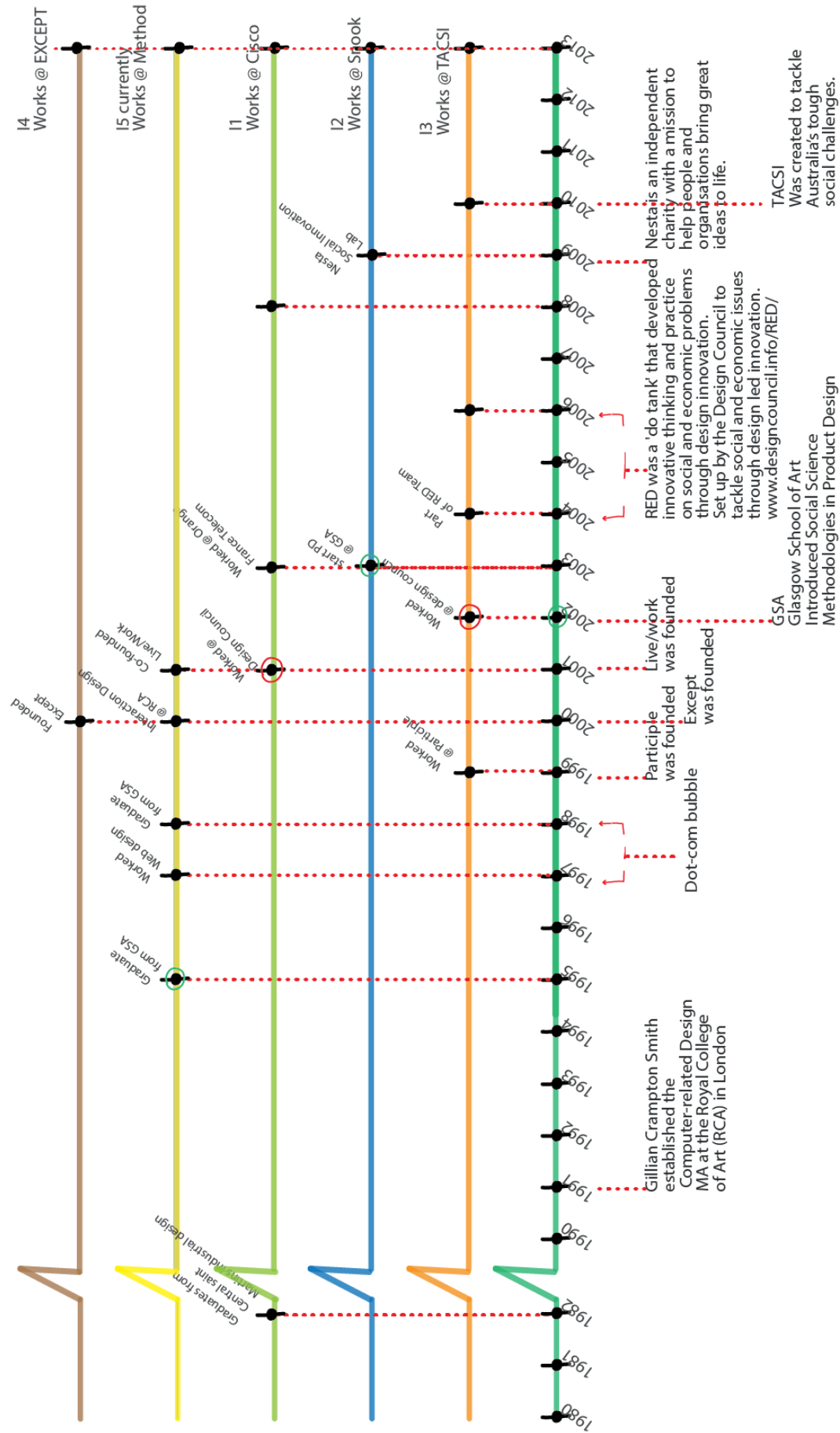
Diagram 2

The interviews aimed to elicit interviewees' perceptions of:

Concepts: In order to gain understanding of the interviewees' perceptions about the relevant concepts by which they might articulate their views (on products, services, service design)

The shift: With the purpose of understanding interviewees' view of the shift from product design to service design (drivers, development, influences)

Design thinking/approach: To elicit interviewees' perceptions about the potential changes in their design thinking and approach, particularly in relation to problem solving and systems thinking (in the context of the shift from designing products to designing services).

To achieve this, the interview questions were divided into five main themes, normally with two questions each. Interviewees were asked to answer each question, and on occasions to draw or write some of their ideas (to facilitate eliciting their thoughts). The themes and questions were as follows:

Theme 1 - Product vs. services
What is the difference between a product and a service?
How different is it to design a product than a service?

Theme 2 - Design of Services
When did you start to design services and why? (What was the first service design project you did?)
What design skills have you developed for designing services?

Theme 3 - Shift from products to services
There has been a shift from product to services design. What has influenced this shift?
How has professional practice changed with the design of services? (Has the nature of your work changed?)

