Fear, Feedback, Familiarity… How are These Connected?

– Can *familiarity* as a design concept applied to *digital feedback* reduce *fear*?

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***Abstract*—This paper is a reflective paper discussing *fear,* and the emotions associated with it, felt by the elderly while using modern technologies. The pattern of *fear* emerged from our initial research activities. The preliminary results presented here are part of the pre-study phase within the Multimodal Elderly Care Systems (MECS) project, which focuses on the design of a safety alarm robot for the elderly. Here, we explored various design issues that elderly encounter in their daily interaction with various modern technologies. One of the explored issues is *digital feedback*, the subject of this paper. The aim of our exploration was to look at what potential design implications that digital feedback may have on the elderly's interactions with these technologies, such as triggering the feeling of *fear* when using them, and what we could learn from those when designing a robot safety alarm. Finally, we propose *familiarity* as a central design concept for designing feedback.**

Keywords-fear; digital feedback; elderly; modern technologies; familiarity.

I. INTRODUCTION

In this paper, we chose to address the feeling of *fear,* and the emotions associated with it, felt by the elderly while using modern technologies, such as smartphones and computers. More specifically, we chose to use here the term *fear* as an umbrella term for derivatives emotions, such as *angst, anxiety, concern, doubt, dread, unease, uneasiness, worry, aversion, fright, phobia, presentiment* [1]. We exemplify this through situations experienced by them, in their daily lives' interactions with these modern technologies. Specifically, we focus on situations where the users do not understand how to perceive the digital feedback received. This may hinder them to understand correctly these technologies, as well as discouraging them to use those. We discuss situations where the feedback provided is *improper*, and where *there is not provided any feedback at all*, e.g., *lack of feedback*.

The preliminary results presented here are part of the pre-study phase within the Multimodal Elderly Care Systems (MECS) project, which focuses on the design of a safety alarm robot for the elderly. We explored elderly's interaction with various modern technologies in their daily lives, such as smartphones and computers. The aim of our exploration is twofold. On one hand, we look at what potential design implications that *digital feedback* may have on the elderly's interactions with these technologies, such as triggering the emotion of *fear*. We do this by bringing empirical evidence from our fieldwork. And, on the other hand, we look at what we could learn from those when designing a safety alarm robot. There, we propose *familiarity* as a central design concept when designing digital feedback.

But why should one focus on the phenomena of *feedback*? Introducing modern technologies in the homes of the elderly, such as robots, requires close scrutiny of the design of current technologies used by them. Understanding what issues the elderly experience in their daily lives with these technologies will help us to develop our understanding prior to designing new ones, such as a safety alarm robot. Further, various societal challenges, such as the aging of the workforce, as shown by [2][3], invoke consequences within the healthcare field. As for Norway, by 2050, there will be an increase of 21% in the elderly population [4]. Furthermore, the active working force will not be able to tackle the healthcare needs imposed by this increase (ibid p. 20), and yet among the action plans taken at the European Union's level, regarding this societal challenge, is the digitalization of health through the use of Information Communication Technologies (ICT's), so-called eHealth [5]. Moreover, several studies address directly or indirectly the issue of the *digital divide* between users with ICT literacy and those with reduced ICT literacy. Elderly are often included in the group of users with reduced ICT literacy as shown in [6]–[9]. Yet, all of the above yield at how important it is to rethink how we design new modern technologies, including digital *feedback,* for the elderly as the target users.

The rest of this paper is organized as follows. Section II describes briefly the case. Section III introduced the central concepts used in this paper, *feedback, fear,* and *familiarity*, by looking at what others have done. Section IV provides a description of the methodology used. Section V presents *preliminary results* from the MECS project, whereas Section VI discusses those, and proposes familiarity as an essential design concept to be considered when designing digital feedback for modern technologies. Finally, Section VII presents the conclusion, a summary of the paper and future work.

