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Designing iLook: An integrated, zoomable interface to support users' interaction with networked home appliances

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ABSTRACT

iLook is a user interface designed to support everyday interaction between people and home appliances focusing on four potential assets provided to us by a leading home appliances manufacturer as a design brief: a) remote control; b) assistance and maintenance; c) ecological-economic impact; d) social networking. We discuss the participatory design process we followed firstly focusing on the future workshops and cultural probe phase where mixed groups of researchers, designers and managers from the manufacturing company and end-users produced concepts and innovative services. The concepts were enriched and refined through diaries given to the participants who produced envisioning scenarios that that described how the concepts would influence their everyday interaction with appliances. Then secondly on the role prototyping workshop where 22 interaction design students produced sketches, explored unexpressed features, functionalities and contexts of use of the earlier concepts through the use of scenarios. To organize the outcomes of the earlier phases we devised a five-level information architecture for interaction with home appliances in the physical space and mapped the four assets onto each level. As a result of the process we present three steps towards the final prototype of iLook, a zooming user interface (ZUI) that embodies some focus+context and augmented reality features allowing the integration of the different assets on the diverse home appliances in one unifying context. We discuss users feedback for each presented prototype and the guidelines we derived for further redesign.

Keywords: *Participatory Design, Information Visualization, focus+context, zoomable user interfaces, Sense Making, Networking, Augmented Reality.*

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1. Introduction

The paper addresses the design of new services for home appliances (dishwasher, washing machine, refrigerator and oven) and the enhancing of customer experience by means of digital networked technology. Indesit Company, a leading manufacturer of

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home domestic devices, hired us as a research and design team. As a brief we were instructed to conduct research on four assets: a) remote control; b) assistance and maintenance; c) ecological-economic impact; d) social networking. The design brief was clear about the expected results: the proposed services (infrastructure, functions, interface and interaction) should create unambiguous added value regarding the reason, motivation and experience of buying and using home appliances for the final user.

Other examples of technology that integrates home appliances exist but they tend to focus on a home-wide smart home implementation rather than the integration of specific home appliances with one consistent user interface that allows a range of actions and interactions beyond remote control and energy saving features (Koskela & Väänänen-Vainio-Mattila, 2004; Quintal, Nunes, Ocneanu, & Berges, 2010).

As an example of the activities we want to support through the technology we design we can consider a washing machine. Initially the user can view the available washing programmes and select them. To aid this decision they can explore the energy consumption and resulting economic impact of running these cycles at different times of the day through various visualizations or they can access user support and forums for other user's recommendations. They can also schedule the running of other appliances so as not to clash with the washing. If the user experiences a problem they can then view further visualizations of the inner components of the machine and inspect and compare them for defects. Further visualization can show a step-by-step guide on how to fix the problem or remotely contact manufacturer support with clear details of what repairs are required. Users can also network with other people who experienced similar issues to see how they managed to solve the problem. This can all be done through the interface of any of the appliances, not just the washing machine, or through a smartphone or tablet which are networked to the appliances. Figure 2 shows a summary of these interactions at high-level and how they relate to the four assets of the brief.

The following section describes the main steps of the participatory design process that led to the current work-in-progress solution, the initial proposal for the inclusion of concepts in iLook and requirements for the user interface. Section 3 presents the first two mock-up interfaces of iLook incorporating these concepts, along with their evaluation and a further refined interface based on a graphical evaluation of the mock-ups. An augmented reality extension for use with tablets and smartphones, both in and out of the home, for iLook is proposed in Section 4, known as iLook Inspection. Section 5 summarises our contributions and conclusions.

2. The participatory design process

A design process concerning home appliances must consider as a lead the user's point of view in a real-world setting because interacting with domestic appliances is a well established human activity for which every end-user has clear aims and can define specific conditions of satisfaction (Marti & Rizzo, 2003). For this reason we chose a participatory design approach (PD). Our goal was to collect suggestions based on everyday experiences and to envision new possible services for home appliances with the direct involvement of the final user. We report in the following diagram the flow of our design process including the sub-steps we briefly account for in the paper.