Theme 4 - Problem solving and systems thinking
Would you be able to write 5 words to explain your design thinking when designing products and when designing services? You have one minute for each.
Problem-solving thinking is a fundamental skill for the design of products. Do you agree? Elaborate.

Systems thinking is a fundamental skill for the design of services. Do you agree? Elaborate.
How does problem solving weigh in comparison to systems thinking when designing products and when designing services?
The interviews were conducted personally or via Skype. They were audio-recorded and summarised. The audio recordings were played and listened to by the researchers several times and notes of key concepts were taken on Post-its. These Post-its were subsequently organized on a grid, becoming a method of coding. Further discussions took place between the researchers in order to identify and differentiate the range of views in response to the interview questions. Diagrams and tables helped to synthesise emerging ideas and findings.
The findings of this study have been synthesised following the themed structure of the interview. Each theme corresponds to individual sub-sections. The views of the interviewees have been reported, emphasising perceived commonalities and differences between the interviewees' responses. At the end of each subsection a table or a diagram has been included, synthesising emergent ideas.

The discussion section examined the findings and made comparisons with the literature review. By extrapolating theory from the literature and first-hand information from the interviews, an attempt has been made to offer a synthetic view of the extent to which a shift in design thinking has taken place in the transition from product to design services, moving from a problem solving to a systems thinking approach.

The validity of this research is limited, as its finding are based on the subjective perceptions of the researcher about the phenomena studied, as well as the views collected from the people interviewed. Equally, it has limitations in terms of reliability (generalisation) as the number of people interviewed does not constitute a representative sample of people involved in the issues of this study.

The claims of this study are moderatum generalisations (Payne & Williams, 2005) and do not attempt to offer a comprehensive and definitive explanation of the phenomena studied. However, a start has been made to underpin further and more conclusive research on the subject of the shift from problem solving to systems thinking in services design.

Findings

The interviews were structured according to the main themes of the research, in order to gain understanding of (i) the interviewees' perceptions of the differences between products and services; (ii) what the design of services entails; (iii) how the shift from product to service design developed; and (iv) their views about changes in their thinking with regard to problem solving and systems thinking.

Theme 1 - Product and services
What is the difference between a product and a service?
Views on the differences between product and services amongst services designers are noticeable and not homogeneous.

One of the interviewees believes that products and services relate functionally to each other, as products can deliver services and services are "ecosystems" that can contain products.

Two other interviewees see the difference in terms of interaction. They explain that while a product involves a single interaction, a service consists of multiple and different interactions over time.

One interviewee declares that the nature of products is static (as they remain unchanged once they have been designed) and the nature of a service is dynamic: they have an "on-going" and flexible character. He highlights the wider scope of services, which includes for example the role of people.

Another interviewee makes reference to the physical character of products as opposed to the intangible character of services. This interviewee highlights the commonality of product and services as they are both means by which design solves problems.

A further interviewee emphasises the academic character of any differentiation between products and services, arguing that this is not relevant for users.

Six criteria emerged from the interviewees' answers to establish differences between products and services:

-Complexity and number of interactions
-Static/dynamic character
-Scope
-Tangibility
-Relationship with problems
-Relevance of differentiation

According to these criteria, perceived differences between products and services are outlined in Table 2.

Criteria	PRODUCTS	SERVICES
Interdependence	Can deliver services	Ecosystems that contain products
Complexity and number of interactions	Simpler and single interaction	More complex and multiple interaction
Movement character	Static	Dynamic
Width of scope	Narrower	Wider
Tangibility/ physical character	Tangible	Intangible
Relationship with problems	Means by which problems are resolved	
Relevance of differentiation	Irrelevant to customers but relevant to design academics/thinkers	
Perceived differences between products and services		

Table 2

How different is it to design a product than a service?
Services designers seem to agree that the process for the design of services and for the design of products is similar at a high level. However they find some differences at lower levels.

For example one of the interviewees declares that while the process is the same, different "crafts" and "techniques" are employed for the design of services and products. This difference relates to the "manufactured" character of products and to the relationship of services with "organisational change" and "back-end systems".

Another interviewee emphasises the scale of products and services as a factor affecting their design process. She suggests that the design process for services is more complex as services are "bigger" and more complex than objects.

One of the interviewees suggests that there is a substantial difference between the development of prototypes when designing products and services. In the first instance, the prototypes are a representation of the final product made through models, renderings and mock-ups amongst others. In the second instance, prototypes are the realisation of the entire service, only at a smaller scale in terms of duration and coverage (number of stake holders). Actually, it is a fully functional scaled down version of the service (a pilot), rather than a representation of it.

Another interviewee seems to imply that there is only one design process, This process helps to understand the context in such a way that a decision can be made about whether a product or a service is the best medium to deliver a design solution.

Another interviewee argues that the design process is affected by the nature of services and products in regard to their complexity and constrains. He explains how products have limited features and functions, and therefore the process to design those deals only with a defined set of constrains. In contrast, services are complex in nature and ask the design process for a broader set of deliverables. He says "the more you work on it, the more you uncover".