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II. Case Description

Multimodal Elderly Care Systems project [10] focuses on exploring ways of developing in-motion digital technologies, such as a safety-alarm robot, for the independently living elderly (≥65 years). Among our project collaborators is Kampen Omsorg Pluss [11], an organization providing accommodation facilities for the independent living elderly. It has 91 apartments, where the residents can rent them on their own, or together with their partner. The building also has a reception, where the staff is available 24/7, in case of emergencies, or otherwise they arrange the social, cultural and another type of events for them. In addition, the facilities have a library, a restaurant publicly open, a gym, and an open area where usually the residents would have coffee every evening at 5 PM, presentations, and performances. As a part of our MECS pre-study, we have conducted three group interviews (n=3), and several individual interviews (n=6, only three included in this work, out of which 1 is a pilot-interview). These research activities are related to the use of modern technology. We present some partial results in this paper.

III. Related Work

In this section, we present three central concepts used in this paper: *digital feedback, fear,* as a feeling triggered by the use of modern technology, and *familiarity,* proposed as a possible design concept solution in preventing fear of new digital technologies.

A. On Digital Feedback

The term *feedback* was initially used within control theory and cybernetics [12] and was described as "the circularity of action" between "the parts of a dynamic system" (p. 53). Later, the same term was used within learning theory, as a form of improving the learning of the students, or the teaching quality. In this case, the feedback could refer to a *dialogical* one, between humans, or between humans but mediated by systems (e.g., learning platforms), or between humans and systems, as in human-computer interaction (HCI) (e.g., getting direct feedback from the systems). [13] showed five clusters of characteristics of feedback from learning theories, such as descriptive, task-related characteristics, time-related, affective and emotional, as well as characteristics related to its effects on learners (p. 5). Here, we are interested in the affective and emotional characteristics. Further, according to [14] in [15], within the HCI field, "feedback refers to a system's response to users' action". Users are here also the learners of the system they interact with. [16] showed that feedback is important when errors should be minimized (p. 688-689). Within *affective computing*, defined as "computing that relates to, arises from, or influences emotions" [17, p. 1], feedback is represented as *bio-* or *multimodal feedback*. Bio-feedback is related to the improvement process, over time, of health and performance [18], where one gets information (e.g., *feedback)* on this process. Multimodal feedback refers to the representation of feedback through visuals, audio, haptic, or video forms etc., and it is often discussed in relation to design for vulnerable groups [19]–[21]. This type of feedback is often discussed as a part of affective computing. Sometimes, feedback *becomes affective* by *design* through its multimodality, whereas in other cases it *becomes affective as a result of how the user experiences it*. In this paper, we look at how *visual feedback* becomes *affective feedback*, when the users, here the elderly, do not understand it. As an effect of the visual feedback received in their interaction with the modern technology, they start having *feelings* of *fear* when using it. The term is used here as an umbrella term for the feelings associated with it. In the next subsection, we explain it further.

B. On Fear

Within the field of Human-Computer Interaction (HCI), one of the areas dealing with the notion of *fear* is affective computing. [17] classified *fear* as one of the basic emotions (p. 540, fig. 3), among the eight: *joy, acceptance, surprise, sadness, disgust, anger, anticipation,* and *fear*. Etymologically, *fear* can be "the emotion of pain or uneasiness caused by the sense of impending danger, or by the prospect of some possible evil." [22]. Among its synonyms are angst, anxiety, concern, doubt, dread, unease, uneasiness, worry, aversion, fright, phobia, presentiment [1].

Multiple studies on learning show that individuals, being young or old, *fear* to deal with modern technologies. This occurs either due to their lack of motivation or interest, a high threshold between the knowledge possessed and the challenge at hand, or due to the health condition of the individuals. In [23] it was identified that *obstacles* in the learning process affect their interest in learning. Here, if the individuals' motivation is sufficiently strong, they will eventually learn the technologies, whereas if it is lacking, there is a lower chance for learning to deal with those. [24] shows that emotional factors affect elderly's technology acceptance in their homes, and a technology shall fulfill their "functional, *emotional*, and social needs" (p. 711, emphasis added). [25] emphasizes the importance of *motivation*, that will determine the elderly people use modern technology, such as smartphones, computers, or robots. To this, the author adds: the importance of the elderly's health condition, in terms of *mood and depression; self-efficacy and coping* when dealing with different situations, i.e., the elderly shall *feel* they have a locus of control over their environment (here the digital environment); and the importance of *wellbeing and happiness (positive computing),* a subfield of *affective computing,* which deals with "the design and development of technology to support psychological wellbeing and human potential." [26, p. 2]. However, in this study, we do not deal with modeling of *fear* as explained in other psychological or medical studies [27], [28], neither with specific ranges of it as in [29]. Can then digital *feedback* motivate or demotivate the elderly to use the modern technologies? We describe, in the next subsection, familiarity, a concept that we propose as central when designing for the elderly users.

