User Involvement in Design: The Four Models

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Abstract. User studies and user involvement in design have been heavily discussed but lacks a systematic theory, thus causing confusion for novice designers and researchers. Through extensive literature review, this paper identifies three approaches of user studies, i.e. 'empirical studies' which tends to 'learn from the past'; 'experimental studies' which tends to 'learn from the present', and 'scenario-based studies' which tends to 'focus on the future'. It also summarises four models of user involvement in design, i.e. designers representing users, designers consulting users, users participating in the design process, and users as designers. These syntheses will help designers and researchers understand user involvement in a more structured manner, thus making the application of the theory and practice easier.

Keywords: User studies · User involvement · User participation · Models

1 Introduction

Users are often referred in the context of their existing relations with something, which can be a natural thing (e.g. a cave), a man-made artefact (e.g. a chair), a kind of service (e.g. healthcare) which might involve other human being(s) (e.g. a doctor) or social systems (e.g. legislation). The continuous changing relations build, construct and develop our environments and ourselves.

User studies firstly appeared in 1940s and they are one of the most researched areas in library and information science (Siatri 1999). In that field, researchers tend to focus on users' behavioural and cognitive responses to the natural and man-made world in order to understand their physical, sensory, cognitive and emotional needs and interactions.

In innovation and management fields, research shows that users were referred to contribute from 10 % to nearly 40 % per cent of the innovative ideas and products (Von Hippel 2006, pp. 19–22). From a postphenomenological point of view, there are four fundamental relations between the user, artefact and the world, where phenomenological analysis can be applied to each relation for revealing the structure of our daily life (Zhang and Dong 2013).

Understanding users/customers' needs and requirements in design studies is regarded as the first and most essential step for designers and manufacturers to take.

Users are one of the human roles who put artefacts to use, the other two are designers and manufacturers 'who stand to have their activity and experience transformed' (Carroll and Rosson 2007). In user-innovation studies, users are 'firms or individual consumers that expect to benefit from *using* a product or a service', while manufacturers 'expect to benefit from *selling* a product or a service' (Von Hippel 2006, p. 3). In post-phenomenology, users are those who get different experiences and perceptions through interacting with artefacts. In this paper, 'users' refer to individuals or a group of people using products or services. 'Artefacts' refer to man-made products. Users and artefacts are both in a context, a background which is the users' daily life.

User studies and user involvement in design have been heavily discussed but lacks a systematic theory, thus causing confusion for novice designers and researchers. In this paper, the authors will review literature from a broad range of disciplines, aiming to offer a structured view on user involvement in design.

2 Approaches of User Studies

In his book '*The Sciences of the Artificial*', Simon (1996) points out that to fulfill or adapt a goal involves a relation among three things: 'the purpose or goal, the character of the artefact, and the environment in which the artefact performs'. He gives two examples, one is that whether a clock will tell the time depends on its character (inner construction) and the environment (where it is placed); the other is whether a knife will cut depends on the material and the hardness of the substance. Influenced by Human-Computer Interaction (HCI) studies and social movements, designers in architecture, public service and industrial design gradually formed an opinion that designers have the ability and should be responsible to solve problems through getting to know users and their various needs and requirements.

These concerns have resulted in a series of approaches/methods of involving various users, e.g.

- **Participatory design**, **user design**, and **open design** (*Design Studies Special Issue* 2007; *CoDesign Special Issue* 2008; Björgvinsson 2008; Von Abel et al. 2011; Simonsen and Robertson 2012; Wilkinson and De Angeli 2014; Taffe 2015)
- **Empathy design** (*The Design Journal Special Issues* 2011; Newell et al. 2011)
- **Universal design** (Wolfgang and Korydon 2010; Lidwell et al. 2010; McAdams and Kostovich 2011; Aragall and Montaña 2012)
- **Inclusive design** (Coleman et al. 2007; *Journal of Engineering Design Special Issue* 2010; McGinley and Dong 2011; Heylighena and Bianchinb 2013; *Applied Ergonomics Special Issue* 2015)
- **Design for all** (Bühler 2008; Aragall et al. 2013; Bendixen and Benktzon 2015)
- **Service design** (Erl 2007; Roberto and Alexis 2008; Meroni and Sangiorgi 2011; Beaumont et al. 2014)

