

# Living intelligently assisted: augmented objects for subtle interaction

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**Abstract.** This paper explores the potentials of an enriched environment to overcome the problem of isolation present in modern western societies. This problem is of special importance when considering dependent or elder people trying to live an independent life. In tackling the problem, we consider intelligent objects as a potential direct help for users as well as a nexus to other people from which they depend (physically, psychologically or emotionally). Thus, we analyze the problem of assisted living considering how different intelligent objects may enrich their human-computer interaction experience as well as how they may allow a subtle remote human-human interaction.

**Keywords:** Ambient intelligence, tangible objects, assisted living, subtle interaction.

## 1 Introduction

The world is changing. When we compare a modern western society with that of a hundred years ago we find that medical improvements have considerably pushed up our life expectancy, for what our families' average age has grown accordingly. On the other hand, the incorporation of women to labor, in addition to improvements in transportation and communication, has change the traditional family structure, being now more distributed and with a weaker core. Thus, while the number of elders and dependent people is growing (thanks to medicine) the family that used to take care of them is physically absent. In addition, since families are nowadays more distributed, elders are no longer used to living in a numerous family but, in many cases, enjoy living an independent life for as long as they can. However, their independence has to be balanced with an enough grade of assistance to support them and provide their relatives and caregivers with control and peace of mind. Nowadays, control and peace of mind result in forcing the elder to move to one of their relatives' houses (or to an old people's home) or to accept an assistant in their own when facing small daily problems. This makes them to lose, in either case, their independence.

In summary we find the problem of isolation vs. independence. What can we do to balance this situation? How can we provide a better assistance to people with special needs while we keep an independent living?

At the Ambient Intelligence Laboratory of the Universidad Autónoma de Madrid we are studying and developing a set of technologies for assisted living that can offer remote services to people with special needs. The goal of these technologies is to narrow the gap that exists between an assisted person and her relatives or caregivers, providing supervision and assistance with activities of daily living.

When looking at assisted living we must consider it as a relationship (i.e. caregiver-“care receiver”) that must be analyzed from both points of view and from the point of view of the relation. Thus, while we must focus on how an intelligent environment may support their inhabitants in their daily lives (e.g. helping Alzheimer patients in recovering from a blank by showing them information of what they were doing before it) we must also pay attention to unobtrusively strengthen their relation (e.g. allowing relatives/caregivers to both guide the users and track their wellbeing). In other words, intelligent environments may help both in **support** and **communication**.

## 2 Augmenting common objects

Once established the goals of research, it is important to study the means. Given the nature of dependent people, we must emphasize technology as an unobtrusive, easy solution. Otherwise, the independence that can be gained by removing the necessity of other people will be lost with the presence of a stranger mean: technology. Thus, computing solutions for assisted living must be both natural in presence and use. In this way, Ubiquitous Computing -as a vision in which computers disappear to vanish in the background [1]- as well as tangible objects [2] and the way in which they offer a confluence for humans and computers [3], present a promising vision of the future: one in which the computing capabilities are embedded in familiar objects around the environment, supporting us an allowing us to communicate in a natural unobtrusive way.

The objects present in our environments are, though, varied and may be used for different purposes in different situations. We believe that it is in the confluence of the capabilities of different objects that we will be able to offer a sound solution to the user, able to adapt to the particular needs of different situations. Focusing on how to use these objects to create a virtual link between an isolated person and his/her beloved ones, we analyze the possibilities of subtle interaction through common simple objects.