C. On familiarity

Familiarity is often described as “a state” that feels “friendly or intimate, a friendly interaction; close friendship, intimacy” [22]. The concept is borrowed by several researchers from Heidegger’s *Being and Time* [30, p. 405] (354), which describes it as “[knowing] its way about” (p. 405 (354)). [31] argues that *familiarity* consists of “dispositions to respond to situations in appropriate ways” (p. 117). Later, [32] has used this concept to explain that *familiarity* with technology “has been found to be something important – if not crucial – in the general relationship that people have with it and their attitudes towards it”. Now, this becomes even more essential for the elderly’s relationship with technology, as they might not have had the same opportunities of experiencing it during their “development years” (p. 464). The study presented by [16] was conducted with 50 people with different backgrounds and showed that “familiarity is the key” when learning to deal with digital technologies, being “a form of understanding”, of “getting involved” with the technology, without requiring an extra effort when “doing things” (p. 468-469). Similarly, [33] have used this concept in their study of older adults learning to use computers. The authors’ advise that one should aim for “human-centered design” (compare to *“user-centered-*” and “*technology-centered design*”), where the design of technologies shall “aim to build on the prior skills, self-perceptions and aspirations of older people as competent individuals” (p. 29). In the same way, [34] describes *familiarity* as the “engagement, understanding, and an intimate or close relationship between the [humans] and the technology” (p. 89). Here, the authors propose implicitly to look at *positive computing* as *salutogenesis,* as a way of focusing on the factors that contribute to well-being and health, rather than “treating” or “fixing” a disability, incapability or weakness (p. 91).

IV. METHODOLOGY

According to [35], interpretive research is afforded through “language, consciousness and shared meanings” (p. 2). Boland (1985) in (ibid) says that “the philosophical base of interpretive research is hermeneutics and phenomenology”. Further, we follow one of Ricoeur’s thesis [36], that hermeneutics builds upon phenomenology (p. 85). We interpret the textual data that using a hermeneutical approach. We explain the data gathering- and data analysis *methods* as it follows.

A. Data gathering

During our pre-study phase, we were particularly interested in the participant’s own understanding of the concept of robots, and other modern technologies such as smartphones and tablets, as well as their experiences with those. We have conducted multiple research activities, gathering data through various research methods, including three semi-structured group interviews, a pilot semi-structured interview, and individual semi-structured interviews. The details are shown in Table I below.

TABLE 1. OVERVIEW PARTICIPANTS

Research activity	**Number of participants**	**Gender distribution**
3 group interviews	15	8 females, 7 males
Pilot interview	1	Female
Individual interviews	2	Female
Total	18	

The participants are elderly (≥65 years), part of the MECS project, recruited through MECS’ partner organization. Some of the participants participated in multiple research activities, whereas some did not. The participants have different backgrounds and present different levels of interest in modern technologies. No family members were interviewed.

The interviews covered multiple types of modern technologies. The same interview guide was used for the first and second group interview. A pilot interview guide was then developed, and together with the initial group interview guide, served later as a base for the third group interview. These were later used as a base for the individual interviews.

