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Challenges in co-designing a building

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Abstract: This paper explores the challenges faced in implementing Co-Design approaches to building design. Co-design approaches have been increasingly applied in building design over the last decade. They call on building designers to engage users more actively by asking them to express their experience and knowledge directly throughout the design process. However there are some concerns as it radically changes how we design, what we design, and who designs. The paper explores these by reviewing the literature around the development of the architecture profession and comparing participatory approaches to others and concludes that there are a number of challenges in co-designing a building, including changes in the role of actors in the design process and issues around managing conflicts between the interests of different users in a multi-user building project. The questions that are raised here will be explored further through a case study of user-engagement in a hospital design project.

Keywords: Architecture profession; co-design; design process; building design

1. Introduction

Co-design approaches have been increasingly applied in building design over the last decade. They call on building designers to engage users more actively in all stages of the process as co-designers, asking them to express their experience and knowledge directly in the design process (Rizzo, 2010). The term co-design, according to Sanders and Stappers (2008), refers to the collective creativity of collaborating designers across the whole span of a design process and in a broader sense, it refers to the creativity of designers and people not trained in design working together in the design development process (Sanders and Stappers, 2008). In other words it is understood as citizen power in the processes of decision-making moving towards significant social reform and means for citizens to have real power to shape their environment. This is based on the principle that the environment works better if citizens are active and involved in its creation and management instead of being treated as passive consumers (Sanoff, 2000).



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According to Sanders and Stappers (2008), bringing co-design into the design process radically changes how we design, what we design, and who designs. As a result, the tools and methods used in the design process will need to change, the design and research stages will blur together and new types of designers and researchers with special expertise in the early stages of the design process will be introduced, among other things (Sanders and Stappers, 2008). Therefore, implementing co-design approaches in the architectural design process raises challenges for future architecture practice.

This paper explores a number of issues relevant to the application of co-design approaches in the built environment:

- What is the impact that co-design approaches have on the role of architect in the architectural process?
- What kind of tools and methods are utilized in co-design approaches to design a building?
- What is the impact co-design approaches have on the building design outcome?

To explore these questions, this paper will firstly review the literature around co-design in architecture. It will then discuss the architecture profession and its role, and then compare co-design approaches to scientific approaches and more traditional approaches across three dimensions: *how* architects design a building, *what* architects design and *who* designs. The paper will then discuss the challenges that are faced in co-designing a building.

2. The Architecture Profession

Before discussing the impact of co-design in the building design process this paper will explore the architecture profession and its roles. As noted by Samuel., et al (2014) there is a lot of confusion about architecture and what architects do. This section will address this issue by looking at the literature on the development of the architecture profession and its role in the UK.

2.1 *The development of the architecture profession in the UK*

Architecture is probably the oldest established design profession and serves as a model for design in other professions and has, as a result, been described as the 'mother profession' within the family of design professions (Schön, 1983).

Prior to the mid-eighteenth century the majority of buildings were designed and built by builders with no input from architects, who only tended to be engaged in the building and design of major monuments such as churches and palaces. As there were no formal institutions governing the architecture profession at this time, architects were trained in a number of different fields including as craftsmen such as stonemasons, painters and carpenters and as engineers.

The Royal Institute of British Architects (RIBA) was established in 1834 by a number of leading architects of the time with the aim of increasing, controlling and unifying standards

of practice within the architecture profession (Lawson, 1980). Prior to this, there was no established route for becoming an architect in the UK and wide variation in the type and quality of education received by architects and, as a result, in standards of practice within the profession (Crinson and Lubbock, 1994). The initial Royal Charter of RIBA (1837) set out its main aims as “...*the general advancement of Civil Architecture, and for promoting and facilitating the acquirement of the knowledge of the various arts and sciences connected therewith...*”.

Over the next 100 years, RIBA played a central role in the development of professional standards in the architecture profession, tightly regulating its members and requiring extensive training to be completed before entering it to reflect the fact that it is a role that requires judgement and an ethical responsibility to act on behalf of society (Duffy and Rabeneck, 2013). By 1882, RIBA introduced compulsory qualifying examinations for its members (Crinson and Lubbock, 1994) and these regulatory developments culminated in the creation of the statutory Architects’ Registration Council of the United Kingdom and the Board of Architectural Education by Parliament in the 1930s.