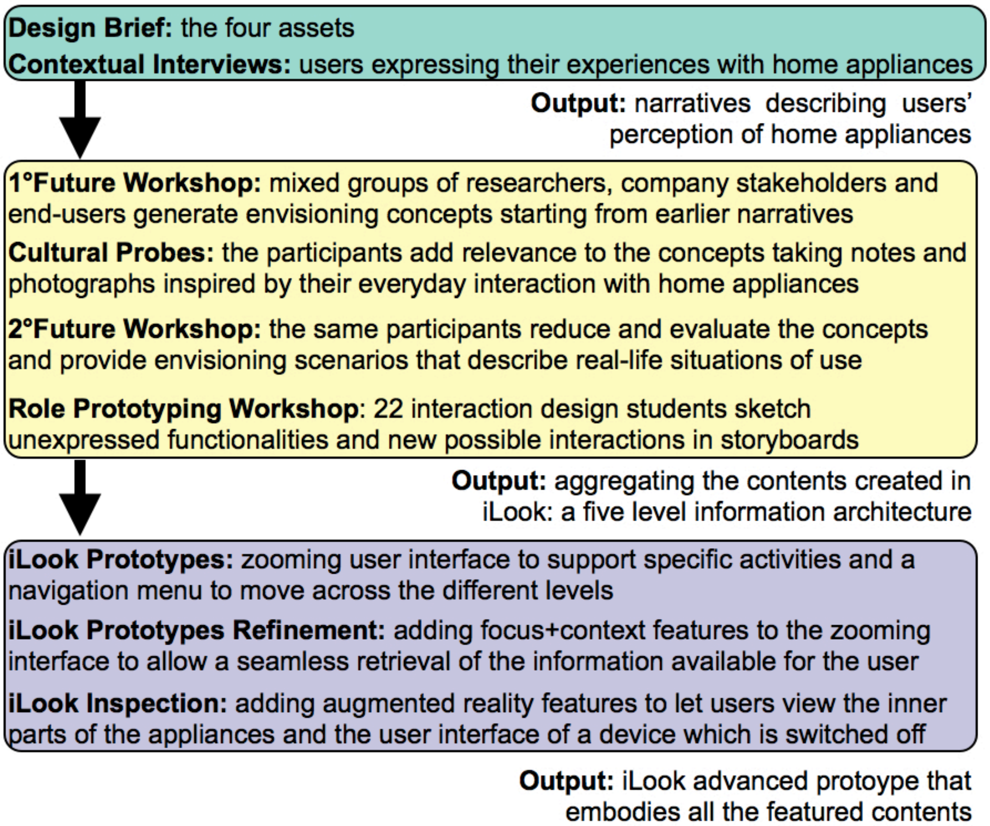

Figure 1. A diagram showing the design process step by step. The first box contains the initial steps of collecting user' perceptions, the second the phases of the participatory design process and the third the phases of iLook prototyping. Their outputs are indicated on the right hand side.

In this section we focus on two essential steps of the design process: a) the future workshops phase that we integrated with the use of cultural probes (Gaver, Dunne, & Pacenti, 1999); b) the role prototyping & concept design phase, which we conducted through a workshop with interaction design students. Before involving the users in the process we designed the map below to explore how the four assets are conceptually related to have an idea of possible design paths.

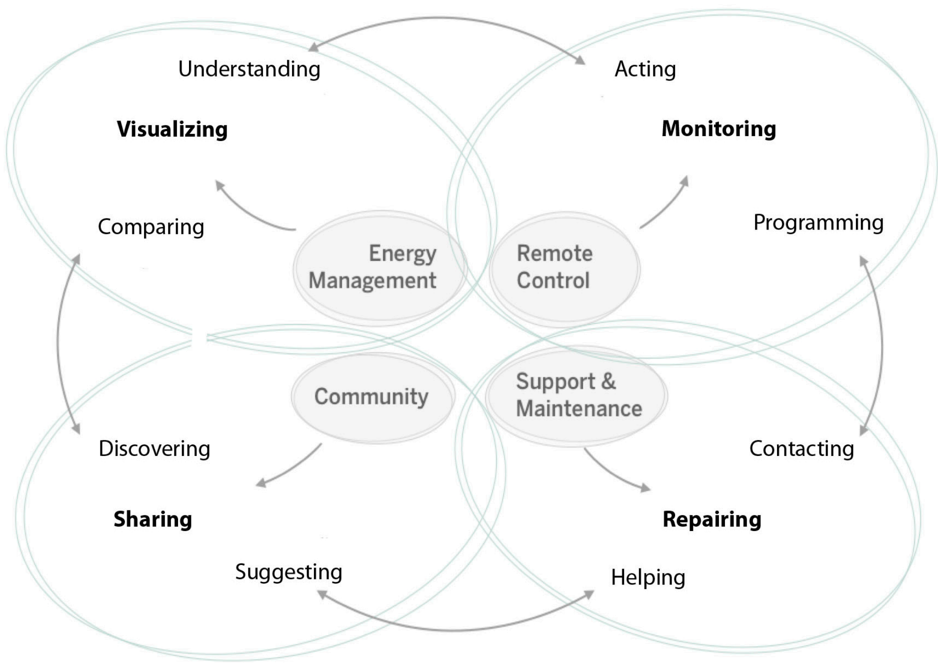

Figure 2. The four potential assets of Indesit's design brief, their features and their interrelationships used to define concepts and possible interactions. Each asset is included and the word in bold is the main feature and the other words are the secondary features. The intersections indicate how the assets are interrelated and the arrows connect specific features between two related assets. For example, in the Energy Management asset we list Visualizing as a main feature and Comparing and Understanding as secondary features. The asset is related to Community through the connection between Comparing and Discovering and related to Monitoring through the connection between Understanding and Acting.

We started with preliminary contextual interviews with end-users that we can sum up in the following statements: a) the four assets clearly have a different weight in users perception (i.e. saving money and energy is considered more important than every other issue); b) the services and the interaction should be available on multiple devices: appliance displays, smartphones, tablets, personal computers and ad-hoc devices; c) the mood should not be that of appliance-centric home automation system but more an "under control" environment that would allow graceful degradation from system control towards manual control/mixed control. Furthermore, the interviews showed that the perception of current home appliances technology was strictly correlated to their user interface, i.e. if the user felt the interface was familiar, clear and easy to use this was more likely to prompt a positive response to the appliance from the user. Interactive services in the home are not as developed as new ad-hoc technologies but are adaptations of standard patterns converging from mobile and networking fields (Loviscach, 2011). This situation results in a wide ambiguity of user interfaces in different home appliances since they appear as a collection of different patterns of interaction rather than as an integrated unit (For an investigation of this phenomenon see (Li & Bonner, 2009)). Therefore, the more familiar and standardized the interfaces are the higher the user preference for them.