Complementary to these, we have attended informal meetings with the elderly at the Kampen Omsorg Pluss’ facilities, and other relevant presentations, in order to familiarize ourselves with the environment and the residents, e.g., the elderly. However, for this contribution, we do not cover all the themes and pattern found in our material. We focused instead on the pattern explored in this paper, *digital feedback* and *fear.*

B. Ethics

This study is part of the MECS-project. MECS is complying with the ethical guidelines from the Norwegian Center for Research Data (reference number: 50689). The participants were recruited through MECS’s partner organization. They were given information about the study, prior the study started, through a formal presentation. Prior starting the research activities, the information was given again, and the participants chose to participate on a voluntary basis after reading the informed consent. They were informed that they can withdraw at any time, without any consequences for them. The data is stored on TSD (Services for Sensitive Data) at University of Oslo, Norway.

C. Data analysis

Our data analysis can be structured into two types: (1) through the researchers' positionality, and (2) through a thorough analysis following several stages of filtering. Both are described below.

(1) Positionality of the researchers and data analysis.

The researchers are considered here non-detached from the data gathered during the research activities, such that their positionality influence at some degree the results [37]. For instance, there were considered here researchers' *first impressions* on the data gathered on how elderly understand *robots* and their experiences with various technologies. These types of *first impressions* would result in post research activity notes that were immediate to the field activity. [38] calls this method *headnotes* as [39], which, according to the author, describe "experiences, impressions, encounters, and evaluations that are continuously present in [the] memory" (p. 32). In the same way, in MECS, the researchers would either discuss the perceived outcomes of the activity, immediate to it or write down those in the form of reflections. These would be later used in (2).

(2) The second type of analysis is a thorough one, that follows several stages.

According to [40], "analysis is less a matter of something emerging from the data, of simply finding what is there; it is more fundamental a process of creating what is there by constantly thinking about the import of previously recorded events and meanings" (p. 168). In this way, the process of analysis started already while being in the field, as a form of doing *some* preliminary work [37, p. 134], as described in *(1)*. This has been followed by a multiple stage analysis process, where the data went through some analytical filters. We illustrate the process of data analysis as a three-tier process, as shown in Figure 1.

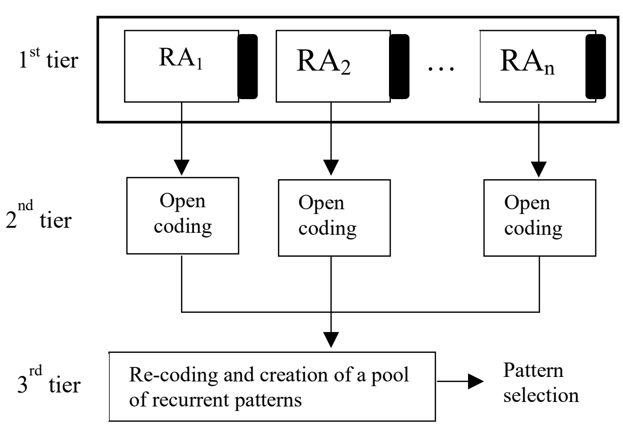

Figure 1. Data Analysis Process

The first tier embeds the research activities (annotated as RA): group interviews, pilot-interview, and individual interviews. The filled-in rounded squares, at the end of each RA, represent the *headnotes,* or preliminary-work did right after each activity in the form of discussions and reflections, as explained in (1). The second-tier is described as *open-coding*. Here, the *raw data* became textual data, in the form of transcribed interviews, notes, or interview summaries. Several of the researchers involved in MECS project has analyzed hermeneutically the data, on their own, and created codes through *open coding,* by reading the material "line-by-line to identify and formulate all ideas, themes, or issues they suggest, no matter how varied and disparate" [40, p. 143]. This resulted in a variety of scattered *patterns*, on one hand, due to our variation in research activities, and on the other hand, due to researchers' own research interests that had some influence on the research activities and their outcome. For instance, the researchers analyzed the data on their own, and thereafter share the analysis both through documents and orally, during a formal analysis meeting. However, this is valid for the first two group interviews, whereas the rest were analyzed independently by the main author of this paper. Noticing that *feedback* and *fear* were present patterns in the data, but also due to own interest, the main author of this paper chose to go through the data again, but also to analyze further the next research activities. Some of the researchers were either not part of the next research activities, or other research areas to focus on, therefore we cannot claim an inter-rater reliability of the study. However, following [38], validity, in this case, is not of "a particular concern", as the study focuses on gathering user-requirements for the safety-alarm robot. Therefore, one would need first to get insights into the participants' understanding of modern technologies before creating the safety alarm robot (ibid, p. 212). In addition, some relations were developed between the RA, in an iterative way, based on the findings from previous activities. This is not shown in Figure 1, but a concrete such example is the understanding of *what a robot is.* The elderly understood the concept of a robot, either as something they have seen on TV's, such as a humanoid robot, or semi-autonomous vacuum cleaners and lawnmower – this is what a *robot* is for them. For limiting our scope, we do not cover these relations here, although we are aware of those. In the third tier of the analysis process, the main author of this paper went again through the whole research material collected, for partially merging the data collected in order to get a holistic view of it, and partially, with the purpose of a second filtering and re-coding. In the end, based on the recurrent pattern available, *fear* has been selected to be discussed in this paper. In Figure 2, we show the details of each of the tiers.

