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Designing Connected Resources for Older People

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Abstract
In this pictorial, we illustrate steps towards a novel approach that situates connected technologies for older people as resources. In contrast to mainstream approaches in gerontechnology that consider elderly as frail and passive, we aim to complement older people's vital competences by designing technologies that can be used in less prescriptive, and broader ways. The pictorial describes our design process in which resourceful strategies were identified through thing ethnography and used as inspiration to create a series of new connected objects conceived as resources.

Authors Keywords
Resourcefulness; thing ethnography; IoT; RtD; gerontechnology.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

1. Introduction
Houses of older people are becoming increasingly connected, as more and more smart devices are entering the home. This creates interest in how to design connected objects for older people; and especially, how to foster valuable activities for them, in contrast to the current approach that focuses on physical decline. In that mainstream approach, technologies for older people are conceived within narrow-scripted scenarios which fail to address the variety of situations elderly encounter [17,19]. These scenarios are especially problematic when they are

based on poor conceptions of older people, framing them as passive recipients of technology [15–17].

Studies in social gerontechnology have shown that rigidly scripted products can become inappropriate very quickly, as they fail to match the design intentions with actual use [7,15,16]. For example, a medicine dispenser that is designed for indoor use only, fails to address that many older people spend a lot of time outdoors [14]. These products can not only become inappropriate, but even limit meaningful activity of elderly people, and suppress their creativity and autonomy [11–13,16].

In our study, we aim to capture how everyday objects and technologies are used and 'misused' resourcefully: *Kathy told us that she received this bracelet from her son, who wants her to be safe when she goes on her long walks in nature. However, she doesn't use the bracelet on her wrist, because she considers she does not need it. Instead, she found a new and very different use for that object: since it is made of flexible rubber, it helps her to keep that lose cupboard door closed.*

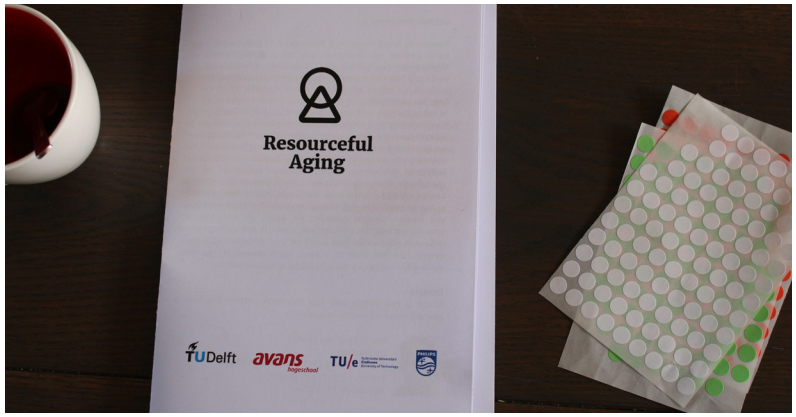
Thus, there is a need for new design approaches, which step away from the stereotype of elderly as frail, passive and technologically incompetent, and see them as well capable of dealing with the challenges they encounter as they age [11]. In the interdisciplinary research project Resourceful Ageing, we focus on designing technologies that can empower elderly people, by *learning from the ways in which they creatively deal with challenges* [12]. This innovative approach proposes to position connected technologies as resources: tools that can "complement the ageing competences of older people and be adapted in a variety of ways" [11].

This pictorial focuses on the question: How to design connected objects as resources for elderly?. In order to explore that question, we worked within a research-through-design process [18], in which we used design tools and prototypes to further understand what are elderly's existing competences of resourcefulness, how to support these competences with new designs, and how to encourage use in a variety of ways. We developed the design tools in a series of iterations, feeding the insights from every step back into the design process – impacting on the brief, ideation tool, and informing esthetical and functional decisions in the design of the prototypes.

