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The role of flow experience in co-designing open-design assistive devices

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Abstract
This paper describes the theoretical framework of an inclusive participatory design approach which leads to qualitative occupational experiences within the field of community-based rehabilitation. The aim is to support voluntarily controlled activities by applying co-construction theories to disabled users and their dynamic environment. The starting point of this open design process is a threefold interaction involving caregivers, patients and occupational therapists within their local product ecology. Co-creation is used as a set of iterative techniques to steer the patient towards flow experiences. Do-it-Yourself is consecutively applied as physical prototyping, communication language and personal manufacturing process. By implementing this active engagement process disabled people and their carers become conscious actors in providing collaborative maintenance of their own physical, mental and social well-being.

Keywords
co-construction, product ecology, flow experience, assistive technology, co-creation, open design, do-it-yourself, cybernetics

Introduction

Social policy has been evolving recently towards a broader focus on sharing and understanding the wicked aspects (Rittel et al, 1973) within social healthcare contexts. The World Health Organization recognizes disability as “a complex interaction between features of a person’s body and the features of the environment and society in which he or she lives.” (ICF, 2001). Many stakeholders at different levels are involved and changing social dynamics make these interactions even harder to grasp and design for. These phenomena manifest themselves in the amount of assistive devices that hardly find their way to disabled users and if so, the usefulness of these products in the field is

rather low. Each disabled individual requires another approach in order to reach the goals based on his or her personal skills. On top of that each person will carry out other activities driven by their social context and direct environment. Regarding inclusive design, excellent work was already done in the past. Generally the emphasis was put on providing cost-efficient aids and finding a certain stage of consensus which homogenizes abilities. Nevertheless, in practice this view conflicts with personalized care provision in the world of disabilities.

There is another growing trend of framing health in terms of well-being up to and including self-management (Dubberly et al, 2010). The largest healthcare provider in many nations is not the national healthcare system but the local family (Arno et al, 1997). The key issue will not be the provision of more doctors and nurses, needed though they may be, but how effectively people are engaged in the responsible, collaborative maintenance of their own health (Leadbeater et al, 2004). This self-management perspective pitchforks disabled people and their caregivers into a job as designers/therapists, which makes them more conscious of their task to build their own adaptive assistive devices. These pragmatic activities argue for a new design approach which we call co-construction (Evenson.et al 2010) since relationships between care appliances, disabled people and caregivers lies at its heart.

'Design for (every)one' is an multidisciplinary education program which conducts participatory action research (Brydon-Miller et al, 2003) and implements open-design principles within disability contexts. Based on frameworks of sociology, cybernetics, occupational science and positive psychology, a co-creation process for open design assistive devices has been derived to augment the quality of occupational experiences. The aim of this paper is to describe the theoretical framework of this inclusive participatory design approach.

Design for flow

Occupational therapy is as a profession concerned with promoting health and well-being through occupation (WFOT, 2004). As mentioned before, the relationship between our health and what we do is complex. Many people may be able to identify occupations that make them feel good and others that make them feel bad. A deeper understanding of how and why occupations impact on well-being will enable designers and occupational therapist to design better affective, assistive devices and provide more efficient services. One of the most surprising findings in positive psychology is the great effect of voluntary controlled activities on one's happiness (Lyubomirsky, 2007). These findings are used to build a well-being design strategy within the field of occupational therapy.