2.1 Future Workshops and Cultural Probes

Following the contextual interviews, we organized two Future Workshops (FW) involving both users and stakeholders from Indesit Company with the aim of further exploring user's perception of home appliances. A FW is a creative session where a group of people with different background and role in a design process work together on envisioning new ideas and solutions for socio-technical matters (Schuler & Namioka, 1993). We adapted the FW structure splitting it in two separate sessions. Our goal was to let participants to spend the time between the sessions rethinking the concepts generated during the first meeting in their everyday activity with home appliances. We chose an interval of ten days between the two workshops because we wanted to make sure that the use of home appliances was explored and reported both in the weekends and working days so to cover the differences in the patterns of use.

In the first meeting designers, managers, technicians of Indesit Company and end-users were divided into small mixed groups. The groups were formed so that in each one there was no more than one member of the design team, one stakeholder from Indesit Company and up to four end-users. Starting from the results produced after the contextual interviews (money and energy saving, multiple device integration, manual/mixed control), the groups were instructed to devise specific concepts and a suitable context of use related to interaction with the home appliances and the integration of several networked appliances in the same home. None of the end-users involved knew anything about the focus of the design brief (i.e. the four assets). At the end of the first small group session, the groups had defined twenty-eight different concepts, envisioning new possible services for home appliances. For instance, people imagined energy tokens to place in every home appliance so to have an association between a physical item and an immaterial one such as energy consumption; another concept was a community of users for sharing in real-time information on how to set the dishwasher, advice on using the oven and energy saving and tips on how to repair broken washing machine. The concepts were laid out and clustered into five categories by the participants, four of which corresponded quite well to the assets of the brief; the fifth category concerned the envisioning of new appliances (e.g. a new portable hood).

By the end of the first FW, after clustering and removing any duplicated concepts, people had defined sixteen different concepts envisioning new possible services for home appliances. For each resulting concept users and designers created a concept card. Each card was structured with a title, a few key features, a brief description and some evocative images. An example of the concept energy orchestra created during the FW is shown in Figure 3.

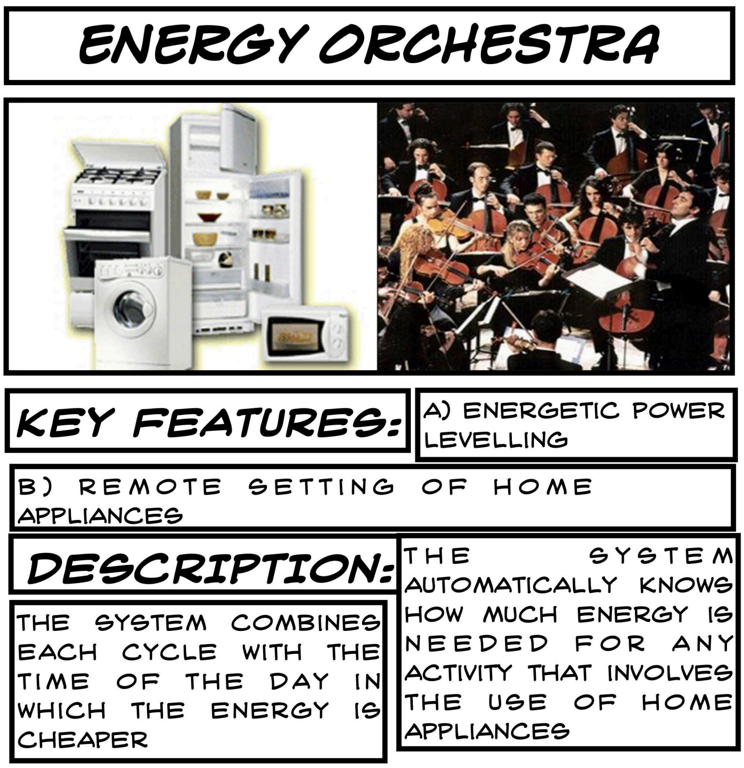

Figure 3. Example of a concept card for the energy orchestra

As a cultural probe, after the first session, each participant adopted a concept and was also given a diary and instructed to use a mobile phone or camera to take photographs. Such tools were not only to inspire them to think about new technologies in the time between the two FWs but also in order to aid the capture, recording and recollection of specific events, feelings and interactions while casting their given concept to their usual environment. The rationale for combining FW with a focused version of the cultural probe method (Hutchinson, Plaisant, & Druin, 2002) is to be found in the situated nature of human cognition. It does not matter how sophisticated are the scenarios that can be produced to explore a concept it is only when the concept meets the real setting that it can be properly explored (Rizzo, Marti, Decortis, Moderini, & Rutgers, 2002).