Yet there seems to be one single difference at a higher level in the process of designing products and services, in the form of an additional step towards the end of the process. For products, the design process finishes with the final specification for production. For services it goes beyond the specification of the service to include the implementation of it and, in some cases, the initial running of it.

To summarise, the differences between designing a product and a service relate to five main areas: first, in relation to the craft and techniques employed; secondly in terms of their perceived complexity; thirdly, regarding the type of prototypes employed; fourthly, concerning the project constraints and breadth of expected deliverables; and finally, in connection with their process length, number of steps and end point. Table 3 illustrates the perceived differences between designing a product and designing a service.

Activity / Area	Designing a product	Designing a service
CRAFT & TECHNIQUE	Related to "manufactured" character of products	Related to organisational change and "back-end systems"
COMPLEXITY	Simple process	Complex process
PROTOTYPING	Models, renders, mock-ups, etc.	Scaled down services (Pilot)
CONSTRAINTS/ DELIVERABLES	Defined set of constraints and demands	Less constraints and broader set of deliverables
PROCESS STEPS/LENGHT/ END POINT	Fewer/shorter final design specifications	More/longer implementation running-beta
Perceived differences between designing a product and designing a service.		

Table 3

Theme 2 - Design of Services
When did you start to design services and why? (What was the first service design project you did?)
It seems that the transition from product design to services design occurred gradually and started with the realisation of the importance of user experience and user-centred design.
One interviewee reported that his first contact with services design occurred during one of his projects when studying product design. He realised that a very important part of the product he was designing was to offer to its user a good experience. His first professional services design project was at Cisco. It was related to data storage, and he integrated work carried out by developers with the insights of users.

Another interviewee was also exposed to services design for the first time during her product design course at the Glasgow School of Art. While developing a project involving a lamp shade, she went beyond it by setting up a website to allow customers to personalise their products. Later she got involved in services design through a social innovation lab organised by Nesta and from there she set up a design services consultancy.

One of the interviewees started his first service-related design activities while working for the Red group at the design council, exploring new interactions for voting, citizenship ceremonies, etc. This made him realise the importance of experiences and behaviours in design.

He then specialised in services design projects, working for the design consultancy Participle and later in social innovation design at Tacsi in Australia.

Another interviewee with an educational background in product design and interaction design got involved in the design of services via his professional activity designing web pages. His first design services project was about data management. He then co-founded Livework, considered by many to be the first services design consultancy.

It is noticeable that all of these designers have moved from product design to services design, but none of them have returned to product. Instead they have moved to other areas such as experience design or social innovation design.

Four main reasons explain why the product designers who were interviewed moved into services design. First, the nature of their design approach "naturally" led them to the development of services rather than products as a design output; secondly, the government agenda seems to stimulate design work in the area of services; thirdly, the transferability of their product design skills to service design challenges enables them to make a swift transition; and finally, the development of new professional design areas stimulated the shift. Table 4 summarises these reasons.

DESIGNERS' APPROACH	Focus on experience
	Understanding the importance of user insights
	Seeking to improve products by enabling user involvement in service-like systems
GOVERNMENT AGENDA	Increasing interest of government in developing innovative ways of approaching social issues
	Increasing interest of government in improving processes of civil participation (Voting, Citizenship ceremonies, etc.)
TRANSFERABLE DESIGN SKILLS	Transferability of design methods from design consultancy to other contexts such as government, organizations and charities.
DEVELOPMENT OF NEW PROFESSIONAL AREAS	Development and crossover of other design fields such as web development and interaction design.
Product designers' reasons for moving into service design	

Table 4

What design skills have you developed for designing services?

As service designers, the interviewees felt they had developed a wide set of skills. These skills have been grouped into 10 different categories: Attitude, Interpersonal, Research, Communication, Participatory Design, Aesthetics, Business, Thinking (about the situation), Knowledge and Interdisciplinary.

It is noticeable that systems thinking was named by only one of the designers, while skills related to business were mentioned by three of them. The categories of Research, Communication and Thinking (about the situation) are the ones that have most items, suggesting some emerging skills in the shift from product to services design. Table 5 shows the skills developed according to the interviewees' account.

	I1	I2	I3	I4	I5
Attitude	Naive view				
	Empathy				
Interpersonal		Confidence to deal with others			Empathy
			Enable conversation		
Research	Questioning				
			User research skills		
			Ethnography		Ethnography
					Being able to interpret customers
Communication	Drawing	Visual communication			
	Scenario building				
	Story telling				
	Quick prototyping		Service prototyping		
Participatory Design		Co-creation abilty	Co-design		
			Face to face design		
Aesthetics	Sense of making things beautiful				
Business			Business modelling/ innovation	Businees planning and management	Business
Thinking (about the situation)		Deal with complexity		Complex thinking	
				System thinking	
				System mapping	
				Value flows	
				Understanding patterns	
			Segmentation		
			Analytical skills		
Knowledge			Programme theory and logic		
				Sociology	
					Interaction
					Project management
Interdisciplinary					Interdisciplinary

