User Interaction Patterns and Strategies in Large Interactive Device Landscapes

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Today, most individuals in developed countries live with, and use, a large number of *interactive* artifacts, systems, and devices. This does not, however, mean that they fully know how to interact with these devices or how these devices interact with each other. Any network of interactive digital artifacts, or *interactive device landscape,* creates, due to its dynamic and interactive nature, emerging qualities difficult to describe, analyze, and explain.

To live within and to make use of large numbers of interactive devices is quite challenging and can be a source of frustration for many individuals since they do not feel as if they understand or have control over their own immediate personal interactive environment. At the same time, most people continue to increase the complexity of their interactive device landscape by adding even more artifacts leading to an increase of both interactivity and connectedness. Being a *user* or an *owner* of a large set of interconnected devices is a growing concern that, so far has not gotten sufficient research attention. To complicate this further, people do not live in easily defined device landscapes. They live in a complex reality where artifacts, devices, and systems from work, home, and public domains create networks of devices that to an individual all overlap and becomes one large emergent device landscape.

There is a need for HCI research aimed at the analysis and examination of user interaction patterns and use strategies of interactive device landscapes with the purpose to create knowledge about how people, over time, *experience, understand*, and *strategize* their use and development of their interactive device landscapes. There is also a research methodological need for appropriate approaches and methods for such examinations.

One reason for the study of large device landscapes from the *perspective of the user* is the fact that people's interactive environments are *not* intentionally designed as a system or as a whole. Designers and developers only have control of the design of individual artifacts or maybe parts of a network but the final composition of a person's device landscape is a result of decisions made by many designers, developers, service providers, employers, and others. The final emerging device landscape, *as experienced by the user*, is *not* a designed entity; instead it is a composite, an emergent entity that evolves from a day-to-day process of adding, removing, and exchanging new individual devices, systems, and infrastructures.

This perspective differs from what is commonly found in *ubiquitous computing* and *pervasive computing* research (Abowd & Mynatt, 2000; Rogers, 2006; Greenfield, 2006), that so far have been quite focused on particular solutions based on specific perspectives, for instance, from *an information management perspective* (Oulasvirta & Sumari, 2007; Dearman & Pierce, 2008); or a *technical infrastructure perspective* (Rodden & Benford, 2003; Schilit & Sengupta, 2004), or a *mobile contexts perspective* (Mainwaring, Anderson & Chang, 2005; Woodruff, Anderson & Mainwaring, 2007). Most of this research has a perspective that is generally *systemic*, that is, it is based on the assumption that the overall question or challenge is how to design systems that lead to a well-designed environment for a user. So, while ubiquitous approaches often focuses on the interactive environment as a coherent system of carefully managed computational devices and resources, the approach proposed here would take on the study of device landscapes as they are understood and handled by an individual user (or small groups of users).

We therefore propose *user interaction oriented research* on large-scale pervasive systems based on the assumptions that there is a general need for:

- *theories* and *frameworks* by which we can describe, analyze, and interpret what it means for individuals to use, live, and manage interactive device landscapes,
- *design* and *development perspectives* that better recognize and can build on knowledge about how people already use and strategize their device landscapes
- *methodological development* in how to study user interaction patterns and strategies in interactive device landscapes.

The proposed approach is inspired and based on research we have conducted over the last few years where we have explored and tested some of these ideas and also experimented with some potential methodological techniques and tools. In this initial research we found that users develop, not necessarily conscious, highly diverse ways of understanding, strategizing, and managing their device landscapes (Jung et al, 2008: Ryan et al 2009). We see these preliminary attempts as promising but there is a need for much larger initiatives, with more diverse and developed approaches, carried out by many research groups.

Even though research of device landscapes as proposed here is challenging in many ways, primarily because of the complexity of the object of study, and can be overwhelming, we are convinced that knowledge about human computer interaction is not anymore only about the traditional task-focused single-artifact/single-user context, or about the interactive well-designed ubiquitous environment (system). Instead, for most ordinary people, "human computer interaction" is about the constant struggle to create and handle, and to make a meaningful and functioning whole of the vast number of interactive devices that play a role in their everyday lives. As researchers we have a responsibility to address this new reality as a serious research and design challenge.