In the second FW the scripts of the diaries were shared so that each concept could be enriched by the experience of all the participants. Then the concepts were evaluated by the end-users in a plenary session highlighting their strengths and weaknesses followed by further clustering to reduce the number of concepts from sixteen to six. Each of the resulting concepts also embodied the most appealing features of the discarded ideas. As an output of the concept generation phase we observed an early convergence among the four assets. The design tips elicited from this phase were to allow end-users to accomplish straightforward and reliable routine activities while at the same time letting them become incrementally more receptive to towards new opportunities through interaction with home appliances.

2.2 Role prototyping

The second step of the design process was the role prototyping session. Role prototyping is part of a three dimensional model made of role, look and feel, and implementation. Specifically, role prototyping focuses on what functionality would be beneficial for users rather than concerning design or implementation details (Houde & Hill, 1997). We focused on the role issues to explore how the concepts provided new opportunities for user’s everyday activities while interacting with home appliances.

When introducing new functionalities the most important questions concern specifying exactly what the role should be and what features are required to support it. To do this a role requires the context of the artefacts’ use to be established. In our process this meant envisioning the more realistic everyday scenarios in order to express known and discover latent features of each concept.

To aid the discovery of features for each concept we conducted a role prototyping workshop with 22 interaction design students and shared with them the brief and concepts expressed in the earlier phase. The students were organized in six groups and each group worked on prototyping two concepts, so that each of the six concepts was elaborated concurrently by two teams. Students managed to sketch many unexpressed features and functionalities and through the use of scenarios they defined many further contexts of use for the artefact. An example of prioritising energy to the oven as opposed to the washing machine is shown in Figure 4.

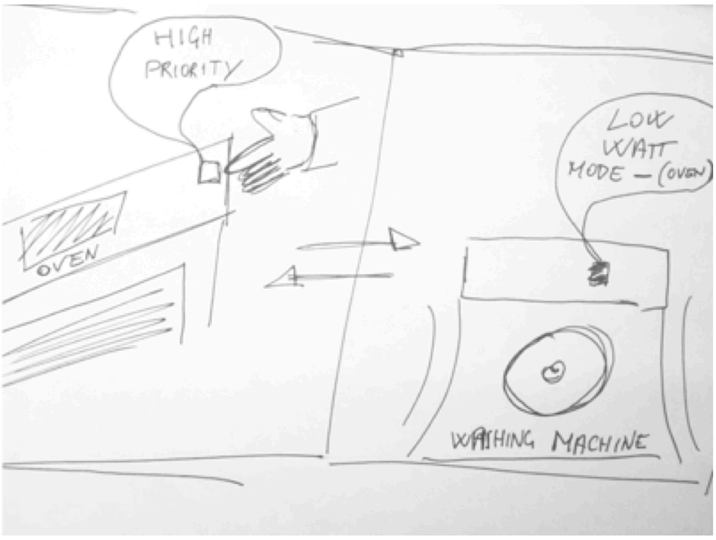

Figure 4. A sketch from the role prototyping session expressing an integrated feature which would direct energy to a higher priority home appliance task so to conserve the total energy used concurrently.

2.3 Aggregating the concepts in iLook

The rich sequence of everyday scenarios and design solutions were elaborated in plenary session and, in the attempt to give them an organizing schema, the iLook solution emerged. iLook is a lens that allows users to interact with home appliances at five hierarchical levels which are positioned sequentially in space; e.g. from the inner components of a dishwasher at INSIDE level to the community of users of all the home appliances at WORLD level. iLook allows both the merging of features (as shown in Figure 2) of the different assets and is able to map them onto different levels.

iLook different levels

The five levels are:

a) INSIDE: to show what the inner working components of every single home appliance are and allow interaction with them;

b) ELDO[2]: to allow, from anywhere, the direct manipulation of the display of a single home appliance;

[2] In Italian, ELDO comes from the contraction of the word “elettrodomestico” which means domestic appliance and is how people working in the home appliances business commonly refer to an appliance in general.

c) HOME: the default level. To let people have an overview of all the devices connected in a particular home from the ones potentially under control and check other homes too;

d) INDESIT: to let people receive information and support from the factory that produces the appliances;

e) WORLD: a community of users where people share their practices of every day use of the home appliances.

Each level embodies most features of the four assets as elaborated in the role scenarios, and the contents are mapped so that the passage from one level to another is as seamless as suggested in the activity scenarios developed during the role prototyping phase.

Which UI for iLook different levels?

The key feature of the above hierarchy consists in the analogy to the physical space where the information is available. The services within iLook then become the landmark in a conceptual space that mimics the real physical space (Benelli, Caporali, Rizzo, & Rubegni, 2001). In the real world information is distributed and never fully available at one time and so users need to navigate to different sources to find the information they need. In physical space the availability of information is limited and thus provides a natural constraint that let users achieve their goals smoothly. Replicating this is a key feature for the design of a UI and it is necessary to establish in a prototype a matching representation with what happens in the real world. As such the information displayed at any one time to the user should be restricted.

Interacting with home appliances usually occurs through common gestures not to be ignored in the design of the UI. Our aim then is to rely on those physical patterns of interaction and provide the users with a single tool to retrieve information and carry out tasks while in the real world they would be interacting in different environments. For example, we imagine a user who can easily see the instant overall energy consumption and some general information such as the weather in the HOME level where all the information about the appliances in the house is held. The user then moves to ELDO to program the washing machine, or even to the INSIDE level to check if the inner components are working or need maintenance. The same user can switch to INDESIT to browse maintenance or repair instructions or to WORLD to find other people's experiences with laundry issues.