Skills developed for service design

Table 5

Theme 3 - Shift from products to services
There has been a shift from product to services design. What has influenced this shift?
It seems that a diverse collection of factors has influenced the shift from product to services design. First, general awareness and concern amongst designers (and the general public) about environmental issues has increased: for example, one of the interviewees says that environmental concerns are moving designers to think that creating fewer objects is a positive action. He also says that as objects become multifunctional they become "dumb", as they are difficult to use and most of their functions become redundant and easily replaceable in a service environment. As function is delivered mostly through an immaterial entity (the service), services seems a more sustainable (and designerly) option to physical products. He also mentions that this is sometimes not supported outside design, and that for example some politicians in the UK still support the development of products over services, in the hope of generating more employment in the manufacturing sector.

Secondly, the worldwide expansion of the internet and the development of interactive technology has also played a fundamental influence on the shift. One of the interviewees explains it by saying that being digital enable multimodal experiences, and that this enables designers to develop services that improve user journeys. Networking technologies and the internet are also identified by other interviewees as accelerators and amplifiers of the services phenomenon.

A third aspect relates to an on-going trend in social and government environments towards user and citizen centeredness. As highlighted by another interviewee, this implies the need for service design thinking rather than product design thinking, as "face to face" design interventions typical of service design practice are required, such as co-design, user conversations, etc. He also highlights that services, as opposed to products, are a better platform for inducing behavioural change, for finding new innovation methodologies and new business models in public services, and to tackle social challenges such as youth disengagement or child protection issues. While he recognises the potential of services design to bring tools to addressing these challenges, he also insists on the need for a rigorous approach that involves other disciplines such as business or social sciences in order to achieve real innovation. Otherwise, he says, "...if we keep doing the same thing, we will keep getting what we always got."

One last aspect that influences the shift relates to the start-up phenomenon. One of the interviewees argues that this embodies the transition from product to services, as it enables the design and development of new services business models. The interviewee comments that this might be a negative development for established services design consultancies, as the start-up model removes the need for a service designer. This is becoming ever more critical, as current services design consultancies have relied too much on public funding for their work (as they mostly works for public organisations), and have developed less expertise in working with business and the private sector (at least in the UK).

Diagram 3 shows a summary of factors influencing the shift from product to services design according to the interviewees.
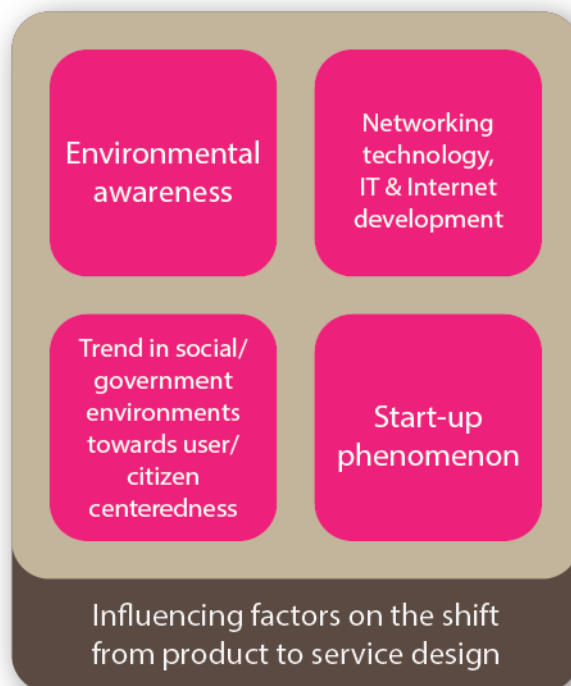
Environmental awareness

Networking technology, IT & Internet development

Trend in social/ government environments towards user/ citizen centeredness

Start-up phenomenon

Influencing factors on the shift from product to service design

Diagram 3

How has professional practice changed with the design of services? (Has the nature of your work changed?)

As one of the interviewees explains, the manufacturing industry has been drying out in the last 30 years and this has made product designers refocus their professional practice towards the design of services. Initially, they concentrated on working for the public sector and the government, as their agenda focused on behavioural change and having people's needs driving their activity and policies. With the financial crisis, public funding for pursuing this agenda became less abundant and a new shift towards the financial, insurance and banking services occurred. Consultancies such as IDEO exemplify this shift.

In this context, there have been noticeable changes in the practice of design. For example, services designers need to invest time and energy in justifying their research methods (as that often requires investing more time and money than clients would expect). As one of the interviewees explains, this might be necessary because some of the research methods used by designers are perceived by their clients as something they have already done.

One aspect raised by several interviewees highlights the increased focus of design activity on understanding people, their needs and behaviours, as the expected design output is often a user behavioural change. However, as another interviewee explains, designers need also to focus their activity beyond customer experience improvement towards the design of the business model.