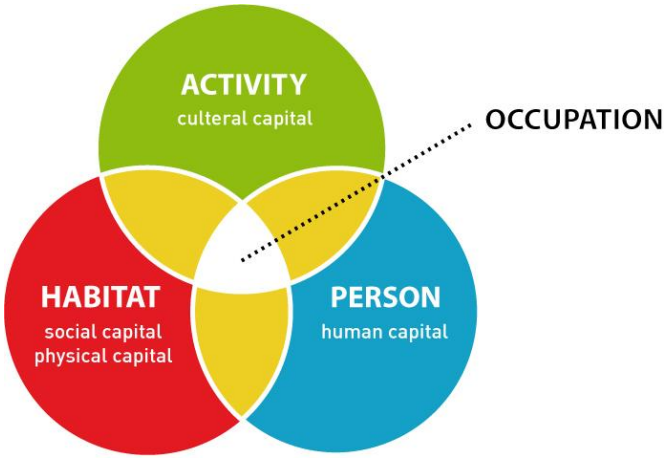

Figure 1: Comprehensive model of occupation

Within occupational science there is a distinction between activity and occupation. The comprehensive model of occupation (CMO, 2010) consists out of three factors that have impact on a well-balanced occupation: the individual himself, his activity capital and the surrounding habitat which in closes both social and physical capital aspects (Figure 1). The model displays a holistic overview of the dynamic variables but it doesn't give stakeholders a notion of the quality of the occupational experience. A psychological construct that may help to unravel the relation between occupation and health is flow (Csíkszentmihályi,1990). In his work 'Flow: The Psychology of Optimal Experience', Csíkszentmihályi outlines his theory that people are most happy when they are in a mental state of being completely involved in an activity for their own sake. Several studies associate flow with an increased level of happiness, self-esteem, work productivity and joy of life. Csikszentmihalyi developed a series of theories to help people to get into their flow state. Since then, these theories have been applied to various fields for designing better interactive experiences.

Of course we can't design experience as such because experiencing is in people. But according to the CMO model designers can still vary the surroundings or the activity as these are both instigators of well-being behaviour. Designers carry out the mechanisms and conditions of flow in the prescribed way when co-designing personal assistive devices with disabled people and their caregivers.

The framework : Co-construction

Designing for one specific user is not new…in fact it is the oldest tailor-made approach we know. However, every single individual problem is connected with individual conflicts of values, goals, skills and specific interests. Thus: if one wants to design meaningful assistive devices, one should take into account the whole product ecology (Forlizzi, 2008) of an individual context. This theoretical framework is based on social ecology theory which focuses simultaneously on the environment and the social relationships among the people within it. It maps all the elements around a disabled user and it examines the broken factors apart from each other and altogether (Figure 2). Within this

organic system, the underlying assumption is that human behavior can be understood as an adaptive fit to an external environment (Netting, 1986).

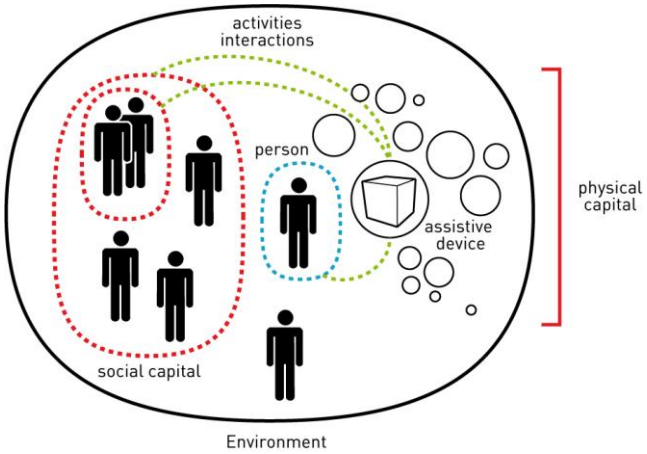

Figure 2. Product ecology derived from Forlizzi

The concept of human adaptation as such is the iterative process whereby an individual becomes better suited to its habitat (Bowler, 2003). We could see this process as a meta activity within the context of design for (dis)ability. In a broad sense, biological co-evolution is "the change of a biological object triggered by the change of a related object". Co-construction (Oudshoorn, et al 2003) examines the product as instigator of change- how it has an effect on people, place and other products in us, effecting dynamic change on all the factors in the product ecology (Forlizzi, 2008). Subtle adaptations can provoke a lot of negative or positive emotions and steer our behavior implicitly towards several product experiences.

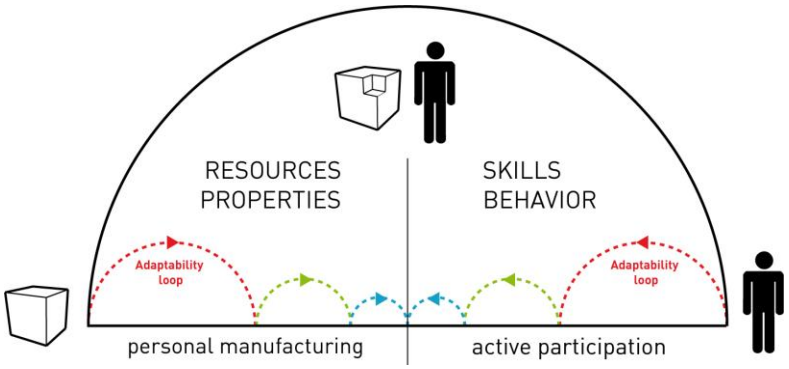

Figure 3. The co-construction of users and assistive device.