These developments of user-involvement research challenge the traditional design approaches, and the users' roles and user-designer relations become a phenomena thrive (Bihanic 2015, pp. vi–vii). Based on the classification of user models and the way of

knowing the user, user studies in the design field can be categorised into three approaches:

The first is **empirical studies**, focusing on literature and relevant data. Designers learn from the existing studies of design theories and former practices. They also use data and references from other different disciplinary studies, e.g. ergonomics studies (physical data), medical research (health reports), economics and management studies (market research, innovation studies), psychology (emotions), and sociology (behaviour, habits, beliefs, culture); or from various surveys and reports (e.g. World Health Statistics annual reports 2005–2015; The International Classification of Functioning, Disability and Health, ICF 2015); or from Standards(e.g. British Standards 7000-6 2005 and regulations, e.g. Americans with Disabilities Act 1990; Disability Discrimination Act 1995). This approach can be characterized as "to learn from the past".

The second is **experimental studies**, focusing on real individuals (potential users, target users, focus groups, or designers themselves and their friends, colleges) to get the first hand data and materials. Designers usually borrow qualitative and quantitative methods from ethnography, and they "typically work in teams and use prototypes during fieldwork to create dialog with the people" (Koskinen et al. 2012, pp. 69–70). This type of user studies can be categorised into three basic forms according to how designers interact with the real user: Forum—to ask, Representation—to observe, and Co-design —to participate (Dong et al. 2007). This approach can be characterized as "to learn from the present".

The third is **scenario-based studies**, focusing on certain sets of 'stories', 'narratives' to build a context of use which involves an actor, various backgrounds, and a series of events. It is "a relatively lightweight method for envisioning future use possibilities." (Rosson and Carroll 2003, p. 1033). Designers "can have a prospective approach and can imagine all sorts of events with many alternative interface ideas" (Hasdoğan 1996). This approach also includes computer simulations, and developers tended to think in terms of two kinds of user: one who was exploring the system with no particular goal in mind and one who knew as much as the developer (Blandford et al. 2007). It is "the imagination of the future".

User studies in design are multi-disciplinary. The three approaches can be mixed in the design process, and in each approach the data gathered can be divided into four types: physical, cognitive, performance and psycho-social. Based on the three approaches of user studies and the four types of typical data, we have developed four models of user involvement in design practice.

3   Models of User Involvement

Due to different ways that designers involve users in the design process, there are various levels of users' activities: At one extreme, users are represented by designers or marketers; at the other extreme, users are the designers who are developing products themselves. Between the two are user consultation and user participation. These four models of user involvement are shown in Fig. 1.
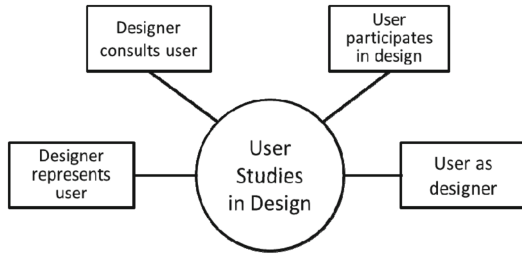
Fig. 1. Models of user involvement