2.2 *The role of architects in the UK*

Sir John Soane wrote in 1788 that the role of the architect is ‘to be the intermediate agent between the employer, whose honour and interest he is to study and the mechanic whose rights he is to defend’ (Darley, 1999). In defining ‘the employer’ as the client and ‘the mechanic’ as the construction industry, he was arguing that an important role architects need to play is exercising even-handed judgement between the desires of the demand side – what their clients want - and the constraints faced by the supply-side of the construction industry – what builders, craftsmen and suppliers can realistically deliver within the resources available.

However the role of the architect changed significantly following the establishment of RIBA. Architects increasingly restricted their activities to ‘designing’ rather than ‘making’ and were often not directly connected with either the clients or makers. Once a design is produced, they withdraw from the scene (Lawson, 1980).

RIBA (2005) require architects to “*apply high standards of skill, knowledge and care in all their work (and) apply their informed and impartial judgment in reaching any decisions, which may require members having to balance differing and sometimes opposing demands (for example, the stakeholders’ interests with the community’s and the project’s capital costs with its overall performance)*”.

An important question is whether we can be optimistic and trust architects’ professional knowledge and their judgement about what makes for a successful design outcome.

Alexander (1964) challenged our optimistic response towards the traditional design approach as well as the designer’s role and asked how drawing-based design processes could replace centuries of adaptation and evolution embodied in vernacular products. He proposed a method of structuring design problems that would allow designers to see a

graphical representation of the structure of non-visual problems. This required the whole design process to become more open to inspection and critical evaluation.

More recently co-design approaches call on architects to facilitate users to act as co-designers in all stages of the design process and also to effectively collaborate with other disciplines. These approaches are characterized by the way in which it cuts across traditional professional boundaries and are based on the principle of not privileging the expertise of the designer over that of the user.

2.3 Participatory architecture

The beginnings of the participatory design movement in the UK can be traced to a conference called *Design Participation* held by the Design Research Society in Manchester in 1971. Cross (1971) states in the book summarising the proceedings of the conference that *“Professional designers in every field have failed in their assumed responsibility to predict and to design-out the adverse effects of their projects. These harmful side effects can no longer be tolerated and regarded as inevitable if we are to survive the future...There is certainly a need for new approaches to design if we are to arrest the escalating problems of the man-made world and citizen participation in decision making could possibly provide a necessary reorientation”* and later suggests that participation should not only be at the moment of decision but also at the moment of idea generation (Cross, 1971).

The idea of user participation in architectural design with the aim of integrating users' needs and desires in the design and planning process has been around since 1960s. For example, Walter Segal developed a method for self-build housing and demonstrated this in the UK and Ireland. The Borough of Lewisham asked him to use his methods to design a self-build social housing project with people who were on local housing list in 1978 (Broome, 1986; Blundell Jones, Petrescu and Till, 2009; Hofmann, 2014). Segal's work also influenced the participatory approaches used by Peter Hübner in designing school buildings in Germany and also had an impact on the design of a student housing project at Stuttgart by students, the Landau Cultural Centre and some other projects by Peter Sulzer (Blundell Jones et al., 2009).

Currently academia and design practices are evidencing more user participation in the design process as predicted by Jungk (1971); for example, there is increasing stakeholder engagement in planning and design healthcare building projects. In the past, user engagement was limited to seeking external input at specially defined moments; more recently its use has been expanded with more active user engagement throughout the whole design process, asking users to express their subjective experience and knowledge directly in the design process. These approaches are based on an assumption that the built environment works more effectively if citizens are actively involved in its creation and management instead of being treated as passive consumers (Sanoff, 2006).