Once we had defined the information architecture of our concept we had to face challenges in the fields of design (Cockburn, Karlson, & Bederson, 2008), usability, sense making (Blandford & Attfield, 2010) and information visualization to build a prototype of the user interface. Our goals were: a) Giving the user access to a system where actions are intuitive; b) Allowing seamless passage from one activity to another through meaningful interaction; c) Reducing the complex and iterative process of information retrieval and task redefinition for each new activity; d) Allow the user to recognize patterns and anomalies in the information about energy consumption and appliances settings.

One important issue related to iLook is that it has to work on different devices such as refrigerator displays, smartphones, and tablets. All of those devices have touch screens and this made us choose a zooming interaction rather than others such as a large use of infinite scroll or navigation through tab patterns. In fact, touch devices still lack standardization in other gestures such as scrolling – see how different is to scroll down content on mobile vs. desktop devices or on Android vs. iOS devices. Recently Apple standardized the scrolling down gesture on their devices introducing to Mac OS X version 10.7 (Lion) the same scrolling pattern already enabled on mobile devices based on iOS to laptops and desktops but no cross brand solution has been defined yet. On the other hand, zooming with a ‘finger spreading’ gesture has been the first pattern to emerge as a commonly used across every touch display from different brands (Wigdor, Fletcher, & Morrison, 2009).

3. iLook User Interface

We describe in this section two early prototypes of the user interface for iLook followed by a final refined prototype that emerged from the initial prototypes. All of these were conceived as zooming user interfaces (ZUI) (Bederson, 2011). A ZUI has the aim of letting the user focus their attention only on the small part of the available information needed for a single task. We designed a lens named iLook which displays contextual information for every level and also provides the user with some cues to anticipate other possible explorations of the system.

3.1 iLook interface: Prototypes

The first animation mock-up was developed using the zooming presentation editor Prezi (prezi.com) to implement the zooming effects; in this phase we had not fully defined the interaction and interface detail, just the main information architecture and the navigation through the levels. The opening transition of iLook features a lens designed starting from Indesit Company logo, where the "i" becomes the handle of the lens and the circle becomes the edge. Three stages of this opening transition can be seen in Figure 5.

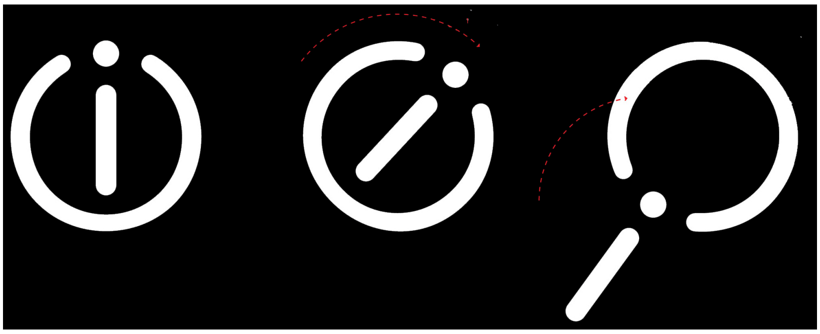

Figure 5. The opening transition of first prototype of iLook – from the Indesit logo to a lens.

The transition between the information layers is enabled by this lens effect so as the user zooms across levels the interaction is consistent in all different devices. In this mock-up there is an atom view with rings that widen or tighten depending on the focus. The main focus is on the activities held by the users. Figure 6 shows an example of the level ELDO. The user chooses which appliance to manage and slide through connected appliances, here the dishwasher icon is selected. The lateral icons for community, maintenance, energy, remote control, and appliance work as graphical cues to the possible actions that can be done at this level.

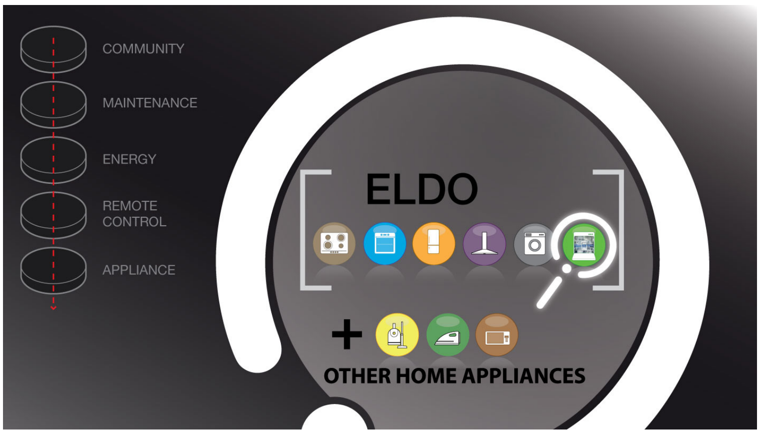

Figure 6. An example of the lens effect at the ELDO level. The ELDO level is contained within a lens and the available appliances within the level are selected with a second lens.

By way of example, in Figure 7 we see what happens when selecting a washing machine, the user directly interacts with the controls of the appliance and can remotely programme what time the washing starts and select further options. The lower part of the figure previews information available at the INSIDE level regarding the inner components of the selected appliance.

