Spinning in Control: Design Exploration of a Cross-Device Remote

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ABSTRACT
You buy a new TV and get a new remote, you buy a DVD player and you get another remote, you buy a sound system and guess what… Almost every digital media product comes with its own designated remote control (RC). What would happen if one remote adapts to the owner's activities and is able to have cross-device control? In this paper we describe a design exploration conducted to create new ways to interact with digital media products. The main ingredients are: fit for a social setting, portable, and including physical interaction. The result is an exploration of a button less single-hand remote control concept.

Author Keywords
Remote control, cross-device interaction, physical interaction, interaction design

ACM Classification Keywords
H.5.2. Information interfaces and presentation: User Interfaces

General Terms
Design, Human Factors

INTRODUCTION
Since the appearance of the first commercial remote controls in the 1950's the number of remote controls per household has gradually increased. Nowadays there are remote controls for digital media devices such as TV's, sound systems, and DVD-players, but also for controlling environment conditions such as lighting and temperature. Each RC has its own set of dedicated buttons with a specific functionality, such as Volume UP/Down, channel choice, or lighting ON/OFF. Originally, these buttons were the result of what was technically possible at the time and since than it has been taken for granted as the way to interact with products. Advantages of these traditional types of RC are the functionality overview, the potential speed of interaction and the interaction from a distance.

The task of controlling all the individual devices with different traditional RC's can become very tedious as each product has its own designated RC and each activity requires a different set of devices. Clustering of relevant devices that relate to a certain activity is a typical solution to circumvent this problem [13, 14] and is task or experience based [12-14].

In this paper we present a design exploration on how to interact with digital media products in the context of the home. We focused our work on two aspects. In the first place is the fact that remote controls are public devices that often come with one appliance. But this appliance is often used by a complete household and at times even by visitors. How can the content of one RC fit the individual user's needs? Secondly it consists of taking the interface beyond the default button-based interaction and explores new interaction possibilities. For this we adopt ideas from physical interaction for their intuitive use that might work well for digital media product users [6]. What could the physical design of a remote look like?

Figure 1: Concept stages, first top left to last bottom right

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Related Work

For our work we took a look at related work, including generic multifunctional RC's such as the Logitech harmony, and strong conceptual examples in the field of physical interaction. The first related conceptual example is the TUISTER [2]. This is a double-handed physical remote control. Here the user has to twist both ends of the remote to interact with a media product. Another interesting work is the Pipet [10], a concept that supports photo sharing by sucking up and shooting a photo from the remote to the display. A third example is the Peppermill [15] which is a two handed RC that uses a mechanical rotary system to harvest just enough power to execute the intended operation.

Several interesting concepts use inspiring types of interaction: Siftables [11] consist of several small blocks with displays that are able to interact with each other; CubeBrowser [17] makes use of the rotation of a cube to navigate through photos; Alarm Clock [16] allows the user to use his expression to set an alarm clock; Marble Answering Machine [1] translates messages into marbles that can be picked up and dropped into several action fields; and the Magical Interaction remote [4] a remote that allows interaction by simple gestures without touching the device. We have used this work as input into our design exploration.

METHODLOGY

For the process we have followed the Reflective Transformative Design Process (RTDP) [8] in combination with design research for physical interaction [7]. In the design process we put an emphasis on the creation process that allowed us to have three iterations that included a focus group, co-design and an expert review. And prototyping methods like paper prototyping, tinkering models and working prototypes.

The concept of personal RC's can best be explored in dynamic social environments with different digital product availability and use. Therefore we have chosen a family environment composed of adults from 35 to 55 and children who live at home.

CONCEPT DEVELOPMENT

Based on observations, focus groups and related work we were able to abstract our focal point in three axes: and define our design directions: first of all "*Generic – Specific/Personal*"-axis from general 'unisex' RCs to tailor-made RCs, it should be personal: the user should be able to adjust and engage with the RC on design, layout, functionality and workflow. Secondly an axis "*Traditional – Physical*" defining the amount of physical interaction used to control and creating a concept that goes beyond traditional buttons [3]. Lastly, the "*Immobile – Mobile"* axis defines the degree of portability of the remote, and depends on size, weight and functionality. Our RC should have a compact design and the functionality has to adapt to environment, increasing the mobility of the RC.

The first iteration concepts consist of rather basic tinkering materials, such as paper, rubber bands, and wooden sticks (Figure 1, number 1 to 3). In next iterations the concepts grow more mature, as do the construction material (Figure 1, number 4 to 6). The concepts can be categorized into three main types. The first type of concepts consists of tabletop concepts: an RC device on a centralized location, e.g. coffee table. The available functions are bound to the products available to that room. Interaction is located around a playing field, which could consist of a centrally localized device, or the combination of several artifacts. One example of such concept is the *Game board* (Figure 2, bottom left). It consists of a field where each subfield represents different functions. With pins and rubber bands the user can make networks, personal presets and keeping an overview of what others might be doing or using. In general tabletop concepts resulted in a good overview of functionality.