Co-construction (Oudshoorn, et al 2003) is a social process in which people and objects and their relationships influence each other and impact upon potential outcomes. The concept is used to identify a form of participatory design. By means of a set of iterative techniques and approaches, co-construction puts users and stakeholders at its heart. While users and stakeholders work from their perspectives, co-construction engages latent perceptions and emotional responses from them to products and services.
In combination with physical prototypes (made by local resources) it becomes a tangible pragmatic tool which continuously shifts between “what is needed?” and “what can be

build?” in order to achieve a qualitative occupational experience (Figure 3). This polarity gives a sound basis for this ‘design for (dis)ability’ approach (De Couvreur et al, 2010).

The process : Adaptability loop

The adaptability loop (Haeckel, 1999) is derived from the classical PDCA quality cycle (Shewart, 1939) build around the key aspects of occupational science. Haeckel proposed this process for coping with changing environments. At first, it appears to be a classic feedback-based control loop based on sense-and-respond. But the options for action include the possibility of changing goals, which is one of the fundamentals in daily rehabilitation programs. Another crucial aspect is the look at this model from a double-loop learning perspective (Figure 4). Unlike single loops, this model includes a shift in understanding, from simple and static to broader and more dynamic, such as taking into account the changes within the product ecology.

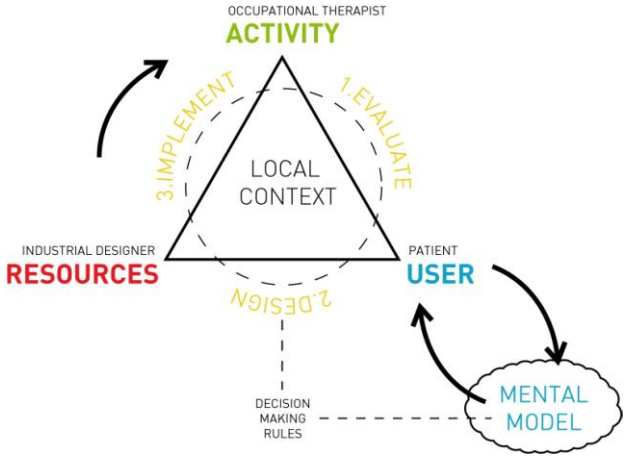

Figure 4. Adaptability loop.

Mental models derived from the flow construct are extended and validated through co-creation of new explicit mockups. By slowly adapting the user to his assistive device and vice versa, we want to steer the patient literally towards a flow experience within his voluntary activity. The product experience is measured by logging the affective responses that are experienced in the user-product interaction (Desmet et al, 2007). Verbal and non-verbal behavior is mapped on the mental state model (Figure 5). Csikszentmihalyi identifies "skills" and "challenges" as the two key variables in the flow experience, placing them on the respective X and Y axes of this graph. He describes occupational emotions as the relationship between the perceived challenges of the task at hand and someone’s perceived skills. Pointing out the position of the client enables designers and occupational therapists to discuss the focus of the next adaptation strategy. It guides the decision making process into new concrete actions.
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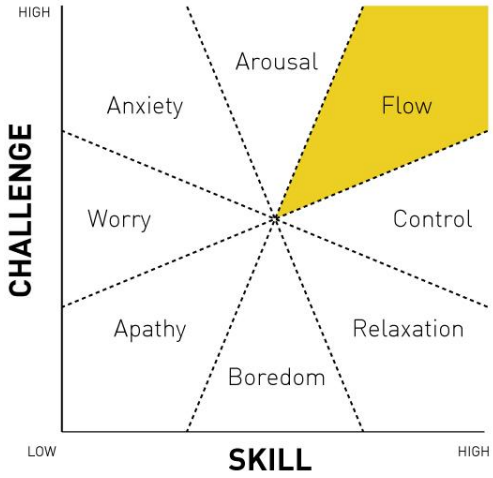