2.4 Typology

There are several different design approaches utilized in the built environment. Lawson (1980) categorised them into three different types distinguished by methodological differentiation in the design process: design by drawing; design by science; and collaborative approaches. Duffy and Rabeneck (2013) identifies three approaches based on differences in how architects prioritise the conflicting demands of clients, industry and the wider world: shape makers (who prioritise aesthetics and innovation), serving commercial entities (focusing on the “look” of new products) and collaborators with other professionals to produce better buildings (focusing on improving the quality of designs through the measurement of results). Samuel et al (2014) uses a similar means of classification to identify three approaches: cultural architects aim to create iconic attractions that are built around ideas that come from the world of art and performance; commercial architects prioritise the requirements of business and advances business needs; and social architects create environments to transform the way we feel and think by engaging people in the design process.

As this paper will address the impact of co-design approach in the design process, Lawson’s classification of design approaches based on the methodologies used is more suitable.

3. Who designs?

As mentioned above, this paper will use Lawson’s categorisation of design approaches utilised in the built environment: design by drawing; design by science; and collaborative approaches. It will compare these three different approaches across three dimensions: who designs, what we design and how we design.

3.1 Design by drawing

In the *design by drawing* approach, architects and designers use their own knowledge and experience to create buildings, beginning with abstract ideas and transforming them to concrete physical formations through their cognitive design activities (Dursun, 2007; Lawson, 1980; K Sailer, et al 2007). In this approach, the client and users have to respect the authority of the architect and trust that the provided design option is the most effective one because there is no way for them to objectively challenge a design. An architect, as a professional with expert knowledge that their clients do not have, plays a manipulating role in clients’ very risky, expensive long term investment while clients’ and users’ roles are very limited and neglected in the entire process of designing and making the building (see *Table 1*).

Table 1 Actors' role in the design process

Type	Architects' role	Researcher' role	Concept of user in design process	Real users' role in design process
Design by drawing	Expert	No role	Imaginary user	No role
Design by science	Expert	Translator	Informant	Informant
Collaborative approach	Expert/ Facilitator	Facilitator	Co-designer	Designer

3.2 Design by science

Design by science approaches try to improve the utilitarian design of the building. They provide more critical and objective evidence about the relationship between human behaviour and spatial configuration to support the decision-making process of designers and architects. But it gives space for designers and architects to evaluate notion between functional matters and their creative development of building design.

Therefore architects and designers remain as experts, with researchers collecting and interpreting human behaviour data in the existing setting which they bring to the designer who then uses it to inform the creative development of their design. Thus clients and users play a passive role in the design process as an informant – users are involved in the process but only indirectly through observation (see *Table 1*).

3.3 Collaborative approach

Collaborative approaches are based on a movement that cuts across traditional professional boundaries (Sanoff, 2006). Users are involved in the creation and management of the design rather than being treated as passive agents as in the other approaches. Users are asked to express their experience and knowledge directly in a design process that does not privilege the expertise of the designer over that of the user. As we can see from table 1, this transforms the role of the designer into one of facilitator rather than expert, with users playing an active role as a co-designer in the design process (see *Table 1*).

4. What do architects design?

The Dutch architect Hertzberger (1991) said that *'everything we do has consequences for people and their relationships...The art of architecture is not only to make things beautiful – nor is it only to make useful things, it is to do both at once – like a tailor who makes clothes that look good and fit well'*. Similarly, Schön (1987) described the architecture profession as bimodality between being a utilitarian profession concerned with the fundamental design and construction of settings for human activity and an art that uses the form of buildings

and the experience of passage through the spaces and media of aesthetic expression. Thus the outcome being sought by architects are buildings that are both visually beautiful and distinctive, and where the organisation of space within them make sense for users and allow the building to effectively fulfil its purpose.

4.1 Design by drawing

According to K Sailer., et al (2007), more traditional approaches (in Lawson’s term *design by drawing*) to building design are highly open and intuitive processes which leaves clients, users and architects themselves uncertain about what the outcome will be. As described by many scholars, the design process is a process of making (Schön, 1983), a trial-and-error approach which is experimental in nature (Van Schaik, 2005) and based on learning by doing where the problem and solution emerge together (Lawson, 1980). This means that it requires highly professional judgement with architects using their experience and intuition to create buildings that meet clients’ and users’ needs.