2. Thing-centered Ethnographic Study

In order to understand older people's resourceful competences, we conducted an ethnographic study. Since resourcefulness is a dispersed practice, which occurs spontaneously in everyday situations, it is particularly difficult to capture [12]. To tackle this challenge, we applied a thing-centered approach to our ethnographic study: considering both elderly as well as their everyday things as participants [10,12]. This method was particularly suitable to uncover resourceful strategies, as it revealed how things were used across practices in unexpected ways.

We conducted the study in the homes of older people living independently. The study was conducted by a social scientist, accompanied partly by a design researcher. We visited four homes of female participants between 65 and 78 years old [24]. Three of them lived alone, and one lived with her spouse. We conducted semi-structured



One crucial aspect of the study was to start from resourceful practices in activities older people valued, rather than from problems. To do that, we asked participants to tag with different colors objects they frequently used, objects they used in activities they value, as well as objects they valued even if they were not strictly "used", such as a picture on a wall.

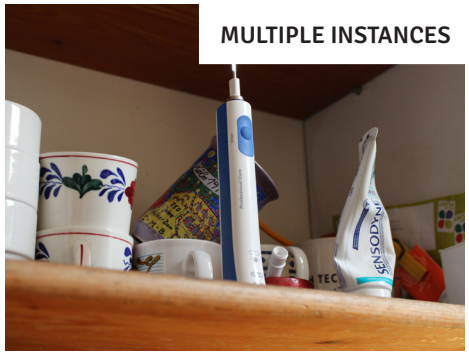
interviews, and a one-week home assignment with a booklet [9,20]. In the assignment, participants were asked to tag objects they frequently used in activities they valued. Once the exercise was completed, the ethnographer and the designer visited the homes, asking participants to walk them through a home tour. The tour consisted in pointing at the tagged objects and explaining the reasoning behind their choices and how they were meaningful for them. Using those tagged objects as a starting point, together with participants, we were able to recognize and better *define resourceful practices in valuable activities*. Once a common understanding was established, participants were able to show us additional examples of resourcefulness, which we documented with photos.

3. Resourceful Repertoire

Data from the thing-centered ethnographic study were clustered into what we call the *resourceful repertoire*: a non-exhaustive collection of elements we found in elderly's existing practices of resourcefulness. We did that by coding the photos and organizing them in three categories: resources, capabilities, and strategies. The idea of a repertoire was inspired by the *resilient repertoire* [8], but instead of focusing on efficiency and safety at work, we focused on creativity and resourcefulness at home.

We recognized eight strategies, sixteen resources and sixteen capabilities. Resources included physical materials and everyday objects. Capabilities included abilities that resources presented. Although resources and capabilities were relatively simple to spot, strategies demanded to look for *know-hows*, high level plans, or emergent systems which participants developed over time [19] in order to achieve a goal or just make do. Strategies also showed combinations with immaterial resources, such as getting help from the family or their social connections. We present here the eight strategies, and a few examples of capabilities and resources.

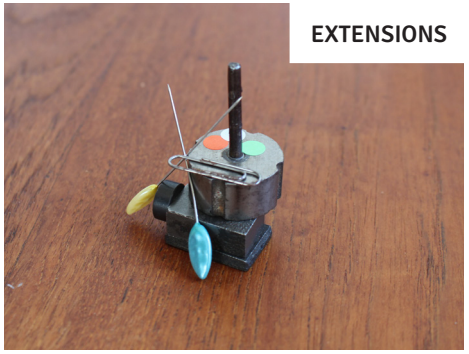
RESOURCEFUL STRATEGIES



Having more than one object, to find always one at hand *Many participants keep multiple pairs of glasses - for example Inge told us she has more than ten pairs. Toothbrushes were also duplicated in Maria's house, one on each floor. Minnie reported having multiple agendas, including digital and physical ones, as well as personal and shared.*