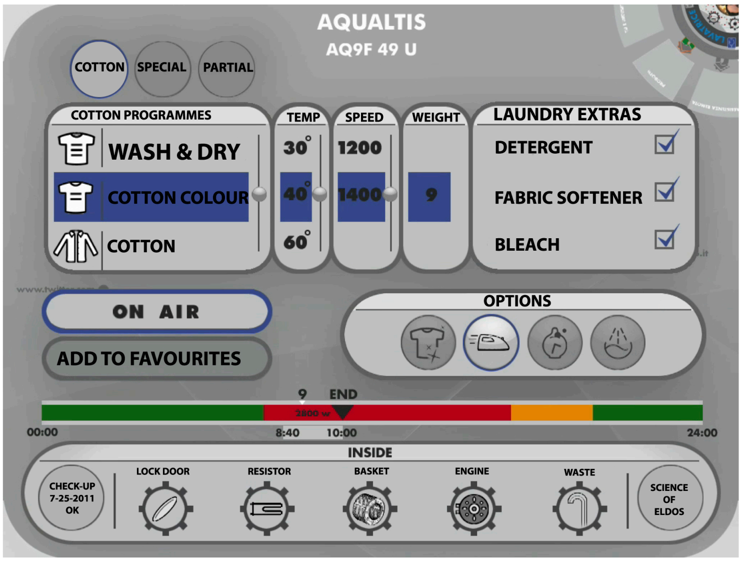

Figure 7. The display given to the user to allow them to control the program of the washing machine. The bottom panel shows a preview of the INSIDE level.

The second mock-up is presented in Figures 8 and 9. It shows the interaction at home level and the passage from HOME to ELDO. Compared to the mock-up presented above this was realized using Adobe Flash and presents a different visual display of information. In Figure 8 we see information on the selected house. There are two indicators in the user area of main focus: one for monthly overall energy consumption and another for instantaneous consumption. On the outer layer information about renewable sources of energy is provided such as how much kWh are produced by photovoltaic panels and wind turbines. The four icons in the inner layer represent the appliances monitored in the home. Tapping on an appliance selects it and enables its control.

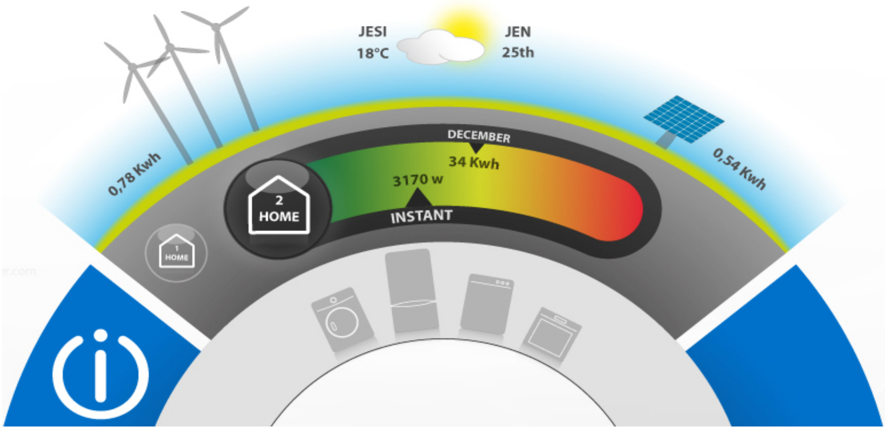

Figure 8. The first part of the transition from HOME to ELDO. HOME is displayed in the centre layer, with total energy consumption in focus, while the inner layer shows appliances available to control at the ELDO level.

In Figure 9 (equivalent to Figure 7 in the previous mock-up) the users zooms to ELDO level to manage the washing machine. The central layer now is no longer related to energy in the home but to the monthly overall and instantaneous energy consumption of the selected appliance. The external layers now display information on how much energy is consumed by different washing cycles and enable the selection of the washing program remotely.

Figure 9. The ELDO level for control of a washing machine in the second mock-up.

3.2 iLook interface: Evaluation

We conducted an evaluation of both prototypes through activity scenario with end-users and stakeholders. Our goal was the testing of the visual organization and the navigation between levels. We report the guidelines collected for the further graphic implementation of iLook. These were: a) replicate in the UI the interaction at the different levels as it is in the physical world; b) the focus must be kept on people's goals without distracting them with information overload; c) similar contents need to be represented to afford different types of interaction. For example searching for assistance in a web community has much more sophisticated interaction than retrieving the same information through reading manuals.

3.3 iLook interface: Refinement

Following the evaluation of the two mock-ups presented in Section 3 we adopted a new solution. This solution embodies many of the zooming features of the early prototypes along with the application of a new user suggested focus+context interaction and follows the outcomes from the evaluation.

Figure 10 displays an example of the implementation of this solution and it also clearly demonstrates how the four assets are integrated into the HOME level. The atom view is retained from the first mock-up and in the centre of the atom we have the user, who is surrounded by their appliances, the main focus is on energy consumption (and so the ecological-economic impact), but there is also the possibility to navigate to the characteristics of the appliances (assistance and maintenance) and then spread to the community (social networking), remote assistance (remote control) and news (social networking) providing context for the scenario. The inner ring shows that we can remotely switch to controlling any other connected appliance.