Figure 5. Mental state in terms of challenge level and skill level

Both axes can be manipulated from occupational expertise and designer expertise. Practically, when an occupational experience leads to anxiety, the co-creation team can undertake two types of action. The first action could be to vary the characteristics of the challenge. Occupational therapists can break down activities into achievable components or they can teach new ways of approaching tasks. Within this activity-centered design (ACD) approach, activity analysis is an often applied technique. It is defined as a process of dissecting an activity into its component parts and a task sequence. It allows people to identify inherent properties and skills required for its performance.

A second type of action can be found on the horizontal axes. It rests on augmenting the skills and ability of the patient through human centered design (HCD). This can be achieved through environmental adaptation within the product ecology, including provision of equipment or designing adaptations to remove obstacles or make them manageable. Factors like persons can also be taken into account through guidance of family members and caregivers.

The aim of this process is to co-create a clear view on the occupational experiences and to build a shared dialogic language which is build on physical manifestation of emotions. In reality there is no ideal standard approach. Design for flow switches constantly from ACD to HCD and vice versa. The main aim is to build through co-construction a stage of homeostasis between environment and user. HCD asserts as a tenet that technology adapts to the person. In ACD, we admit that much of human behavior can be thought of as an adaptation to the powers and limitations of technology (Norman, 2005). Adapting technology to users increases the costs. Adapting users to technology takes time. Every individual has its own constraints and possibilities, physically or mentally. These will influence a person's capability of executing his activities and tasks. Through ACD techniques we translate these into functions and properties. We look for matching resources and try to adapt them (HCD) to the context of the patient. This pragmatic process can be run in a number of iterations. Every cycle we gain more insights on both levels. The point of ideality, where high challenges and skills meet, will rarely be reached. Users are moving targets within dynamic environments. What you design for the user today could be wrong tomorrow. This emphasizes the need for a new product language which is highly adaptable and sustainable.

The medium : DIY as co-creation language.

More and more rapid live projects within healthcare contexts are running in order to develop new thinking and practical design solutions in the form of systems, services and products (Leadbeater et al, 2004). Based on wicked problem theory, understanding can only come from creating possible solutions and building knowledge through validating specific solutions with individual users. The role of the mockup or prototype is instrumental. It creates a shared language between all the stakeholders by converting their expertise and needs into product properties. If we want to design qualitative occupational experiences within this dynamic settings, we have to build upon knowledge and skill acquisition from all stakeholders simultaneously and on the spot. In terms of assistive devices this process is already implemented on a daily basis by caregivers, occupational therapists and even disabled people around the world.

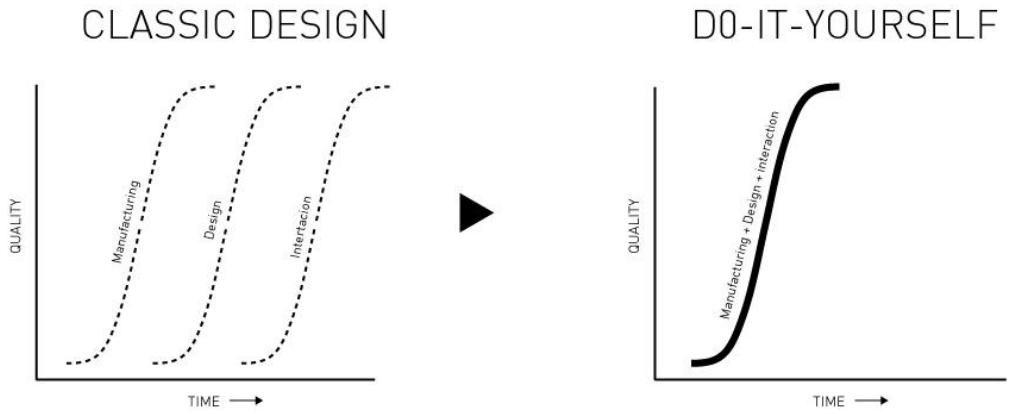

Figure 6. learning curves

A nice reference to illustrate this phenomenon is “instructables.com”, which is a web-based DIY documentation platform where passionate people share what they do and how they do it, and learn from and collaborate with others. If we look at the category “health”, we find numerous of disruptive assistive devices adapted to personal settings. All these projects can be considered as small co-creation projects between caregivers and their disabled relatives. Compared to standard assistive devices, the degree of usefulness of these projects is high, due to the right balance between user, environment and activity. The DIY approach empowers people to validate their assistive devices through co-creation with the surrounding product ecology and with the local resources and skills available.