Communicating with others through objects *Inge shares a newspaper subscription with her daughter, and brings it to her every afternoon. In that way, her daughter knows she was there: "If she does not receive it, they know something is going on." This practice serves both of them to keep an eye on each other in a non-intrusive way. Another example of communication through objects is from Minnie: she placed a sticker in a drawer to remind guests that rent her home sometimes, to be careful with the old piece of furniture.*

Sorting by type or purpose *Items are commonly arranged in groups according to their function, use or shape. These clusters seem to be sometimes intentional, when things are placed in drawers; and some other times unintentional, when a collection of items that don't have a specific place, ends up in a sort of container.*



Extending physical capabilities, to reach where we cannot *In order to reach higher, Inge placed double-side tape on a broomstick. She uses this to kill spiders in the ceiling. Kathy also showed us how a magnet helps her to pick up small metallic items, which she cannot grab with her hands anymore.*

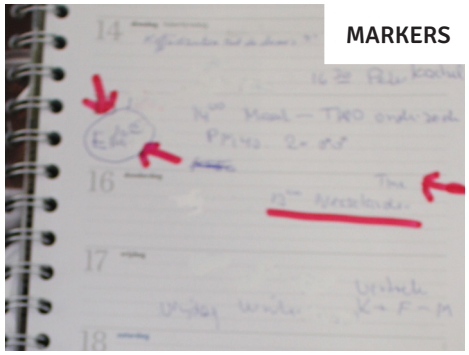
RESOURCEFUL STRATEGIES

MATERIAL ADAPTATIONS

Combining unusual elements to form something new *Kathy adapted her pans by wrapping the handles with thread, in order to avoid burning her hands, especially since she prefers grabbing close to the pan, as it gives her a stronger grip. Inge created a wooden cube wrapped with leather to block the garden door. This is her own "low-tech" system to avoid theft, and feel safe.*

KEEPING TOGETHER

Arranging related things close to each other *Many people keep things together next to the door, for example, to remember them before leaving the home. Many participants keep the remote controls next to the television. When Minnie is knitting, she leaves the unfinished parts and needles together -normally on this decoration plate- so she can easily continue knitting later.*



MARKERS

Highlighting or emphasizing physical elements *Inge uses this strategy around the kitchen: she placed a red mark in her kettle, to make the minimum water level more visible. She also showed us how in order to avoid missing important events from the agenda, her system was to highlight them with a red marker.*

SEQUENCES

Organizing actions in a temporal order *All participants follow steps more or less in the same order, while doing a recurring practice. For example, Minnie described her morning routine, which starts by turning on the radio, and then making cereal in a sequence that involves several steps.*

Most of the resources we found in the ethnographic study were in between products and raw materials. For instance, clips and elastic bands, which were very common amongst our resourceful examples, are mass produced objects, but have a mundane character.

Regarding capabilities, although we saw in the ethnographic study that our participants use digital devices frequently, we didn't encounter resourcefulness using digital means, and especially not in combination with physical ones.

RESOURCES

Clips and bands were used to keep parts together, either a door or a curtain, or a cover on a garden bench. Magnets were extensively used to stick papers and photos in metallic surfaces.