In the design process, architects are both using their subjective knowledge and experience to create aesthetic value and using their understanding of utilitarian design to create buildings that will effectively fulfil their purpose based on their ‘professional judgement’ (see *Table 2*).

Table 2 Design objectives and the type of space incorporated into the different approaches

Type	Design objective	Space
Design by drawing	Architects’ creative aesthetic design	Architects’ subjective space
Design by science	Architects’ creative aesthetic design & scientific utilitarian design	Architects’ subjective space & Users’ objective space
Collaborative approach	Architects & Users’ creative design	Architects & Users’ subjective space

But an emerging question is what this professional judgement towards utilitarian design is based on? If this critical judgment is based on the experience and intuition of the architect, where does it come from and how do they acquire it? As mentioned earlier, the relationship between architects and clients ends when the project finishes and they are not explicitly looking backwards by carrying out systematic evaluations about how effectively their previous projects met their design objectives once built. How then do architects make a judgement about what works or not? The problem of more traditional design processes lies in this uncertainty on architects’ professional judgement towards their design.

4.2 Design by science

Scientific approaches are a response to this uncertainty about architects’ professional judgement towards their design. They seek a more systematic evaluation of the success or

otherwise of building design by, for example, using data based on observations of collective human behavioural in previous research, environment variables and spatial analysis.

Post Occupancy Evaluation (POE) was developed in the 1970s as a method to analyse efficiency and building performance which is widely used in facility management but was not used in architectural research and design until relatively recently. Some Ergonomists and workplace design practices started using POE to study existing clients' environments to build an evidence base about the spaces, behaviours and space usage patterns of that organisation. This evidence is used to suggest design solutions that better fit the clients' character and needs rather than solely relying on the intuition and experience of the individual designer (Jenso, M. Hansen, G K. Haugen, T, 2004; K Sailer, et al 2007; K Sailer, et al 2010).

Space Syntax takes this even further by using a mathematical description of spatial configuration and collective human behaviour data to advise designers and architects at an early stage in the design process as well as to predict the likely behaviour of building users if the proposed design option goes ahead (K Sailer, et al 2008; K Sailer, et al 2010).

It seems that scientific approach is trying to contribute to the utilitarian design part of the architects' role. It provides more critical and objective evidence about the relationship between human behaviour and spatial configuration to support the decision-making process of designers and architects. But it also provides space for designers and architects to use their professional judgement to make a trade-off between functional matters and their creative development of the aesthetic components of building design (see *Table 2*).

4.3 Collaborative approach

In contrast to the indirect involvement of users through analysing data about human behaviour in the built environment used in *design by science* approaches, *collaborative approaches* try to overcome the problem in the briefing and the design process by involving users directly in the design process through collaboration between architects, researchers, clients and users. Users are actively engaged in all stages of the design process and asked to express their subjective experience and knowledge directly. To do so, this approach quite often includes a whole range of new techniques – workshops, gaming and virtual reality (Garde and van der Voort, 2009; Iversen and Dindler, 2014; Nilsson, et al 2011; Vaajakallio, Lee, and Mattelmäki, 2009) - to identify the crucial aspects of the problem or positive aspects of the existing space and building, make them explicit, and suggest alternative courses of action for comment by the non-designer participant (Lawson, 1980). Therefore it is trying to incorporate users' subjective space and building into architects' subjective aesthetic and utilitarian design (see *Table 2*).

A key question is how do architects, clients and users know how the design that emerges from these processes will either make sense for users or allow the building to effectively fulfil its functions? Further, how can architects be certain that their creations are visually beautiful not only for themselves but for the building users, their clients and the wider

public and are considered to do so over the life of the building? Finally, how can we be sure that users themselves know what it is they really need from the space and the building?

As noted by Hillier (2004), it is very difficult to talk about our relationship with space in the built environment as space is non-discursive and we do not have an adequate language to describe it: we don't think *of* space, we think *with* space. This leaves a clear risk that the result of co-design processes will be a building that the clients and stakeholders desire rather than one they need as there is a strong chance that they do not understand exactly what it is they need from space and buildings.

