

## Emotional engineering techniques for ambient assisted living

Emotional Engineering is defined as a consumer oriented methodology for new product development that translates consumer feelings and mental images of a product into design elements<sup>1</sup>. Housing design and supportive technology, including ambient assisting living systems, can help older adults to live independently. Users can be reluctant to use them, however, because of physical difficulties handling the devices or cognitive barriers to understanding procedures and navigating the interfaces. Emotional barriers may also influence the consumer choice to reject smart-home technology rather than looking at it as a possible way to enhance their quality of life<sup>2,3</sup>. Emotions play a significant role in our behaviour. Emotions are processed unconsciously and affect our decision making processes. At home, older adults should feel safe, independent and comfortable and these are partly emotional components. Some of these components, for instance independence, rely on aspects of living that technology makes easier, but others address feelings.

A project, called 'Development of modular systems for the Lartec's Domotic Home System based on user profile, use and type of environment', is carried out by the Instituto de Biomecánica de Valencia, in collaboration with LARTEC, as final manufacturer. Its goal is to generate the requirements to fully adapt LARTEC's Domotic System to the reality of older persons and of people with disabilities. A key part of this project has been to explore the role of emotions in the acceptance of home ambient assistive living by older persons. Emotional design techniques have been reviewed and applied to explore this role<sup>4</sup>. The target user profile was defined as people within the age segment from 45 to 75 years without known pathologies affecting cognitive processes.



Tactile screen interface of LARTEC's Domotic System before (upper picture) as tested in the experiment and new non-tactile interfaces after applying the results of emotional engineering (middle picture: main menu; and lower picture: a sub-menu)

### FUNCTIONALITIES

Main functionalities of the prototype of the ambient intelligent system, include: (i) illumination control, (ii) roller blinds

automation control, (iii) environmental control functions activated with a switch, (iv) security with access rights definition, (v) monitoring of incidents, and (vi) scheduler of daily tasks. The study focused on the interaction between the user and the tactile screen of the user-interface of the prototype, including the different menus and functionalities. Accessibility, usability, and acceptability analysis were performed as to this interface.

## ASSESSMENT

In total 102 persons (52 females and 50 males) used the tactile interface. In addition, three focus groups were formed of 6 to 8 persons each, consisting of a total of 21 participants: 10 females and 11 males. Semantic descriptors representative of the user emotional response were identified during the focus groups sessions using semantic differential techniques<sup>5,6</sup>. These descriptors are considered to have an emotional meaning according to Kansei methodologies<sup>7</sup>. They reflect the wishes and hopes of the users in relation to ambient assistive living devices. These included: (i) practical for older adults, (ii) basic, simple, and intuitive, (iii) innovative and novel, (iv) comfortable, quality of life improvement, (v) expensive and unattainable, (vi) confidence building, (vii) luxury, (viii) contributing to autonomy and independence, and (ix) technological and futuristic. These terms were valued on a five-point Likert scale, most of them are defined in a positive sense, while some are worded negatively in order to avoid automatic responses.

Results with positive emotional valence included the following:

- (i) Older adults look at ambient intelligent systems as potentially useful assistive technology, in the sense that an ambient intelligent system can help them to live autonomously;
- (ii) Comfort is one of the most relevant requirements; relating to both diminishing effort to perform ordinary but frequently

recurring tasks, and solving a lack of capacities of specific populations with certain restrictions; and

- (iii) Security is seen as another relevant requirement in relation to user health (emergency call systems) and home protection (incident sign warnings).

A negative emotional valence was shown in the following results:

- (i) Older adults consider ambient intelligent systems expensive and not affordable for the average population;
- (ii) They link these systems with lack of robustness, and frequent faults in electric system or software;
- (iii) They consider current smart-home designs to represent assistive technologies for disabled people;
- (iv) Users unfamiliar with new technologies are reluctant to consider the use of interfaces such as touch screens, wireless mouse and a mouse integrated in keyboards; and
- (v) The higher age segment (65–75 years old) considers icons and messages presented by the interface as unfit for their generation; they are perceived as too strange, and too complicated.

## DESIGN CONSEQUENCES

Design improvements concentrated on accessibility and usability, and intelligibility of wording and icons on the screen (items iv and v of the negative emotional valence list). This included the following specific improvements:

- (i) Elimination of the touch screen since users not only appeared scared of it, but also had problems frequently with the pressure required to activate the different commands;
- (ii) The system is now handled with the arrow buttons and OK button of the remote control of the TV.
- (iii) All menus follow the same order and have the same development;
- (iv) Menu structures and wording were simplified;

(v) All icons are located in the same place (in the different screens);  
(vi) With the exception of the icons located at the bottom (that are always the same), icons always have explanatory text attached; and

(vii) The colour contrast has been increased.  
A new run of tests lays ahead to assess the new design.

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