CAPABILITIES

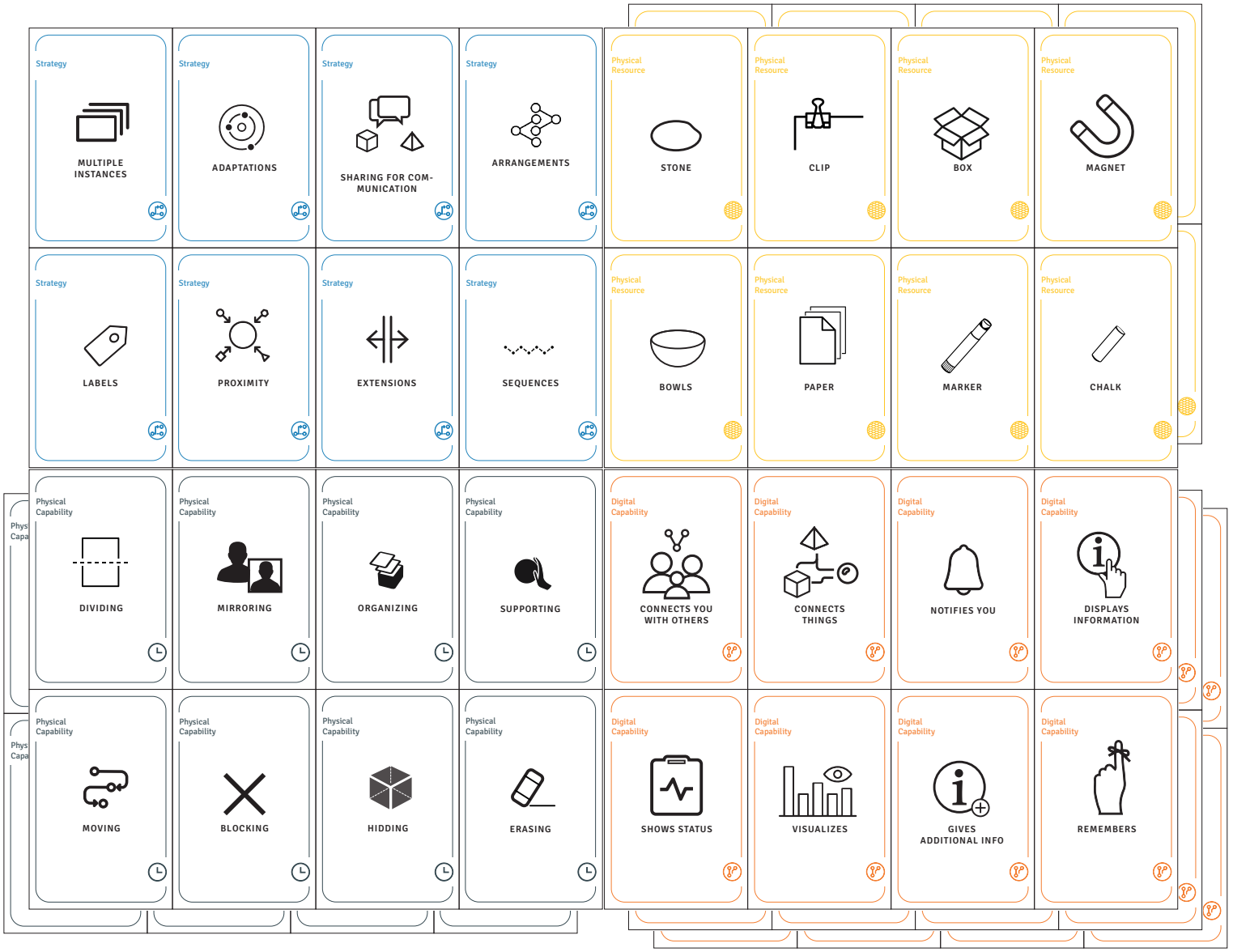
Some capabilities included for example: hanging a garbage bag from the handle, or a plug in a hook for towels; inserting photos behind sockets and other tight spaces; or wrapping a handle or a broken hinge with threads.

4. Design Process

One of the aims of our project was to use the resourceful competences of older people as an inspiration for the design of new connected objects. For this purpose, we used the resourceful repertoire as a generative tool by translating its items into cards. Every item was represented in a card with its name and an icon. The items were organized in groups according to the categories we had in the repertoire (resources, capabilities and strategies) and had different colors.

Since we wanted to create not only new resources but technological ones, we added a new category of digital capabilities, which included twenty four cards. The items of this group were defined during the kick off session (see 3.1).

The card set was used in a series of workshops with a design team –composed by one design researcher, three design master students, and one computer science student. Then it was evaluated in two sessions with professional designers. The process is briefly described in the following sections.