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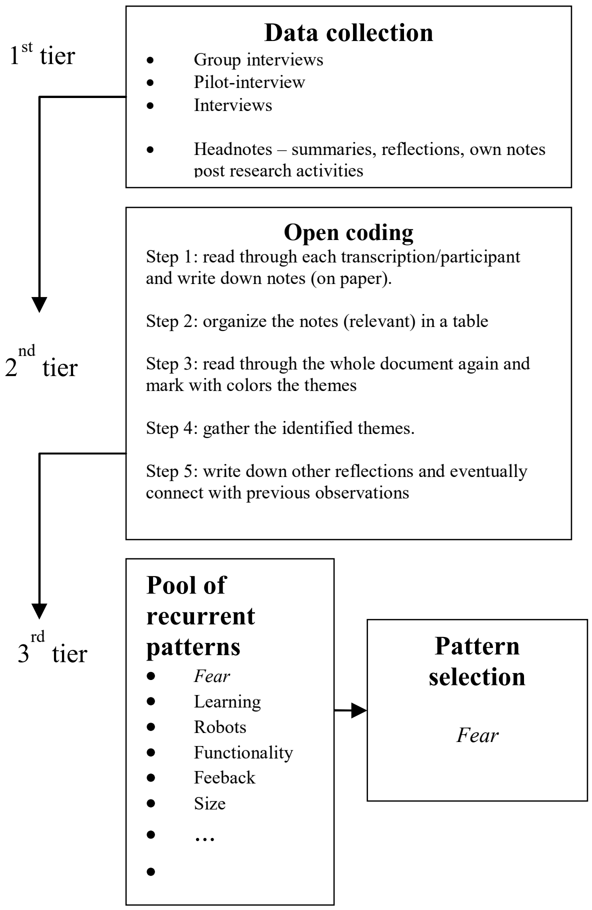

Figure 2. Data Analysis Process – Detailed View

V. PRELIMINARY RESULTS OF FEEDBACK AND FEAR

We illustrate in the next paragraphs two types of situations from our research: technology providing improper feedback where the user (here the elderly) does not know how to proceed, and the technology not providing any feedback at all, e.g., lack of feedback. We showcase each of these through real-life situations experienced by the elderly in their daily interaction with modern technologies, i.e., *stories from the elderly*.

A. Situation 1: Providing improper feedback

"*SMS shows full. Do I need to buy a new phone?"* - One of the participants tells about her experience with the mobile phone and the feedback of SMS - full blinking icon. She would tell that she is not able to store any new photos received from her children or grandchildren. The participant feared that she had to buy a new phone and losing the photos because of the feedback is shown by the phone. Regarding the design issue here, we can look at how the elderly may perceive the digital feedback gotten from the technology.

"I couldn't start it—but it was so much more.. among others, the screen.. disappeared and so.." - Another participant explains her experience with a semi-autonomous vacuum cleaner which can be controlled by an app. During a power outage, the app controlling the domestic robot stopped working. The participant got a message that the app "*cannot connect to the cloud services*".