Norman's model (see Fig. 2) will be used to further explain user involvement in design. The model shows the interactions and relationships between the designer, the user, and the system. The design model means the conceptualization that the designer has in mind; the user's model is what the user develops to explain the operation of the system. It depends on not only the system that the designer has designed, but also the various abilities of the users; the system is the only means that designers and users communicate with each other, which often has an interface for operation and responding, and the associated manuals and instructions.
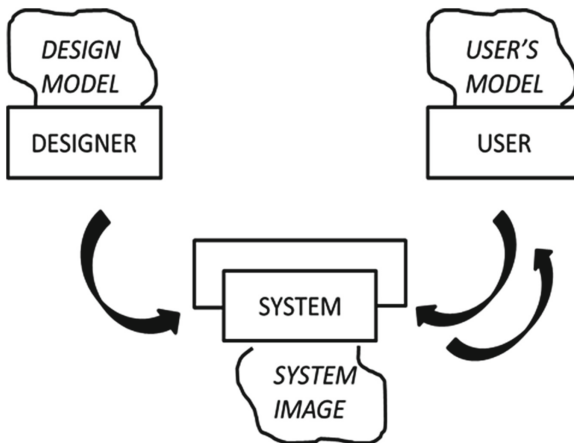

Fig. 2. Three aspects of mental models (Source: Norman 2002, pp. 189–190)

3.1   Designers Representing the Users

In this context, designers are the only users who are 'involved' in the design process, interacting with the device (see Fig. 3). It contains a premise that professional designers are those who know what is best for everyone, no matter who they really are.
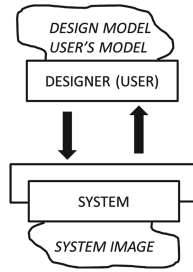
Fig. 3. Designers representing the users

Designers in this model are often users of their own designs, and often think themselves as (typical) users at the early stage of design. In some specific circumstances, this representation can be powerful in getting an insight into the users, the use contexts and the user experiences. Patricia Moore, in the 1970s, made up and acted as an old woman to visit a number of cities in North American with artificial restrictions to her joints, hearing and vision. Her personal experiences show that in the late 1970s there were much discrimination towards old people and people with disabilities in America, especially when using products and public services (Moore 1985). This 'representation' revealed different experiences and conditions that various users encounter, which has made a huge influence on the growing universal design movement.

3.2 Designers Consulting the Users

This model of user involvement is most prevalent in design practice (see Fig. 4). The consultation can take place at any stage of the design process: from conceptual design to detail design. It is helpful for designers to gain access to users, to understand users' needs, requirements, and their responses. There are many different conventions of consulting users in different design disciplines, e.g. product design and architectural design.
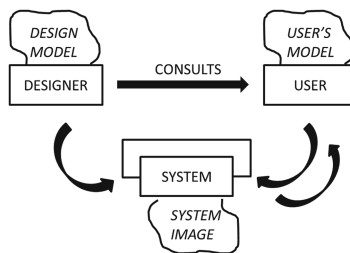

Fig. 4. Designers consulting the users

User consultation can be regarded as a scientific experiment (Newell et al. 2011). The designers are viewed as scientists, and users are the experimental subjects. Scientists pick up and chose what they need from the experimental subjects when doing research

in their lab, then collect and analyse data to achieve their goals. In this model, users play a passive role in the design process and decision-making; they are only regarded as information providers.

3.3   Users Participating in the Design Process

This model is represented by participatory design and user design, where users become stakeholders in the design process. It is a turning point from the information providers to the design participants, from the designer design to the designer-user co-design. It is also a co-creation design process of sharing knowledge, skills and experiences of all the participators (Fig. 5).
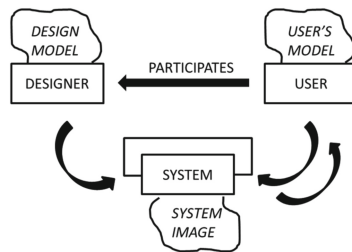

Fig. 5.   Users participating in design

Many methods of this kind of user involvement have been developed (Hanington and Martin 2012; LUMA Institute 2012), such as webpage design and software development (Frick et al. 2001), customized computers (Randall et al. 2007), UTOPIA project (Newell et al. 2011), product design (Kostovich et al. 2009; McAdams and Kostovich 2011; Goodman-Deane et al. 2014). Several approaches and platforms provide supports for user participation in design, e.g. the 'critical user forums' (Dong and Cassim 2007) organized at the Helen Hamlyn Centre at the Royal College of Arts since 2000. Through bringing designers and users with disabilities together, the forums provide designers with an effective method to engage users in design, which inspires designers to develop more inclusive solutions. Open design, an approach that is the 'free distribution, documentation and permission of modifications and derivations' of an object, product or service (Von Abel et al. 2011), offers unprecedented possibilities for not only the end users or amateurs to participate in design, but also opportunities for more professional designers and manufacturers to get involved in the process.