4.1. Kick off session

A design team brainstormed initial ideas of "connected objects to empower elderly to age resourcefully". The cards were not used yet as such, but examples from the repertoire were shown to the team before the brainstorming exercise. After the team presented ideas for new connected objects, we noticed they all included extra capabilities, such as visualizing information, saving information, or showing notifications. Thus we made a list of what we called 'digital capabilities', which was added as a new group in the card set.

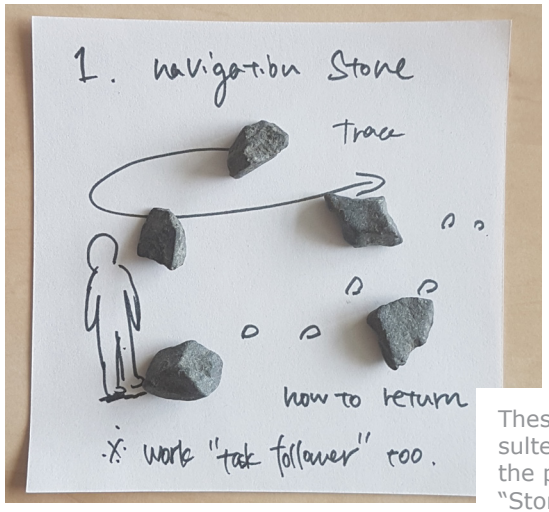
4.2. Design session

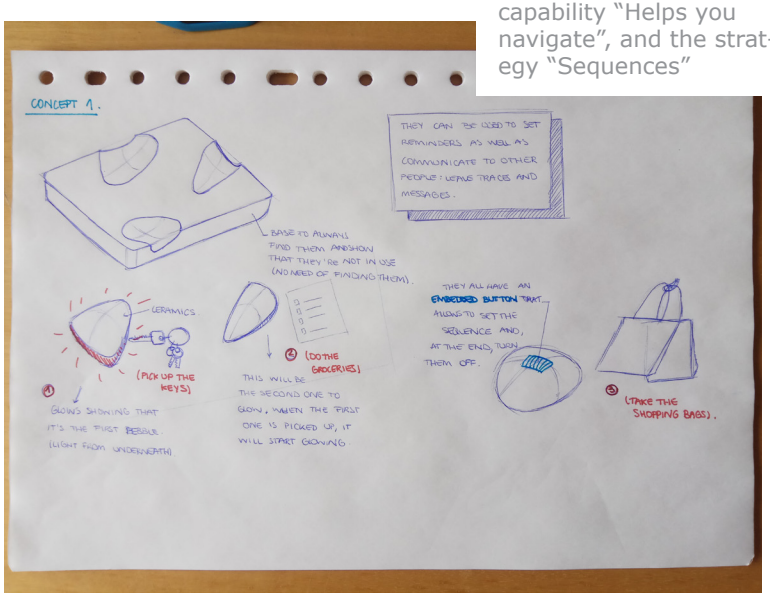
The card deck was printed in a draft version and used in an ideation session with the design team. We presented the following brief: "Using the set of cards, design connected resources for elderly, that can be configured in their everyday practices, in a variety of ways". After the researcher introduced the card set, and presented the brief, the team was divided into two groups and provided with a deck of cards and physical resources (such as clips, elastic bands, fabric, etc.). Since we had a collection of physical resources in that meeting, we skipped the cards 'resources' and worked directly with physical elements.

At every round, someone picked a card of each category, and a physical resource. Then we sketched as many ideas as possible. We noticed that physical capabilities and resources were sometimes overlapping, and either one or the other was chosen as a starting point. However, later the group agreed that it was useful to have more than one option to choose from. The resulting ideas were a combination of a physical resource –or capability, with a digital capability, to support a certain strategy. Several proposals were presented per group, and three concepts were selected, according to the student's interests (see section 3.4).