"Where is the 'No' option when updating software?" - Another situation described by one of the participants is related to the feedback received when a software shall be updated. The participant explained that she is tired of getting constant updates, and points out that an *exit* option does not exist. She would get either the option '*Now*' or *'Later',* but not a *'No'* option. She contacted the company providing the operating system via a *handwritten* letter and asked about this option. To her surprise, got called up by the customer service, and got offered help on *how to deal with the two options available, 'Now'* and *'Later'*, but the company had no regard in planning to introduce a *No-option.* The participant explained that she knew how to deal with the updates, but what she wanted was that the feedback should embed a *'No'*-option alternative. Regarding this design issue, this has to do with the continuous update of software and the point of view of the elderly on these "*never-ending*" updates. This example illustrates a situation where feedback messages do not provide enough options.

"*It was just standing still there. Or when I pressed on it there it says something about cloud-service. It didn't do anything, but I thought you will come tomorrow*" - Another participant explains a situation with controlling a semi-autonomous vacuum cleaner through an app, which did not provide sufficient feedback. Using the wording "*cloud-services*" can confuse a user not-knowing what it means. The user, in this case, relied on the researchers help to come along the next days.

B. Situation 2: The software does not provide any feedback at all, e.g., lack of feedback

"You were terribly afraid of doing something wrong" - In one of our interviews sessions, one participant describes that when she learns using new technologies, she is so afraid of *doing something wrong.* A concrete example is that the technology, being it smartphone or tablet, does not provide any feedback on how to "*get back to basics*": "*so you were very afraid that .. I did not feel I could come back to the base. But I was afraid to do something wrong*."

By this, the participant means that the applications are built in such a way, that one is expected to have that intuitive knowledge, but for new learners, it can be difficult to understand how to navigate within an app, and one can easily "get stuck". She explained about her experience when using a streaming TV-channel app and its search function: "*I think now I will do this… Huuuu (exhales heavy) and I do not get it.. and there are many of you who have explained to me. (laughs) But it goes so fast!*".

"I have an example absolutely horrible. I had to print something on 3 pages.. and the printer goes fine.. and it prints and it prints and it prints. I cannot afford it. In the end, I had a lot of printed files.." - Another participant explains an experience with a printing machine, where no feedback was provided at all. She had to call an organization that provides IT services for the elderly users, in order to be able to stop the machine. Another participant agreeing on the story, says: "*It can get so difficult when one does not understand [what's happening]*."

VI. DISCUSSION: FEEDBACK AND FAMILIARITY

In this section, we unpack the pattern of *fear* emerged from our data, based on its derivatives, e.g., associated emotions. The pattern is unpacked with regard to *digital feedback*, and how it is experienced by the elderly. We assigned this based on our phenomenological interpretation and understanding of what has been communicated. This is strictly our phenomenological interpretation, and we are aware that other interpretations are possible. But first, we typecast the situations described to the corresponding derivative of the emotion of fear, as shown in Table II.

TABLE II TYPECAST SITUATIONS – AND FEAR

Situation	**Typecast**	**The emotion of fear and its derivatives**
Situation 1	Not providing proper feedback	Concern (here for buying a new phone), doubt (from getting a black screen), unease, uneasiness and presentiment when the technology *provides improper feedback*
Situation 2	Not providing any feedback at all	Angst, anxiety, concern unease, uneasiness, fright, phobia, worry – when there is *lack of feedback*

We can observe from concrete situations presented in the previous section and typecast in Table 1 above how feedback, from digital technologies, being it improper, or lacking completely, may generate at some degree the emotion of *fear*, or feelings associated with it. This is due to either not knowing what happened, or how to proceed further.