3.4   Users as Designers

This model can be regarded as Do It Yourself (DIY). Through creative thinking and practice to make functional items for themselves, users become designers and innovators. According to Von Hippel's studies, the user firms and individual customers develop or modify products for their own use, and this ranges from 10 per cent to nearly 40 per cent of the innovative ideas and products. "Users as designers are a combination of

existing and customized participatory and empathic design methods that help to facilitate the dialogue needed to illicit personal and contextual information that helps define the user's needs and wants" (Resink et al. 2011) (Fig. 6).
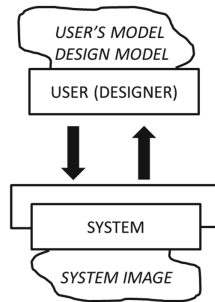

Fig. 6. Users as designers

In this model, users are designers themselves and their creativity often leads to personalized products for themselves in daily use. Because of the lack of expertise and skills, it is rare for users to make the products standardised and then mass-produced.

4   Challenges of User Involvement

User involvements in design are facing three challenges: users' conventions, different cultures and contexts, and company's constrains. Firstly, users' conventions or natural mappings lead users to get an immediate understanding of the relationship between any two kinds of things. Some of them are cultural or biological, and some of them follow the principles of perception. This requires designers to fully recognise what the natural mappings are, and how to apply them correctly.

Secondly, the differences between various cultures result in consumers' different knowledge, experiences, tastes and habits. These differences result in various contexts of use/consumption, which challenge designers when involving the user. Designers might get lost and make mistakes if they fail to choose appropriate methods to understand the users.

Thirdly, user research can be constrained and delayed whether in Small to Medium-sized Enterprises (SMEs) or big companies, because of the limited resources (financial or time pressures).

Several methods have been developed to deal with the challenges, e.g. the Methods Lab (Aldersey-Williams et al. 1999) aims to help designers and other stakeholders to weigh and choose the proper and efficient design methods in design practice or research; The Make Tools (Sanders 2002), regarded as a 'design language' not only for designers, but also for users, are 'built upon an aesthetics of experience rather than an aesthetics of form… and there are many different types of Toolkits that facilitate the expression of a wide range of artefacts and/or models'. The IDEO Human-Centred Design Toolkit provides methods for each HCD phase (i.e. to hear, to create and to deliver), guidance

for role-playing workshops, storytelling sessions, scenario building, and prototyping; it gives voice to communities and allows their desires to guide the creation and implementation of solutions.

Various challenges and methods in user involvement require designers' wide range of abilities, knowledge and experiences. Designers, as Henry Dreyfuss once said, 'must be part engineer, part businessman, part salesman, part public-relations man, artist, and almost, it seems at times, Indian chief' (Dreyfuss 2003, p. 24).

5   Discussions and Conclusions

User studies in design can be categorised into four models of user involvement:

- Model (1): Designers representing users
- Model (2): Designers consulting users
- Model (3): Users participating in the design process
- Model (4): Users as designers

In Models (1), (2) and (3), designers with participating users are usually the first batch of 'users' from early concepts to final products. The roles that designers and users play in these three models are distinguishable, but not rigorously distinct. For example, Model (1) is often mixed with Models (2) and (3). When designers do not have the direct experiences and knowledge that the specific users have, e.g. people with disabilities, the Models (2) and (3) will be adopted. Model (4) is less discussed in existing design literature, but more and more emerging design practice adopts this model.

The four models of user involvement show different relations of designers, users and systems. They will help designers and researchers understand user involvement in a more structured manner, thus making the application of the theory and practice much easier.

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