4.3. Feedback session

The card set was evaluated later at the design studio The Incredible Machine, and at Philips Design (partners in the





These sketches resulted from combining the physical resource "Stones", with the digital capability "Helps you navigate", and the strategy "Sequences"

Resourceful Ageing project). In both sessions, we played some rounds and then reflected on the card set as a generative tool. The feedback focused around how the card set could be scaled for other projects and other user groups.

4.4. Design and Prototyping

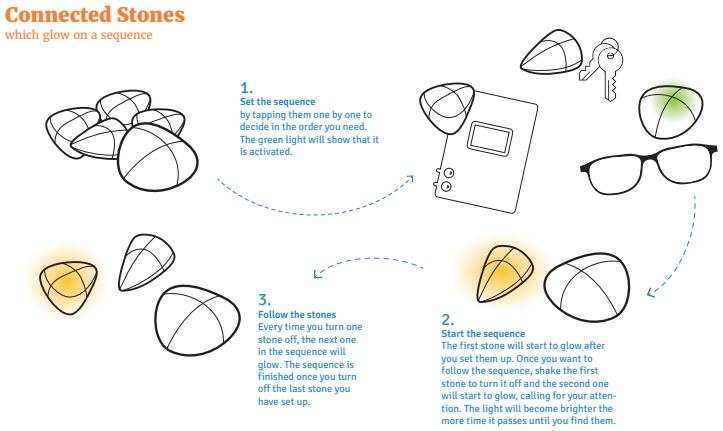
The three initial ideas selected at the design session evolved with a series of iterations to three final concepts:

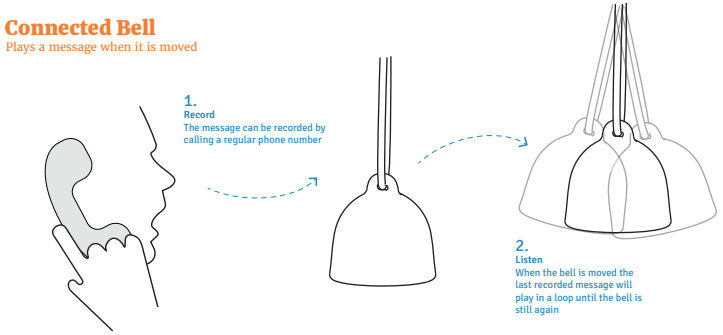
1- Connected Stones

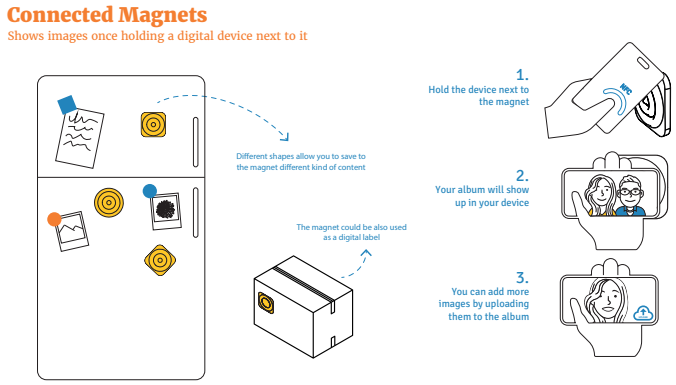
2- Connected Bell

3- Connected Magnets

The three concepts were prototyped in several iterations. The design and making of these prototypes included: defining their shape and interaction based on existing objects/ metaphors in elderly's homes; deciding and trying different materials, including 3D printing in PLA and porcelain; and developing electronics and connectivity, which included a custom board and the design of a website. For technical details of the prototypes see [23].