Recently the two phenomena have been compared (Hoftijzer, 2009) which leads us to some remarkable parallels and conclusions. Co-creation could very well be regarded as a new type of DIY, adapted to modern times. Physical prototypes being part of a professional language can help designers and occupational therapists to better understand the complexity of an assistive design (Schön, 1983). They offer a tangible

physical summary of the knowledge related to all involved aspects (manufacturing aspect, design aspect, interaction aspect,…). They even give a designer the opportunity to solve several problems in less design iterations (Figure 6). The result is an open design process which leads to a personalized manufactured product. This scenario of assistive devices even includes self- repairing and recycling of local resources. Designers will no longer only design for people. They will have to learn to design with people. Cheap and powerful prototyping tools combined with physical hacking principles can turn non-engineers into self manufacturers. Professionalize DIY towards open design could be the first step to bridge this gap.

CONCLUSION

Although this framework has been partly validated through several small case studies (figure 7), a lot of research still needs to be done. It aims to extend design culture within the field of occupational therapy by providing a roadmap for choosing appropriate and qualitative research methods which can be used by non-designers. The shift from product to experience is already strongly embedded within current design culture, but for caregivers and occupational therapists it opens out a new way to look at their problems in the field.

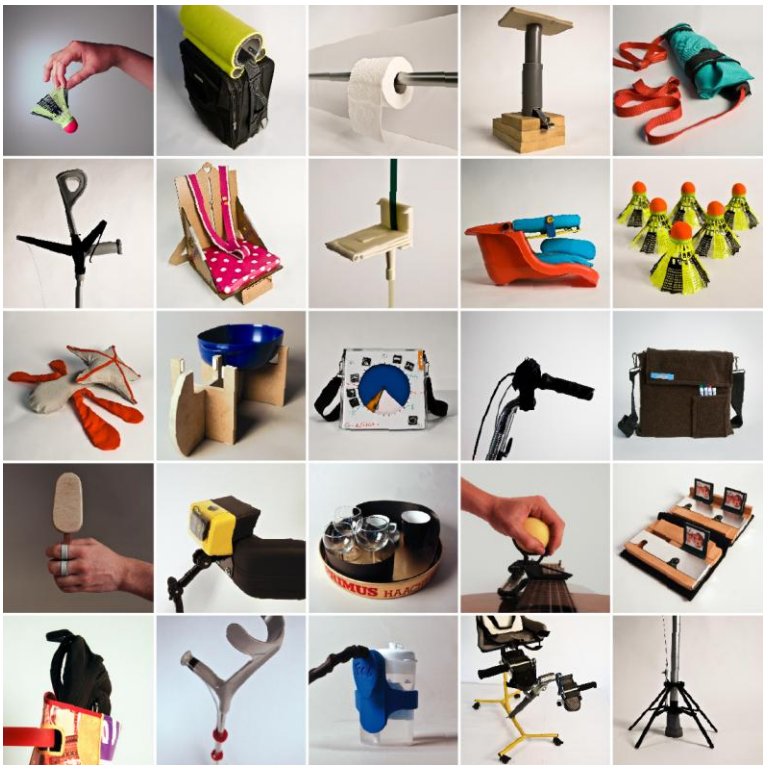

Figure 7. design for (every)one case studies

The process tries not being prescriptive. It rather attempts to build on the use of local implicit knowledge. This participatory design method allows participants to understand the experience domain of the patient within his or her product ecology. The array of

gained user data explores three perspectives (Sanders, 2001) simultaneously: what people say (evaluate) and what they make (design) and what people do (implement). They try to sketch a clearer view on the phenomena that contribute to wicked problems in healthcare. The results prove the fact that people are disabled by the context they live in and not directly by their impairment or shortcoming. Just as design can disable, it can also enable people to manage their well-being in a self-organising sustainable way.

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