5. How architects design buildings: the briefing and design process

5.1 Design by drawing

Building projects start with the client approaching someone for professional advice about the possibility of creating a new building. The clients and the design team discuss general information such as their requirements and the client's initial idea of what they want (Tunstall, 2000). Architects then produce the building designs based on their understanding of the situation and feed this back to the clients. For this purpose, architects generally produce the drawings including plans, elevations, sections and rendered perspective drawings by hand or Auto CAD. A three-dimensional real model of the building or a virtual computer model often accompanies this.

However, according to Granath (2001), the communication with users and clients with architectural objects is very hard as it is difficult to determine whether the suggested design will really facilitate their future activities. This is due to the client's requirements and needs often being affected by their familiarity with their current situation and the natural bias towards the status quo that this leads to. The inadequacies of their existing arrangements are often not recognized and change is resisted because their previous experience has apparently not been bad or they have not been able to step back and look at their situation dispassionately. Sometimes, even the good points or advantages of their situation are obscured because they have been used to doing things in their own particular way (Tunstall, 2000).

As Collinge and Harty (2013) point out the briefing phase, gauging and understanding stakeholder interests is often problematic for architects and it is often difficult to effectively incorporate stakeholder communication into the design process.

5.2 Design by science

The existence of these issues is not a recent problem. As mentioned earlier in this paper, scholars such as Alexander (1964) pointed out the importance of developing more structures and tools to allow designers to more effectively visualise design problems and sharpen their conception of what the design process involves. This approach calls on the design process to be more open to inspection and to critical and scientific evaluation.

Recently ergonomists developed evidence-based design approaches which use data about collective human behaviour in the built environment to understand users' needs and use analysis based on this to support decision making process in the design process. These approaches use various analytical tools and computer generated visualisations such as Space Syntax, Social Network Analysis, pre-and post-occupancy evaluation and Generative Design. There also have been significant developments in evidence-based healthcare design and planning strategies in the NHS in the UK. For example, the NHS commissioned the development of an evidence database and different design tools to support the design process of NHS healthcare building projects, including ASPECT (A Staff/Patient Environment Calibration Tool), AEDET (Achieving Excellence Design Evaluation Toolkit), IDEA (Inspiring Design Excellence and Achievements) and more recently DQI (Design Quality Indicator) for health for design quality improvement (Phiri, 2015).

5.3 Collaborative approach

In contrast to *design by science* approaches, *collaborative approaches* call on direct user engagement in the design process to overcome the problems in the briefing and design process faced when using *design by drawing* approaches. As Latham (1994) and Sanders and Stappers (2008) suggested, users, clients and designers must discuss issues and solutions together in the design process to produce better buildings.

This approach uses new techniques for better communication and engagement with clients and users to generate new ideas and visualise future spaces and buildings. For example, an on-site 'design festival' event can be used to engage users and clients in generating ideas by, for example, using post-it notes to collect suggestions on a large three dimensional model of the project, issue lists to help people priorities concerns and possible solutions themselves, and interactive media to record comments and analyse findings on a digital map and so on (*The Architecture Foundation, 2000*). Techniques such as workshops, gaming and a virtual reality setting are also applied to identify the crucial aspects of the problem or positive aspects of the existing space and building, make them explicit, and suggest alternative courses of action for comment by the non-designer participant (Lawson, 1980). It would therefore claim to incorporate the user more closely in the process, and to not privilege the expertise of the designer over that of the user (Lawson, 1980: p30).

6. Discussion

The architecture profession is both aiming to produce aesthetic value in the buildings they design and organising the space within them to accommodate human activities. An architect is both a creative artist who needs to design a building that is visually beautiful and distinctive to other buildings to create originality and a utilitarian profession who needs to create buildings that are able to accommodate human activities, make sense for the people who use it and fulfil its functions effectively. The problem facing the architecture profession is ensuring that both of these outcomes can be achieved, which is not certain to be the case in the *design by drawing* approach.

There have been a number of different developments in design approaches aiming to tackle these issues, such as the *design by science* approaches and *collaborative approaches* outlined in this paper.