4.5 Presentation

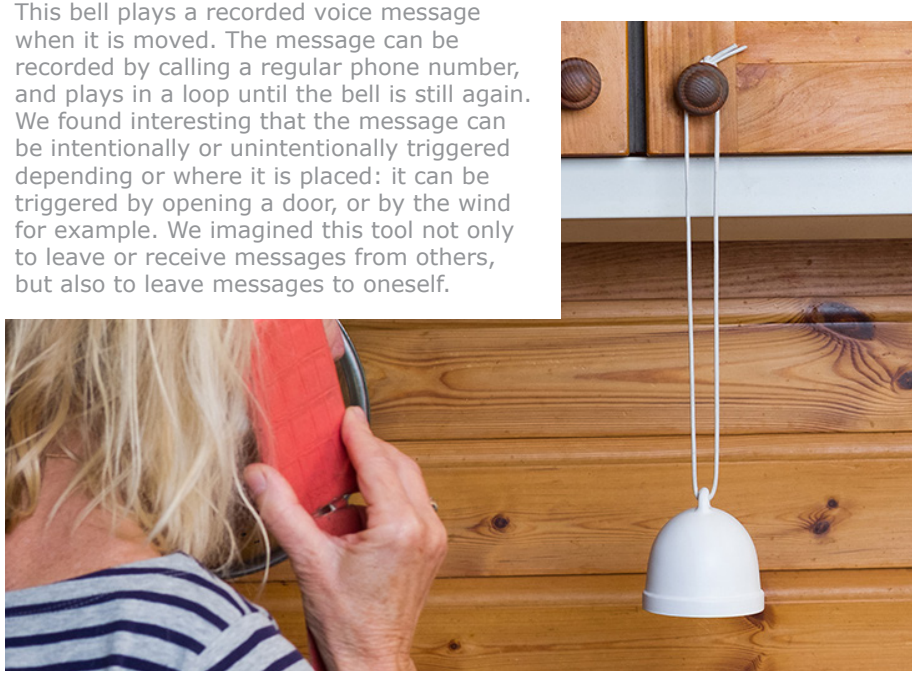
Although the final prototypes weren't deployed yet, we photographed them in a home to better explain their context for an exhibition at the Dutch Design Week.

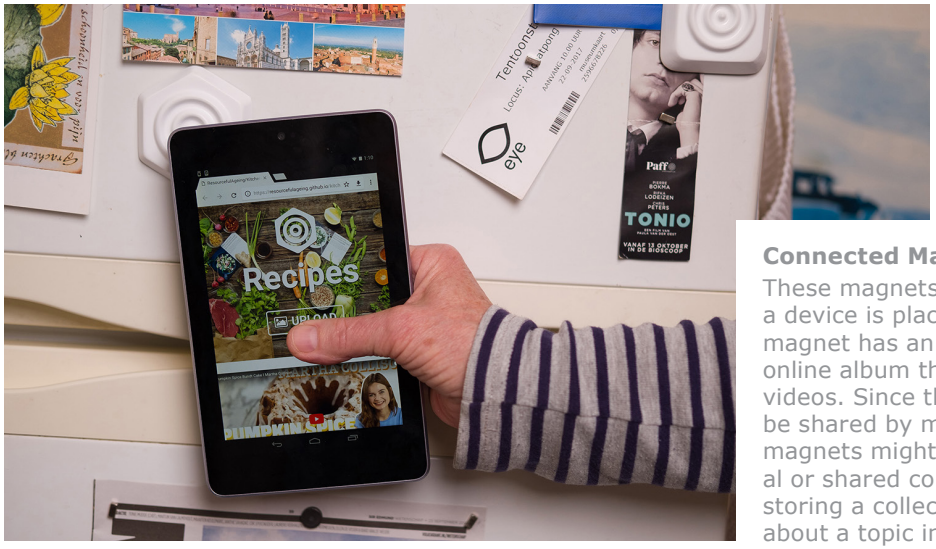
Connected Stones

Inspired by the idea of leaving a trail with crumbs, this series of stones glow in a sequence. The interaction is very simple: once the first pebble is turned off by shaking it, the second stone starts to glow; once the second one is turned off, the third stone glows; and so on. We imagined these objects could be used to make sequences more visible, to light up a path at night, to leave a step-by-step instruction, message or reminder. As we observed, participants leave objects together to easily find them, so this tool could facilitate that strategy without the need of taking objects out of their context. Thus, keeping them together "virtually".