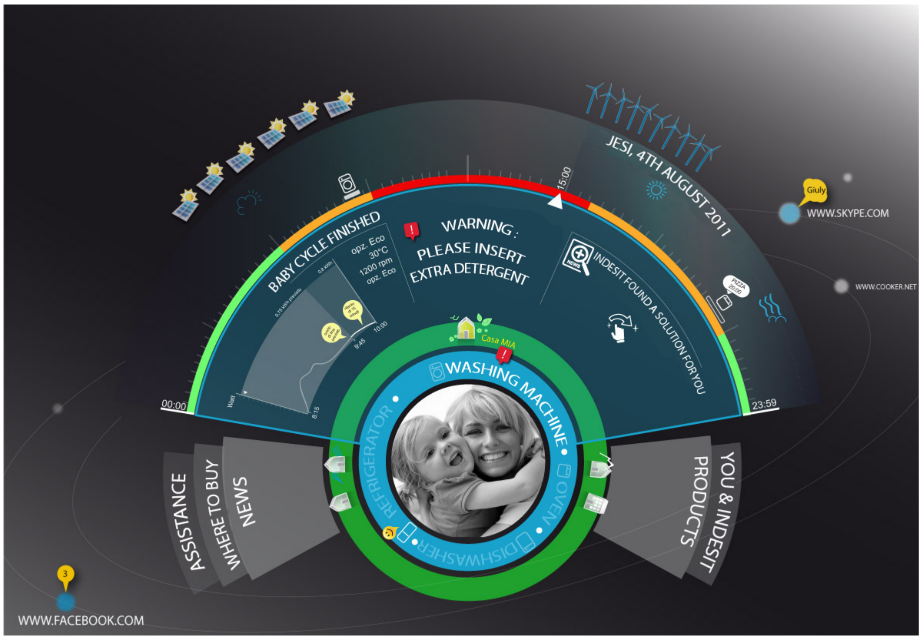

Figure 10. The iLook new prototype developed after evaluating the first two mock-ups from Section 3.1

The multi-layer display is retained, a feature that was integral in the second mock-up. At a first glance the observer sees information on overall and instant energy consumption, with some advice on how to save energy (merging of ecological-economic impact and assistance and maintenance), for example, delay washing machine cycles to cheaper time of the day. On the upper layer the time of the day is shown with the schedule of programmed activities for all home appliances highlighted – washing at 10am, pizza at 8pm (remote control). In the background the weather forecast is displayed so that, alternative sources of energy are used whenever it's possible, in this case solar and wind power (further ecological-economic impacts).

Social networks act like planets orbiting around the home. The architecture of iLook lets the user browse and search planets content in relation to the appliance under focus. The interaction deliberately distances itself from the usual patterns of web browsing and introduces a model that fits the use of mobile systems. This final design for iLook clearly presents a consistent interface from which each level integrates the four potential assets of the design brief. We conducted an investigation involving users from the focus groups session and let them explore the graphic interface to check how much they thought the prototype was incorporating the features depicted in the concepts they had previously created. The users response to the prototype in Figure 10 showed that the features of all the outer levels of the iLook concept were easily accessible while the features related to the INSIDE level were briefly explored.

Considering the wide range of tasks involved in the management of home appliances and how they could potentially benefit from the four assets proposed in the design brief, the external representations that could be of help should embody three main viewing modalities: a) an overall control of every home appliance connected to the system (Figure 10); b) A view that let users carry out a single task without being distracted by an information overload whilst providing meaningful transitions through each level (Figure 7); c) An augmented modality that displays invisible information into the real world setting, i.e., the state of each appliance's inner parts or energy consumption visualized as graphs through the use of augmented reality tags (Figures 11 and 12). This final augmented reality modality served as motivation for an extension known as iLook Inspection and is discussed in the next section.

4. iLook Inspection

We realized that some of the information at the INSIDE level such as the inner components of each appliance and some of the energy saving functionalities could be better represented than how they are in the prototype designed in Figure 10. Secondly, the interface should improve appliances user's perception and it is only when the user arrives home that they can experience it, while no value is given to those who have not bought the home appliance yet. This suggested us to build an extra display mode that the user can access with their smartphone or tablet rather than adding other information to our prototype.

In addition to the type of navigation described earlier, iLook has a display mode called inspection that works through augmented reality. This mode enables an enhanced navigation of the physical space and let the user explore the functionalities of each appliance even when it is switched off. Each level of iLook is now supported by specific visualizations and animations in augmented reality (AR) designed to follow rather than guide the user activity. In terms of usability this means expanding the visual cues that users can rely on when they need extra information such as a weather forecast to perform a task such as setting the washing machine. This visualization enhances the INSIDE level and to a wider extent improves the entire assistance and maintenance field. Augmented Reality at the INSIDE level is a viewing mode that lets users visualize the inner part of the system by projecting an animation of the home appliance structure. This information is a valuable means of making users aware of how the home appliances work normally. This will then give them the possibility of diagnosing failures of usage before asking for support and determine which appliances need to be fixed or replaced through comparing the animations with the real home appliances parts. Augmented reality also offers the power to highlight the user interface of devices which are switched off. As we describe in the next section this provides a valuable means to promote home appliances functionalities such as cycles and programmes in electronics stores.