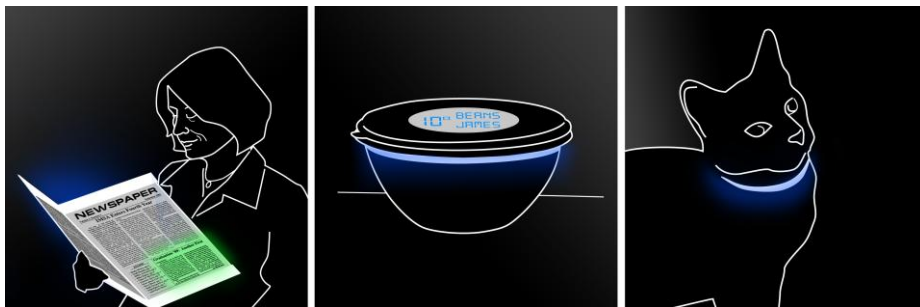
Big objects or surfaces such as tables or counter-tops may be used to offer static services, allowing to take advantage of multitouch interaction [4]: having a virtual chess game that can be played remotely, showing the objects and interactions of a “twin” table on a remote space, leaving post-its or showing a cooking recipe to follow (recommended and track by another person). In addition, other kind of surfaces, such as doors, floors or walls may be used for sporadic interaction such as showing a big icon of a pill in the door when the user is about to leave the house, so the user can touch it (an discard it) if the pill has been taken, or going back to take it if forgotten. This last kind of interaction requires low-cost multitouch technologies that can be

widely installed in the house but, on the other hand, they do not require high definition, for what led technologies may be successfully used.

Small objects, on the other hand, are more suited for transient communication. An example of communication from the user to the caregiver can be seen in the augmented family portrait [5] in which the color of the picture frame allows the caregiver to get an idea of how the user is feeling (i.e. from green for “everything is going as it used to go” to red for “behavior patterns are going unexpectedly strange”). On the other hand, it may be interesting to also study the possibilities brought by the same small objects to allow communication from the relatives to the user. That is, how allowing relatives to act upon the assisted person's small objects, so he/she can see that interaction, may provide a subtle mean to break his/her isolation. In this sense, we analyze how a simple mechanism, such as associating a color with each relative/caregiver, may provide a powerful way of subtle interaction when embedded in different small objects.

A digital newspaper can be enhanced so if a relative recommends the user a particular piece of news, that report is highlighted with the color of the relative (see figure 1). Thus, while the user is guided to a particular piece of information, he/she can feel the attention that the particular relative has put into it, being also able to dress it with what he/she knows from the recommender (e.g. Why is recommending that piece of news, how a conversation they had about that topic influenced in the recommendation or what is the recommender worried about today).

Applying the same color scheme to a Tupperware, we allow subtle recommendations on food (see figure 1), so when the fridge is opened in dinner time some content glows with the color of someone (e.g. “my son is recommending me the watermelon”), this recommendation has all the implicit knowledge of the relation between the assisted person and the relative/caregiver (e.g. a son knows what his mother may prefer when she has lost her appetite, and she also realizes that her son is aware and cares about her). This relation is triggered and exploited, enhancing the recommendation of food, with a subtle and unobtrusive glowing.



**Fig. 1.** Examples of augmented objects for subtle interaction: A newspaper, a Tupperware and a pet collar glowing with someone's color upon distant interaction.

This kind of subtle interaction can be used not only to provide useful services (such as recommending news or food) but also to simply break the feeling of isolation by, for example, augmenting the cat's collar with the color scheme so it can be remotely

stroked. This type of apparently aimless interaction has been exploited in social networks to allow people to express their presence and attention (e.g. the “poke” application of Facebook), just to say “I am here and I remember you”. In addition, associating the implicit loving message of “poking” with a pet’s collar helps to fill the social needs of the user.

### 3 Conclusions

When analyzing the problem of designing technologies for assisted living, we must consider both the benefits it can bring to support the user in their daily life as well as how it can strengthen the potentials of the relation between the dependent people and their caregivers. This is done by empowering their communication in different and new ways.

Regarding communication, besides studying the use of traditional interaction means, such as displays of different size provided with multitouch or object recognition capabilities, this article presents a simpler approach of communication. It pursues a subtle interaction of the caregivers with the dependent person through small common objects, trying to overcome some of the simple problems of isolation while preserving the feeling of independence.

A first proposal for subtle interaction is done through augmenting small objects with embedded color LEDs strips, allowing them to glow with the color of the person that remotely interacts with it. How can people control and interact with those objects, what kind of objects are best suited to be augmented and how can we allow an easy bidirectional interaction through the very same objects are some of the questions that need to be answered.

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