[42, p. 75] propose *familiarity* as a design aspect in order to enhance the usability of the digital technology, pointing out that "usability alone does not guarantee that the technology will be used (Hirsch, Forlizzi et. al 2000)" (p. 86). Even in our study, the aspect of usability was indicated, but *feeling unsafe* (aka feeling *fear*) is still an indicator of using or not the technology. For instance, one of the participants points out on his concrete experiences with new digital technologies: "*As soon as I feel unsafe regarding the technology, I put it aside."'; "First, I do not need it to.. go [meaning learning it] in deep.. and secondly, I am afraid… I feel unsafe, yes..*"

Hence, here we could identify two aspects: on one hand the aspect of familiarity through the feeling of safety, and *functionality,* the value provided by the technology in itself.

But concrete experiences have to be complemented by the allocation of the 'appropriate resources' if one should follow the zone of proximal development (ZPD) theory on learning [43]. What if the only 'appropriate resources' might be the technology in itself, or as [31, p. 431] puts it: "~The medium is the message."? Specifically, in our case, digital *feedback* can be considered as a *carrier* of design concepts, such as *familiarity*. As we show in our findings, feedback might be either *improper or lacking completely*. This also implies that the elderly's concrete experiences with technologies are not supported through design. But how can familiarity be applied to in practice to digital feedback? We discuss further both situations described in *Section VI Preliminary Results.*

A. Familiarity with a design concept for situation 1) – providing improper feedback

First, a solution for providing proper feedback is, for instance, through clear messages, avoiding the use of single modalities of feedback representations, such as the blinking icon for showing the status of *full messages.* Although, there are situations when this type of feedback is supported by a text informing the user about "full messages", it does not guide the user on how to proceed further. One solution is to decrease the gap, e.g., the zone of proximal development, between what the user knows, and what has to be achieved, i.e., deleting messages, by providing *proper feedback.* Specifically, we mean by *proper* feedback, *descriptive* and *relevant feedback:* this can simply be done through a text that points out how to proceed further, as for instance: "*SMS full. You need to delete some of your SMS before you can receive new ones*."; or by including more step-by-step guidelines: "*SMS full. You can solve this by 1. Go to your SMS messages. 2. Click long on one of the SMS from the list. 3. Mark the checkbox of those SMS you wish to delete. 4. Select delete*." In this way, we decrease the gap between what is not familiar to the user, and what it is.

Second, one can provide proper feedback, by avoiding the use of technical terminologies, such as "*it cannot connect to the cloud-services*". Many of the elderly do not know what a "cloud-service" is. Using such technical terminology discourages them from using the technology. Instead, one could build upon the concept of *familiarity,* starting from the assumption that one does not know what the "*cloud service*" is. This can be done either through simple visualization or animations or through further explanations in plain English. Second, this type of feedback can be supported by additional alternatives, showing step-by-step how one could connect to the service: "*Have you*

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checked out your internet connection – is your router turned on? Go to..", without assuming that the users know how to get around, giving them step-by-step feedback on how to proceed further.

Third, in the case of not providing enough alternatives example, one can provide proper feedback through giving more explanations on *why* one has to proceed in a certain way, e.g., such as updating the software when the *"No"*-option is not available. Another way of doing it is through actually making these updates invisible to the user. In that case, the interaction should be robust enough, so the user does not end up in not getting any feedback at all, as described in Situation 2), which is also discussed next.

B. *Familiarity with a design concept for situation 2)- not providing feedback at all, e.g., lack of feedback*

One can provide proper feedback before the breakdown situation, when the user gets stuck, by indicating the user where it is, or by preventing such a situation and offering feedback in time. This can be done by building upon the *familiarity* of the user – what does the user might not know, and how can the design prevent breakdown situations? This way of enhancing the user experience in its interaction with modern technologies is sometimes referred as *feed-forward* [40][41]. This approach relates to *showing the way forward* on how the user shall proceed, prior an event occurred as an effect of the user's interaction with the modern technology. In the next paragraphs, we provide a few examples.

First, a solution example is used for instance in Android Operating Systems, when it is required in a text field, an input from the user. Some designs allow so-called *hints*, which are non-editable texts that are shown in the background of a text field, indicating the user what to enter in the respective field. This way of providing feedback to the user counteracts eventual *deviations* in the user's interaction with the technology, prior to the interaction occurring.