Another important change relates to the disciplinary identity of the designers. Services design projects often involve teamwork with people from a wide range of disciplines, and with different project stakeholders. The activity of these teams, as highlighted by one of the interviewees, is centred on the purpose rather than the participants' skills. Therefore, designers ought to "care" less about their discipline, and be more ready to embrace other people's approaches. One of the interviewees illustrates this by explaining how, in the interdisciplinary project sessions he holds in his services practice, he asks colleagues to "leave their profession"

outside the meeting room, and come in not as designer or architect, or whatever profession they have, but as a person.

One last change is expressed by one of the interviewees as the need for designers to be more responsible. This refers to the idea that the design of a service does not end with the approval of a final concept (as may well happen in a product design project). Instead, the service design project includes the realisation of prototypes and the implementation of pilots for testing purposes, and can also include the operation and running of the service for an initial period. As this happens, the designers' area of responsibility increases, as well as the provision of their design toolkit.

Diagram 4 illustrates the main changes in professional design practice while doing service design identified by the interviewees.

Focus on understanding and interacting with people

Justifying and explaining what they do

Disciplinary de-identification

Moving away from the manufacturing industry

Wider scope and responsibility

Main changes in professional design practice while doing service design

Diagram 4

Theme 4 - Problem solving and systems thinking

The questions relating to problem solving and systems thinking did not offer the interviewees a predefinition of these concepts or ask them directly to give their own definition. However, as inferred from their answers, it became evident that although the interviewees did not have an homogeneous understanding of problem-solving thinking and systems thinking they did share several fundamental ideas in their definitions, especially in regard to systems thinking.

The first interviewee, for example, describes problem solving as a designer's mental process for seeking, finding and creating new visions and new technological opportunities in order to solve issues. He believes that systems thinking as well as problem solving is part of design thinking and that both are fundamental to being a designer. He refers to systems thinking as architectural orchestration. He argues that since product designers need to understand various

complex processes such as manufacturing processes, as well as investment and how organisations do things, they will use problem solving more than systems thinking, while in designing services he believes that the "eco-system" is much more complicated or perhaps much less mature and fuzzier, needing more of a systems thinking approach.

The second interviewee thinks that to create new products a designer has to constantly use problem solving thinking to identify problems. She sees systems thinking as a quality that a service designer should have in order to design services and as an ability to deal with complexity. She thinks that in systems thinking the designer's brain will zoom out from very specific things or from single things to tackle more complex situations or systems comprising various elements.

Another interviewee believes that systems thinking refers to the ability to deal with complex situations, where multiple elements need to "work together". It also relates to the ability to systematise and to grow or scale things and keep them working. It is also about the ability to think of multiple interrelated concepts and being able to see a situation from the outside.

The fourth interviewee thinks that systems thinking is a tool to understand the impact that individual products or services have in society in the context of a complex world. Within systems thinking, problem solving can result from problem analysis. Problem analysis is the identification of the current state of affairs at the onset of the design process.

The last interviewee thinks that systems thinking is a way of understanding situations structured as networks of interconnected nodes. He also regards problem solving as design, implying that problem-solving thinking is equivalent to design thinking.

It is clear that all these competing views have in common the idea of systems thinking as a necessary skill to deal with complexity and fussiness, and as a design tool to enable designers to step back from specific problems and rethink them as part of wider complex systems. Even if they not agree, they do not contradict the view this study takes (as explained in the literature review) that systems thinking is a way of thinking about and understanding phenomena, and a holistic world view which helps to understand relational aspects of otherwise fuzzy and complex issues, thus becoming an instrument of analysis and synthesis.

Would you be able to write 5 words to explain your design thinking when designing products and when designing services?
The interviewees were able to identify a wide range of words to describe their thinking while designing products and services. Even though most of them manifested at the beginning of the interview (in theme 1) that the design of services was not that different from designing products (at least at a higher levels), the results of this question seems to indicate otherwise. Out of 12 words elicited for product and 10 for service, there was only one in common: user. This leads to thinking that the user-centred approach, common amongst product designers, is transferred to the design of services. It is also noticeable that words directly associated with systems thinking, such as network, organisation, system, task, outputs and process, were only include as descriptors for the design of services.

Table 6 shows the design thinking concepts elicited by the interviewees. The words in the left-hand column represent categories identified by the researchers of this study.

PRODUCT					
	I1	I2	I3	I4	I5
Function	Function				
Aesthetics		Detail	Style		
Interaction	Product		Interactions		
Form	Product		Form		
Object		Object			Artefact
Materiality		Material			Material
Manufacture	Product	Manufacture			
Consumption					Comsumption
User	Product		Market		User needs
Ownership					Ownership
Competition			Competition		

SERVICE					
	I1	I2	I3	I4*	I5
Centre of Activity	Value/proposition				Data
User	Person/Context		Face to face		User Capabil./Access
Network	T-Points/Eco-Systems	Eco-system		Full spectrum	Network
Description	Journey/Design Vision	Umbrella			
Organisation		Organisation			
Business models			Business models	Bottom-up/Top down	
Systems	Architecture of delivery	Holistic		Systemic	
Multidisciplinary				Multidisciplinary	
Task/output		Delivery	Change/Roles/Scenes		Contribution
Process				Iterative	

Design thinking concepts in product design and service design

Table 6

Problem-solving thinking is a fundamental skill for the design of products. Do you agree? Elaborate.