These benefits that the inspection mode provide are analogous to those of external visual representation: they afford an external anchoring to information and therefore achieve the aim of minimizing the semantic distance by making the system interface support the users conception of how to carry out a given task in the most economical way (Hutchins, Hollan, & Norman, 1985).

4.1 iLook Inspection Scenarios

We devised two scenarios to illustrate how the inspection mode is implemented. The technologies used were: 1) Tags for augmented reality from the AR toolkit. Each tag had animated 3D information about the energy class, prices, programmes and other associated features (see Figure 11), 2) QR code stickers placed on the appliances associated with a video explaining the mode of operation of each program.

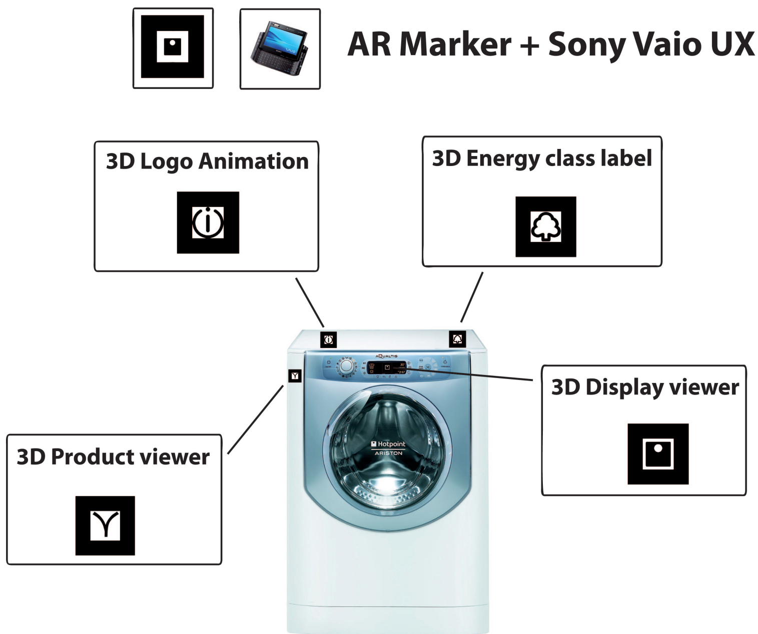

Figure 11: Tags for the 3D AR toolkit attached to a washing machine to access AR experiences through the Sony Vaio UX.

Figure 12. The user is out at an appliances store and can receive information about the appliances they can see and use AR to experience usage and functions.

In the first scenario the user is at home and uses their smartphone to display instantaneous and cumulative energy consumption through 3D graphics. Then through both a display and augmented reality, in a wash cycle, the amount of clothing washed in a load is shown on the appliance. The second scenario demonstrates how the augmented reality mode would motivate a purchase of the appliance. The user is located at an electronics store and receives information about tagged home appliances straight onto their smartphone through an application and receives additional local information through GPS as well, such as how distant is the appliance from the phone. The application detects the presence of an AR tag which activates content on the phone about the appliance. Once a user is close to the appliance, they can see through AR the display as if it was switched on and understand how to set various programmes. This both informs the user about how useful and easy to control the appliance would be in their home and allows them to experience how, through the purchase of this appliance, it would seamlessly integrate with the existing appliances they already own. The inspection mode did not work as a way to enhance the iLook user experience because the necessary tools to carry out the supposed tasks described in the two scenarios were judged by users who knew the iLook architecture was too complicated and too distant from their everyday interaction with home appliances therefore we do not report further investigation of augmented reality in the project.

5. Conclusion

People are embedded in their environments and therefore coupled to the real world settings and cognitive processes are carried out in the place and time that they are more cost effective but, at the same time, they also "dis-embed" from those environments (Kirsh, 2010; Neisser, 1992). Devising the UI for iLook levels requires providing users the best external representation for performing multiple sequential tasks such as those connected to handling home appliances. However, such external representation can do more than just reducing the user’s overall cognitive cost of sense making. Interacting with external representation allows users many other opportunities such as understanding structures of greater complexity, envisioning new ideas and new ways of manipulating them, run simulation build conceptual schema to be cast onto material objects.

In the framework of information visualization neither standard overview+detail nor a focus+context UI can be immediately used to display the different functionalities envisioned in iLook. A different kind of focus+context is necessary for each of the wide range of activities supported by iLook, since for many activities there is no need to display the context at all. A focus+context display is useful when the content to display in focus is that of a homogenous map (Ware, 2004). In our case, the content is multilevel and various so there would be no value, for example, to show in the context the overall energy consumption of the house when someone is seeking cooking tips. On the other hand, a context is fundamental for tasks such as checking the activity of each home appliance to explain an expensive electricity bill. The context has to be both conceptual so as to highlight the user goals and multi-layer because for certain tasks it must be the same at different levels of iLook. These considerations suggested us the choices of a zooming user interface together with some focus+context features so that the context given at each level is necessary to better understand the object in focus and also works as a shortcut to switch to another activity with the navigation pattern we adopted in iLook. The further introduction of an augmented reality mode that assimilates with each of the iLook levels allowed the better integration of certain iLook features keeping within the original design brief and navigation patterns.

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