Second, another example is shown by autofill functions, for instance, in a web-browser, where the text fields are filled in with information, based on historical data – name, email addresses, home address, zip code, phone number etc. that have been used as input on that respective computer.

Third, a similar example is also the auto-complete input function, that learns based on the user's past inputs.

The second and third examples of built-in feedback are examples, on *supporting* the user interaction with the technology, *on the go*. As the technology learns more about *its* user, it can also give *appropriate* feedback for that specific user. Appropriate feedback is based in this case on elements that are already *familiar* to the user.

These type of approaches are also often discussed in literature of universal design, as *simple and intuitive use,* and as *perceptible information* (see principles 3 and 4 in [46]–[48]).

C. *Some final reflections and wrap-up*

One study, [49] shows that feedback increases performance encourages reflection "by increasing knowledge and awareness of behaviors and their impact", and has motivational consequences (p. 63). In this way, feedback, not only encourages what [50] calls 'reflection on action' on "evaluating [own] past behavior", but also 'reflection-in-action', "the analysis of behavior as it occurs" [49]. One should take into account feedback's properties such as: the technology, the content, timing, modality, duration, frequency, presentation, user experience [49], as well as spatiality between the user and the technology in itself, which is important when interacting with robots, as reported by [15]. Could then it be so that if the technology embeds a better design of feedback (compare to *improper,* or *lacking completely* as shown in this study), would eventually contribute to the learning experience of the user (e.g. elderly)? We argue that if users such as elderly would be provided with *enough* and *proper* feedback, with respect to the properties enumerated earlier, the zone of proximal development will provide the user with sufficient resources for the learner, in such way that the learner will feel *safer* to use the technology. In its turn, this will contribute to the familiarity of the user with the technology, reducing the threshold between the user's prior knowledge and the challenge at hand.

VII. CONCLUSION AN D FUTURE WORK

In this paper, we have presented: what affective implications the design of digital feedback in modern technologies may have on the elderly users while they use those, such as triggering the emotion of *fear*; and proposed familiarity as a central design concept to be considered when designing for the elderly users. We started the paper by introducing the reader to three central concepts: *digital feedback, fear* and the emotions associated with it, and *familiarity.* Digital feedback is presented here as visual feedback received by the elderly in their interaction with the modern technologies. We argued that *feedback* can be affective *by its design*, through multimodality, or *become affective* as a result of how it is experienced by the users, here the elderly. We exemplified this through the use of the umbrella term for *fear* and the feelings associated with it, e.g., derivatives, such as *angst, anxiety, concern, doubt, dread, unease, uneasiness, worry, aversion, fright, phobia, presentiment* [1]. After presenting our methodology, as an interpretative phenomenological one, the methods used and our analysis, we showcased this through empirical data. Thereafter, we discussed theoretically *familiarity* as a design concept that should be considered when designing *feedback* in modern technologies. We argue that having *familiarity* in mind when designing new technologies, can bridge the gap between the elderly's zone of proximal development and the challenge at hand while learning new technologies. Yet, specifically, we encourage to consider feedback as the *carrier* of the *familiarity* design concept, which would support the elderly's learning process of interacting with new

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modern technologies. However, we do not address here the issue of cognitive impairments, or representations of visual feedback through other visual ways (e.g. animations). We propose this be further investigated through concepts such as *universal design.* Specifically, we intend to explore this further through focusing on the principle five of universal design, namely *tolerance for error,* and build further upon it. Based on our theoretical findings, we hope, in the future, to contribute to the design of modern technologies that will encompass the patterns explored here. Based on our reported work so far in the MECS project, we plan to build further upon *familiarity* design concept while designing the safety alarm robot for the elderly. More concrete, in a second phase of the project, we introduced semi-autonomous vacuum cleaners robots in the home of the elderly, in order to learn more about their daily interaction with a robot. The partial results presented here, as well as the second phase of the project, are part of the MECS project phase where we get insights on the elderly's understanding of robots and welfare technologies, as well as of the gathering requirements phase. We plan to continue our work in this sense, in order to get a deeper understanding of the pattern explored here.

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