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EDITORIAL

Thinking beyond the box: designing interactive TV across different devices

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Nowadays television means more than the passive consumption of broadcast content. Television sets are equipped with modern computer technologies and provide manifold opportunities for accessing content interactively and on-demand. Personal devices such as the smartphone can be used as a second screen to show additional information, to chat with others and interact with the content on the main screen. Additionally, new technologies such as gesture or audio recognition are being integrated in current market technologies. These enable new ways to control and interact with content. Beyond simply watching television, the TV set now provides opportunities for using home-related services including online gaming, visualisation of energy consumption, home security and support for healthy living. The TV set is thus becoming a high-tech platform for on-demand media consumption which integrates a variety of home computing services.

The ubiquitous nature of current home technologies requires interdisciplinary perspectives for designing new value-adding services. Interweaving developments in novel technologies, findings from empirical studies and user-centred design help us to shape these services. Designing for such an environment with a multiplicity of interconnected devices requires multi-faceted research that explores people's needs with regard to technological feasibility. It needs to explore the limitations and opportunities for novel interaction between people, their practices, innovative technologies and new content formats.

This special issue of *Behaviour & Information Technology* addresses novel interaction concepts that connect different devices and interfaces. For instance, a tablet computer can be used as a secondary screen for remote control or for tweeting and chatting, when related to the TV content. From a design-oriented point of view, new concepts which add value for the user need to be evolved in a more integrated manner, for example accessing Internet services on TV, or making content accessible on various devices. Additionally, new interface technologies such as gesture and audio recognition offer new opportunities to interact with iTV functionalities. Such an integrated platform provides manifold opportunities for the research community to design value-adding technologies and services. Besides investigating new interaction technologies, further research may provide an integrated perspective on how new interfaces could better be linked to new content formats. New interactive services need to combine intuitive and easy-to-use technologies with on-demand forms for interactive storytelling. In any case, social studies are highly relevant and help us to understand how new services such as these are used in daily life.

The papers in this special issue address TV-related design concepts and present empirical studies exploring how users interact with interconnected services. Attention has been strongly focused on the usage of alternative control and interaction mechanisms, whereby three of the papers present technological concepts for using hand gestures or secondary devices to interact with video content. Louise Barkhuus, Goranka Zoric, Arvid Engström, Javier Ruiz-Hidalgo and Nico Verzijp present a new interaction mode for panoramic live video. Users can trigger commands by making gestures in mid-air with their hands. Niloofar Dezfuli, Mohammadreza Khalilbeigi, Jochen Huber, Murat Özkorkmaz and Max Mühlhäuser present a hands-free interaction concept: users can interact with content on TV by tipping the palm of their hand with their fingers. Regina Bernhaupt and Michael M. Pirker present insights from using the smartphone as an alternative control device, and in their paper they also summarise guidelines for the design of interaction modes with companion devices.

In comparison to traditional forms of TV, reception might be possible with other, alternative, approaches. Lizzy Bleumers, Wendy Van den Broeck, Bram Lievens and Jo Pierson present a new technology called 360° TV. This enables users to watch video dynamically in 360°, similar to the view of a camera operator who moves freely. Two other papers help to understand how media centre systems and related technologies, such as smartphones, are

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integrated into the social practice of households. Benedikt Ley, Corinna Ogonowski, Jan Hess, Tim Reichling, Lin Wan and Volker Wulf investigate how TV and social media are being used in daily practice. Results from a long-term study in a living lab setting provide insights into the effects that Internet-enhanced TV sets and smartphones have on the life in 16 households. Cédric Courtois, Lieven De Marez and Pieter Verdegem present empirical insights regarding the role of technology in audiovisual media consumption. They identified relevant patterns of watching TV, expanding the practice by using multiple devices and replacing the television with a laptop.

The papers in this special issue give an insight into novel TV-related technologies for the living room, including alternative interaction concepts, such as interacting with TV content by hand gestures, new viewing modes and empirical studies of media usage. Two of the papers provide a detailed understanding of the current practice of TV and video reception on various devices. Media centre systems allow valuable opportunities for more flexible, on-demand and integrated services. The results also show how watching TV is replaced or enriched by new consumption and interaction modes on secondary devices. Investigating this practice brings to light several implications as to how new technologies are embedded in the daily practice of households, and how they are actually used. For further design cases we need to understand the implications of the technologies used in daily life in various types of households. We also need to find new ways of co-designing more closely with users, in order to identify needs directly and explore how prototypes are adapted in households.

From our point of view, designing for the living room provides great potential for further investigation. In the future, TV is most likely to become an integrative platform for all kinds of interactive services, such as healthy living, home control and easy-to-access community functions. Novel services and interaction concepts need to address a contextualised, well-adjusted functional design by considering the characteristics of TV as a shared screen. Further work may explore new design perspectives on how users can be supported with new multimodal interfaces and with functionalities for social exchange within and between households.

Some relevant research areas for further work are listed below.

- *Multimodal interaction concepts and interfaces*: in further work we need to explore multimodal interfaces connected to the TV. Physical artefacts, new forms of interaction between available devices, and the combination of these provide an interesting design space. Also of interest are novel approaches of proxemic interactions for the home, concepts that recognise the context and adapt the interface semi-automatically. It is important to design new forms of interaction for different devices considering the characteristics of user types and their requirements in various contexts (family usage, within home usage, on the way usage, etc.).
- *Functionalities for social exchange*: existing market technology, such as a Facebook plugin for smart TVs, is straightforwardly implemented as standalone functionality. In further research we need to find novel concepts that make use of the TV as a shared display in the living room, for example by displaying content merged from different profiles, favourites, and likes related to a household profile. The design of new community approaches also needs to support cooperation and media exchange between households in a more active, easy-to-use and playful manner. A user-centred design that also considers personal and community modes is particularly relevant. We need to investigate better integration of social networks and the design of different views on data.
- *TV as integration platform*: TV becomes an integration platform for any kind of service. In further work, the TV as a public shared display will be able to connect to other sensors/actors in the home and visualise any home-related information services, such as energy consumption, or to support health and well-being. With such approaches, it will become increasingly important to support and guide users by pre-selecting and recommending media content and services to address particular needs.
- *Methodological investigation*: the design of new services and interaction concepts must be linked more effectively to the practice of usage in households. We need to investigate new methods and tools for co-designing in practice (Living Lab). Such continuous forms of co-designing should support different stakeholders in an interdisciplinary manner. We need to shift practice-based research from a ‘single-user study design’ to a more long-term exploration of how technologies are suitable for use in daily household routines. Such processes need to be supported better by tools that support user–user and user–developer cooperation continuously.

Eight submissions were received for this special issue: seven manuscripts were invited, and revised versions of highly rated papers that were presented at EuroITV 2012 in Berlin. A further paper was an extended version of a full paper presented at EuroITV 2013 in Como. Each manuscript was evaluated again by two reviewers. Based on these reviews, six manuscripts were invited to resubmit. After another round of improvements, we finally accepted all six of these papers for publication.

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