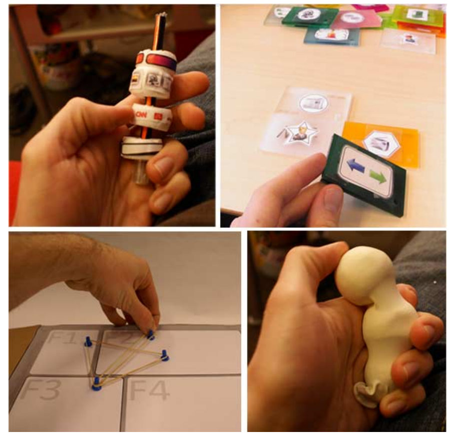

Figure 2. Tinkering models of concept directions. Top left to bottom right: Slider Stick, Puzzle Piece, Game Board and Ball

The *Puzzle piece-class* is the second main class, which is characterized by many separate interaction artifacts. These elements can be randomly placed and give their own context and meaning to the controlled products. An example is given by *Blocks* (Figure 2, top right): blocks that can be shuffled and stacked in a random order to activate products. Each product or function has its own dedicated block. For example: one for the TV (on/off), one to change channels up/down and one to change volume up/down. This class can be considered as a more mobile variation to the tabletop.

The last class is the Hand held-class, and consists of portable devices, similar format as traditional remotes. However, our concepts make use of physical interaction: browsing, navigating, and interacting on a more natural way by making use of people's manipulation skills and experience. The Ball (Figure 2, bottom right) is an example of the hand held class. Two spherical shapes are connected by a flexible material that can be pulled, twisted, turned, flicked to control objects. Each movement results in an interaction with the device. This allows many degrees of freedom in the movement, facilitating small hand and finger gestures. The *Slider stick* (Figure 2, top left) is another example: an object with rotating wheels that are used as dedicated knobs, for example one for the up/down of the volume, one for channels and one to browse through music libraries. The user is able to compose his own remote to what he wants and needs at that moment by selecting the related wheels to place on the stick.

User Involvement

A focus group was organized to extract the values of ideas and concepts. The group consisted of two female and two male participants in the age range of 24 to 50 years. All have experience with digital media products and were living together with their partner. From the focus group we have learnt that the available choices presented to the user should be limited. As a participant explained that too many choices generate noise that causes people to fall back to an obvious choice. This refers to in the aesthetics introduced “Less is more” or 80/20 rule [9]. In RC design this could be a cut in the total number of functions and result in the consumer using for example 15 of the 25 functions instead of 20 of the 75 functions. Another participant added that additional functionality does not directly result in an increased product experience.

Producers of electronic products have tried to simplify the interaction by means of generic presets e.g. pre-installed color and audio settings. From the focus group we learned that these presets typically do not fit individual wishes and therefore are seldom used. Additionally, the participants also mentioned the functionality of the RC as an important aspect; it should only provide the information and functionality that is currently relevant. For our exploration it was important to provide ease of use for novice users and feedback about performed actions to all users.

Expert Involvement

A group of experts was also asked to contribute with their knowledge and experience in the field of industrial design and physical interaction in an expert evaluation. This expert evaluation was conducted with 3 trained industrial designers that have experience and knowledge in the field of physical interaction.

A general, but important comment, regarding this RC design is to take the original function of the RC into account, which is to “not having to walk over” to the TV. The slogan Zenith Electronics used in the 1950’s applies to this comment „Change the life of the lazy people for good”. Considering this a tabletop system would have a lower chance of success, as the user would need to get up and out of his sitting position to alter settings, which is not the intended goal of a remote control.

Another element the experts found intriguing was a Lego like approach, having a remote control that each user can alter to his own needs. They indicated that this could be software or hardware based ‘Lego’. However the remote should not contain more than three physical building blocks as more could negatively affect the usability of the design. More blocks allow more room for interpretation and thus more room for confusion. Additionally more elements require a higher cognitive load and more hands compared to the two handed TUISTER [2]. So a one-handed controllable remote would be preferred by the group of experts.