The interviewees generally agreed that problem-solving thinking is a fundamental skill for the design of products. However, some of them suggested that there are equivalent but more "positive" ways of framing this skill, implying the negative character of the word problem. One interviewee equates "problem" with "opportunity", emphasising the optimistic character of the later. Similarly, another interviewee proposes to replace problem-solving with opportunity-grasping.

Some additional observations were made on the usefulness of problem solving. For example, one of the interviewees stated that the problem-solving approach is useful for integrating tangible and intangible elements in design. Another highlighted its usefulness if geared towards the building of visions. Other interviewee made a distinction between design tasks which focus on altering or improving an existing product and those concerned with the creation of a "new product or innovation". He pointed out that problem solving is more useful for the latter than for the former.

Diagram 5 shows the reasons underpinning the idea that the problem-solving approach is a fundamental skill for the design of products according to the interviewees.
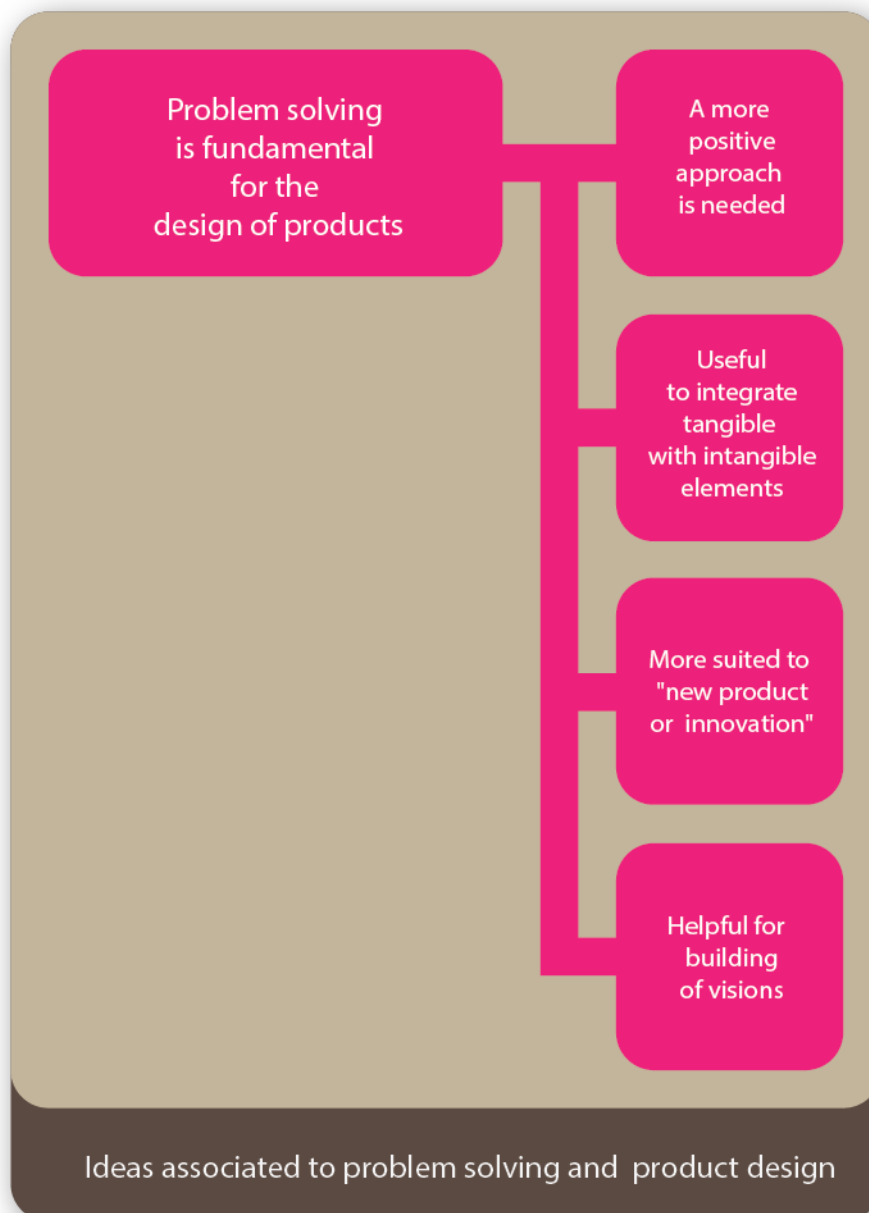
Diagram 5

Systems thinking is a fundamental skill for the design of services. Do you agree? Elaborate.
The interviewees agreed on the importance of systems thinking for designing services. A generalised conception amongst the interviewees is the usefulness of systems thinking to deal with complex issues in design services.