In *design by science* approaches, researchers use a range of techniques to understand the needs of users and architects and designers use this evidence about the objective components of space and buildings to help ensure the buildings that they design fit the people who will be using them. By doing this, these approaches try to bridge the uncertainty about architects' professional judgment towards their design and increase the clients' trust towards the design outcome for their expensive long-term investment.

In *collaborative* approaches, users are actively engaged in the design process to incorporate their perceptual and cognitive evaluations of space and buildings. These approaches use a range of techniques to allow users to express their subjective spatial experience and desires. By doing this, users' subjective conceptions of space and building are incorporated into the design process. The question is why this subjectivity matters: both what it can add to the design process and the potential risks that using such approaches could give rise to in how effectively the building fulfils its functions.

There is growing emphasis on the impact of the built environment on subjective wellbeing, for instance, in spatial design of housing for ageing populations. As Halpern (1995) mentioned, the ability to control the environment is of great importance as the negative impact of environmental stressors is greatly reduced when people feel that they have control over them. The involvement of people is important not only because of the acceptability of final decisions but also because the process of involvement itself. Samuel et al (2014) also state that the importance of process-orientated participatory practice for wellbeing and stressed that participatory practice is a key part of the architects role.

However, this approach shifts a focus from the role of the building itself and its design quality to the design process and the performance of the organisation that uses the building, meaning that the focus is often on the integration between the design of built space, technical systems and organisation of work (Granath, 2001; Mills., et al 2015).

7. Conclusions and next steps

This paper explored the challenges faced in implementing co-design approaches to building design. It explored the impact that co-design approaches have on the role of actors, the design outcomes and tools and methods by comparing it with other approaches. The paper found that there are at least three significant challenges involved in using co-design approaches to design a building.

Firstly, there are challenges in managing the changing role of actors in co-design approaches compared with more traditional approaches. The architecture profession is highly skilled and qualifying to become an architect requires extensive training and subject to the successful completion of a number of examinations need to be passed with the aim of ensuring that all architects are able to exercise good professional judgement and their ethical responsibility

to act on behalf of society. If co-design approaches are to be successful, architects need to be able to effectively integrate users' lived experience with their own professional judgement on functional matters to be able to create buildings that can effectively fulfil their functions. A further question is what kind of skills architects need to successfully co-design a building with users and how that differs to that required in more traditional approaches?

Secondly, there are challenges for architects and designers in deciding which of the various tools and methods developed in participatory architecture to use at different design stages¹ and for different types of project. According to Sanders and Stappers (2014) there are three different types of participatory method - cultural probes, toolkits and prototypes – and these are aiming for different outcomes and are used at different stages of the design process. For example probes and toolkits are for the early stage of the design process, and prototypes are used in the design and construction stage of the process.

Thirdly, there are challenges in ensuring that a high-quality design outcome is achieved in co-design approaches. As this approach tends to focus less attention on the role of the building itself and its design quality, how can architects and designers involved in the project manage the design quality and ensure they discharge their professional responsibility to create buildings that can effectively fulfil their functions.

A number of further challenges can also be identified. For example, it may be difficult for architects to manage the input of different users into the design process where there is conflict between different user groups. The co-design process would be relatively straightforward if there is one user group (e.g. in a house building project) but more complicated if there are several different user groups in the same building project with conflicting needs, (e.g. in a hospital building). Deciding how to prioritise different user interests where they are in conflict with one another and trade them off against each other is a difficult task. Another challenge is ensuring that those users who are engaged in the design process and the opinions they express are representative of the entire user group.

This paper explored the challenges faced in implementing co-design approaches to building design through reviewing the literature around the development of the architecture profession and by comparing different design approaches. The questions that are raised here will be explored further through a case study of user-engagement in a hospital design project.

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¹ For example, RIBA Plan of Work 2013 organizes the building design project into a number of key stages; Stage 0 (Strategic Definition), Stage 1 (Preparation and Brief), Stage 2 (Concept design), Stage 3 (Developed design), Stage 4 (Technical Design), Stage 5 (Construction), Stage 6 (Handover and close out), Stage 7 (In use).

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