Furthermore the RC should allow for playful interaction that makes it nice to hold, fiddle around with, and become skilled in fast and easy navigation. Besides this it is worthwhile to

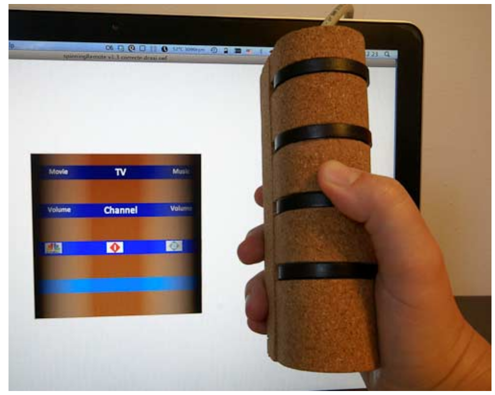

Figure 3. Spinning Remote demo, changing channels.

understand unpredictable usage of a product. Two expert evaluation participants mentioned that they have an unusual and pointless habit of constantly removing and putting back the battery of the RC while watching TV. Taking these elements into account, we were able to evaluate the available concepts and use these guidelines for new and improved concepts.

Final Design

The process described above has led to the *Spinning Remote* that is an individual remote control that allows for multi-product-control. The concept consists of four wheels that contain the functionality of the remote. Each wheel should be accompanied by a small display that generates a peripheral view and provides the user with functional feedback and feed forward. In the prototype (Figure 3) we decided, for practical reasons, to separate the input and the output (display) from each other. The peripheral view is displayed on a monitor and programmed in Flash while the input is controlled by a set of Phidgets [5] actuators.

The user controls the activity through a hierarchical menu structure (Figure 4). That provides him with the options that he needs, preventing from distraction and noise. The wheel is used to select a function; the subsequent wheels set the parameters. For example the first wheel is used to select the activity of watching movies, with all relevant products connected to it such as TV, sound system, lighting and media station. The second wheel is used to select the movie from a database, the third to start/pause playing, and the fourth for setting the volume. Obviously the function of the lower wheels depends on the selections made with the wheels above. For proper feedback to the user the wheels should be embedded with flexible screens that show the options available. The options should be presented such that the user always sees the previous and next item on the hierarchical wheels, creating a peripheral view (Figure 3). For an additional personal experience we decided to use an organic and soft material that should increase the experience of holding it (soft and smooth in the hand) and make it become part of the owner by the natural wear and tear from the cork material.

EVALUATION

The final concept was evaluated by consulting four experts from academia and the Consumer Electronics industry. The

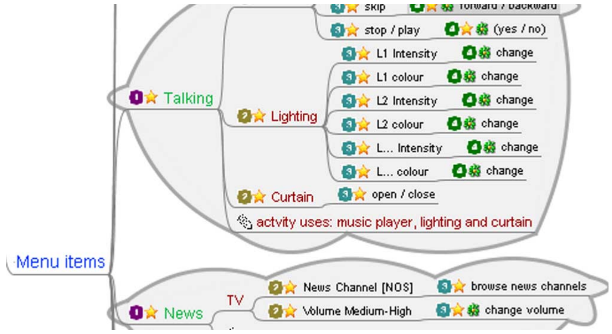

Figure 4. Element of hierarchical menu structure.

unconventional idea of using cork for the finishing of the RC was generally appreciated. Furthermore the interaction concept of the rotary wheels should be taken some steps further. First, the user needs a means to confirm a selection. This is important since otherwise the whole system changes on each move of a wheel. Confirmation can be implemented by means of clickable rotary wheels, similar to clickable mouse wheels. Second, the user can be supplied with a tangible feel of the amount of data that is available on the wheel. For example, 10 items would allow larger interval between rotation steps than 500 items would. This could be achieved by developing dynamically changing discreet rotation sensors. The feasibility of the hierarchical wheels has not fully been evaluated. The content and flow might need to be altered, depending on the outcome of further research with the working prototype.

DISCUSSION

From a design perspective the RC currently is fairly bulky, which could unpractical, but eventually it should allow the user to have a good grip and single handed control on the RC which is not possible with the TUISTER remote [2]. The extent to which the user is willing to use the Spinning Remote will depend largely on the final size and functionality of the device. With respect to the functionality of the design two additional aspects need to be further tested and considered. Firstly, the user may get disoriented, as the four wheels are identical in size and placement. Although the design has already offset the location on the wheel, this will still be a potential danger. Secondly, the tree structure of the operation flow could be too complicated. (Novice) users might get lost or experience a high mental load while navigating. On the other hand we do see a lot of potential for this type of RC as it allows us to browse through vast amounts of items (e.g. channels, songs, and photos) rapidly. And after a short learning curve users will be able to navigate without having to look at the remote.

CONCLUSION

In this paper we have described our exploration study to find cross-device remotes that employ physical interaction. The physical interaction is implemented by means of rotary wheels that provide a more natural interaction with content and functions. The personal appearance is realized by using the cork finishing that erodes through usage.

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