For example, one of them explains that in dealing with complexity, systems thinking can be useful to zoom in on specific processes such as customer journeys, to understand dynamic processes such as service delivery, and to zoom out into wider contextual structures such as government. Another interviewee values systems thinking as a tool for grasping complexity, for making multiple things work together and to enable the generation of multiple interrelated concepts. He also believes that systems thinking enables the systematisation of pilot services with the purpose of making them grow and work when scaled up.

Another interviewee comments on the perceived quality of systems thinking to develop services for social benefit. He claims that in order to do good for society, "systems thinking is your basic

toolkit". In contrast, a further interviewee affirms that systems thinking helps to understand that the solution is not in an individual artefact, but is the combination of a network of actors coming together. Diagram 6 illustrates concepts associated with the relevance of systems thinking in the design of services according to the interviewees.
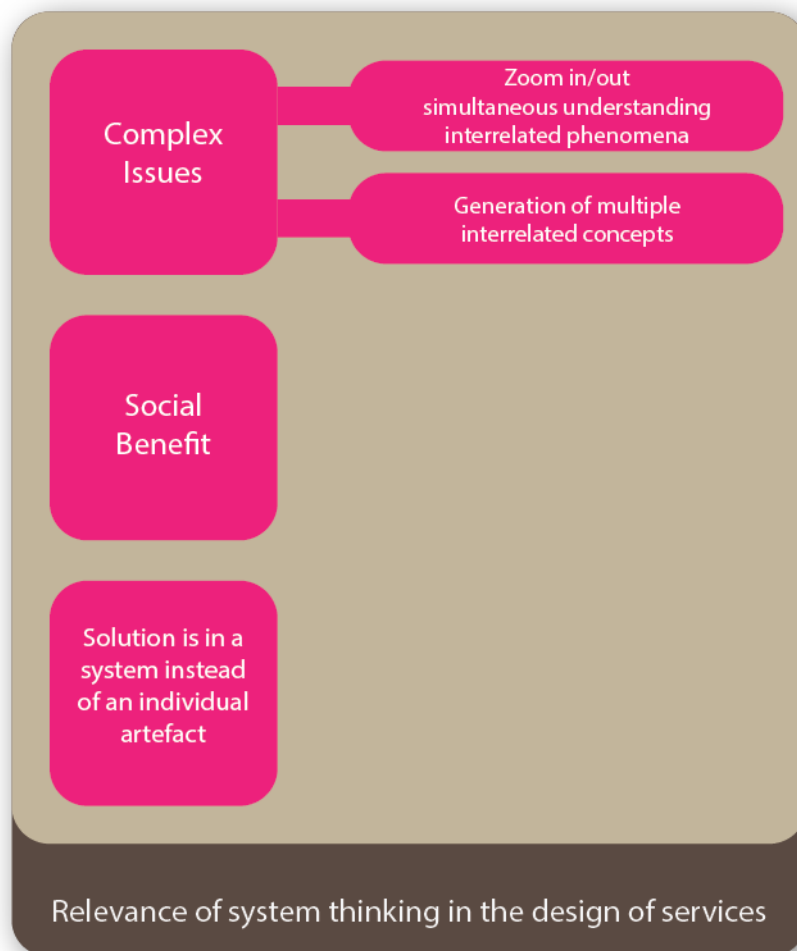

Diagram 6

How does problem solving weigh in comparison to systems thinking, when designing products and when designing services?

The interviewees seem to agree on the value of both problem-solving and systems thinking approaches for both product and services design. However, some of them believe that one particular approach is better suited to either product or services design. For example, one of the interviewees explains how problem solving is more appropriate to product design, while systems thinking is better for the design of services due to their fuzzy nature and greater size and complexity. He argues that systems thinking helps the designer of services to "orchestrate" multiple variables and stakeholders within a service.

Other interviewees believe that systems thinking and problem solving can be integrated to address complex or "wicked" problems in product and service design. Additionally, one of them explains that both approaches are necessary and not mutually exclusive. Furthermore, systems thinking serves to sketch the landscape in which problems are identified and solved: systems thinking overarches problem solving.

Another interviewee describes how in services design is possible to use systems thinking without needing to employ problem solving; for example, to understand a network of mutually interacting elements. Yet, he explains, as solving a problem in a network brings repercussions to the whole network, a systems thinking approach allows designers to understand these repercussions. He summarises this concept by explaining that service design is solving a problem (using problem-solving thinking) in the context of systems (understood by using systems thinking).

Table 7 summarises when a problem-solving and/or a systems thinking approach is appropriate in product and service design according to the interviewees. Six different factors determine the level of appropriateness of each approach, and help to define the weight of each approach in product design and service design. It is noticeable that in regard to two of these factors ("integration" and "function of approach") both problem solving and systems thinking have similar weight.