Connected Bell

This bell plays a recorded voice message when it is moved. The message can be recorded by calling a regular phone number, and plays in a loop until the bell is still again. We found interesting that the message can be intentionally or unintentionally triggered depending or where it is placed: it can be triggered by opening a door, or by the wind for example. We imagined this tool not only to leave or receive messages from others, but also to leave messages to oneself.





Connected Magnets

These magnets open a digital album once a device is placed close to them. Every magnet has an NFC tag, which links to an online album that supports images and videos. Since the album is online, it can be shared by more than one person. The magnets might be used to access personal or shared content in a situated way, by storing a collection of photos and videos about a topic in a relevant place.

5. Discussion

Designing connected objects as resources demanded a shift in focus, from solving specific problems of older people, to conceiving technologies that can support their strategies of resourcefulness, and be used in a variety of ways. This shift implied a different design process. Even though the connected resources have so far not been deployed in the homes of our target audience, we can reflect on the design process and how these objects can be positioned as resources.

The connected objects we created can be positioned as resources firstly because they are conceived to support, and inspired by, older people's competences of resourcefulness. In order to understand what were these competences, we used a *decentered* 'thing perspective' [10] to identify the possible strategies, capabilities, and materials that play a key role in shaping elderly's resourceful arrangements. We first organized these strategies, capabilities, and materials in a repertoire, and then translated them into an ideation card set, which was used to generate ideas for connected objects.

Secondly, we position these connected objects as resources because they don't try to solve one specific problem, but are designed to be used in multiple ways. Since resourcefulness is not a property of a person or a technology alone but the result of how they work together [5,22], connected resources let users decide how and why to use them in a situated way [11]. To avoid rigidly scripted scenarios, one necessary step was to keep the purpose of these objects as *underdesigned* [6] as possible. However, while some *dimensions* [12] had to be open in order to make these objects suitable across practices; others needed to be closed to make them familiar and easy to use.

In summary, these objects can be positioned as resources because they (i) complement the resourceful competences of older people, and (ii) can be used in a variety of ways.

Positioning technologies as resources opens new design opportunities in the space between digital and physical, as well as between products and materials. Although our participants used digital devices frequently, we didn't encounter instances of resourcefulness that combined both digital and physical capabilities. Thus we wanted to explore how elderly could use digital capabilities as everyday resources in a simple and playful way. We explored this by adding digital capabilities to existing physical resources. The assumption was that the familiarity that older people have with these physical resources, as well as their everyday character, might help to perceive them as materials for adaptation [1,12,22]. Additionally, we observed that resources such as clips and elastic bands seem to be somewhere in between products and raw materials. This space seemed refreshing, since technologies are commonly divided into high-tech smart products, or smart materials.

In a previous publication [12,] we have uncovered some of the characteristics of resourcefulness as a dispersed practice. However, still many questions remain open regarding how resourcefulness manifests differently in older people versus other groups. Long-term deployment and further studies are needed to identify how different groups may relate to these objects, and whether they support or inspire new strategies of resourcefulness.

6. Conclusion

Designing connected resources instead of scripted products is not an easy task. We, as designers, tend to start from personas or scenarios [2,3]. Designing resources required a different approach. In this pictorial we presented the alternative process we followed, which included organizing elderly's competences of resourcefulness in a repertoire, by analyzing data from a thing-centered ethnographic study. We also showed how we used those competences as inspiration for the design of new technologies by translating them into a card set, which was used in the design of three prototypes. Finally, we reflected on our design process by discussing how these prototypes can be positioned as resources, and what new design spaces are opened with a resourceful approach.

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