Discipline / Factors	PRODUCT DESIGN	SERVICE DESIGN
NATURE OF PROBLEMS	PS: Clear, smaller and simpler	ST: Fuzzy, bigger and more complex
VARIABLES & STAKEHOLDERS	PS: fewer	ST: Multiple/ needs orchestration
PURPOSE OF THINKING		ST: Understand network of interacting elements
INTEGRATION (In relation to problem type)	PS & ST can be integrated to solve "wicked" problems.	
INTEGRATION (In relation to function)	PS: Address problems/ ST: Sketches landscapes for problems	
FUNCTION OF APPROACH	PS: Solve problems/ ST: Helps to understand their repercussions	
Appropriateness of problem solving (PS) & systems thinking (ST) in product & service design		

Table 7

Discussion

Based on the findings from the interviews, it is apparent that the shift from problem-solving thinking to systems thinking as a consequence of a shift from product to services design is not as simple as the literature review suggests, and systems thinking appears to be only one of the aspects of this change in design thinking. To develop this idea, each of the finding themes of the previous "finding" section will be discussed.

Theme 1 - Product vs. services

It seems that differences between products and services are related to their dynamicity, scope width and tangibility. However, product and services seem to be integrateable, as products can be accompanied by or be part of services, and contingent, as neither one is mutually necessary for the other's existence.

Designing services is regarded as a more complex activity than designing products. The design process nature changes for services as its end becomes fuzzy and entangled with the implementation and running of the service.

If there is an identifiable factor related to the difference between products and services and their design processes which indicates a shift in design thinking, it must be the dynamic and intangible nature of services, as well as its higher complexity. These differences might be an indication that a new type of thinking is required by product designers for the design of services.

Theme 2 - Design of Services

It is apparent that product designers have been able to move into the design of services thanks mainly to the transferability of their skills, and that this process has been also stimulated by government and social drive.

Systems thinking is recognised as an important skill, but others such as research skills, collaborative skills, etc. are considered important too. It might be the case that the thinking shift in service design is not necessarily towards the paradigm of systems thinking, but to another one and yet to be identified.

Theme 3 - Shift from products to services

Amongst the main factors influencing the shift from product to services design are the increasing development of technology, the emergence of new business models, government agendas for the development of services, and changes in people's mainstream thinking and values.

As designers move from product design to services design, there are perceived changes in the scope of their profession, especially regarding the increasing involvement of users in the design process and the focus on user behavioural change and innovation in business models and public services.

This possibly suggests that important changes in designers' thinking are necessary, related to their ability to understand complex areas such as business and public services. However, as important as the adoption of systems thinking might appear for the satisfaction of this need, other types of thinking such as business thinking and customer service thinking might be as important as systems thinking.

Theme 4 - Problem solving and systems thinking

It is apparent that design thinking changes noticeably from product design to service design, but regardless of this the focus on the user remains a key consideration in both cases.

It seems that systems thinking is not regarded as a very important feature in product design, but in service design it is, especially because of its usefulness to deal with complexity, as suggested in the literature. In contrast, problem solving is perceived as equally useful in the design of both

products and services (although it has been suggested that problem solving is sometimes counterproductive in service design).

This may imply that, rather than causing a shift from problem-solving thinking to systems thinking, the transition from product to service design has produced an "addition", bringing systems thinking to the design of services. Actually, in service design, problem solving and systems thinking are not opposite, competing or mutually exclusive ways of thinking, but complementary.

This research suggests that the need for problem-solving and systems thinking approaches in design activity is not determined by the desired design output (products and/or services). Instead, it seems to be individually dictated by the particular and individual design process adopted by an individual designer in each project undertaken. Their likelihood of being employed mostly depends on how general (holistic) or specific is the view that the designer takes at the moment of application, as well as whether the reason for adopting either approach is geared more towards understanding or resolution.

Conclusions

This paper has presented the results of a study examining how design activity has changed for product designers who have become service designers. In particular, it has explored the adoption of systems thinking as an approach to the design of services, in relation to the problem-solving approach commonly utilised by product designers.

First, it has examined relevant literature, explaining how the problem-solving approach has become insufficient to deal with the fuzzy nature of the issues designers face nowadays. It has also explored how product design has shifted to service design, explaining why the systems thinking approach can be useful to deal with the complex nature of services and how it has been adopted by service designers.

Secondly, it has presented the results of a series of semi-structured interviews with designers working in five design consultancies that have moved from product design towards services design. It has reported the interviewees' views about differences and commonalities between product design and service design, about their experiences while shifting from product to service design, and about their design approach in relation to problem solving and systems thinking approaches.

The literature review and the interviews results have been compared, showing that a change in the way designers think and approach projects has taken place, demonstrating that the design of products requires a different approach to the design of services.

The weight of the evidence seems to indicate that a movement from problem solving to systems thinking takes place when designers are faced with the challenges of designing a service. However it seems that the systems thinking approach does not necessarily replace the problem-solving approach but complements it. The results also indicate that the growing complexity of the issues designers have to deal with influences the adoption of systems thinking in response to service design challenges. It also shows that current changes in ideas about sustainability, society, etc. have also an impact on this.

This paper does not claim to be definitive and can be taken only as initial exploration of the subject. Further study will be needed to establish exactly how the systems thinking approach is utilised in the design of services, and to examine how it compares with other alternative design approaches employed in services design.

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