



OPINION ARTICLE

Learning from COVID-19: Design, Age-friendly Technology, Hacking and Mental Models [version 1; peer review: 1 approved]

P.J. White ¹, Hannah R. Marston ^{2,3}, Linda Shore ⁴, Robert Turner⁵

¹DesignCORE, Humanities, Institute of Technology Carlow, Carlow, R93 V960, Ireland

²Centre for Innovative Ageing, Swansea University, Swansea, SA2 8PP, United Kingdom

³Health and Wellbeing Strategic Research Area, The Open University, Milton Keynes, MK7 6AA, United Kingdom

⁴Design Factors, School of Design, Science & Engineering Faculty, University of Limerick, Limerick, V94 T9PX, Ireland

⁵Airbus Defence and Space, 28 Keswick Drive, Castleford, West Yorkshire, WF10 2RD, United Kingdom

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Abstract

In March 2020 the United Nations published an open brief for the creative community to propose interventions to the unfolding COVID-19 pandemic. However, when faced with unprecedented wicked problems such as these, the rigour of design and creative processes can be tested. COVID-19 has demonstrated how important human centred design responses are in understanding the worldviews and ecosystems of users. Ad hoc design responses or design hacks have demonstrated that they have a role to play in how we create our future individual, community and societal ecosystems.

In terms of age friendly design, this pandemic makes us envision what should be, furthermore, how we could create better products and services through technology. For our ageing communities 'Cocooning' and other social restriction measures have exposed technological deficiencies for the needs of older people and opens up questions of our future preparedness for a growing ageing society. Now more than ever, designers need to understand the behavioural mind-set of older people in their own ecosystem and understand existing mental models.

In this opinion piece we posit what acts of design hacking can lead us to greater understanding of users mental models and therefore better understanding of technology needs for both older and younger adults. While presenting various examples of how design hacking is conducted by citizens and participants alike, it shows that it offers designers differing perspectives, experiences and inspiration for technology.

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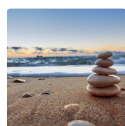
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1. **Helene Fournier**, National Research Council
Canada, Moncton, Canada

Any reports and responses or comments on the article can be found at the end of the article.

Keywords

Design, Age Friendly, Technology, Design Hacking, Coronavirus, Mental Model



This article is included in the [Healthier Lives](#) gateway.



This article is included in the [Fairer Society](#) gateway.



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Corresponding author: P.J. White (pj.white@itcarlow.ie)

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Introduction: COVID-19 and creative responses

COVID-19 is the unwelcome visitor at a dinner party, and not only has it arrived at our door steps without an invitation or a dessert (Marston *et al.*, 2020), it is impacting our various ecosystems from the individual, to the community, towns, cities, countries and continents at unprecedented rates and behaviour. Since the beginning of 2020, COVID-19 has been moving rapidly through the world, not discriminating in who it attacks; whether you live in a deprived or affluent community, whether you are a baby, a frontline keyworker, vulnerable or the Prime Minister (PM) of the UK. This is leading exemplar of how vicious COVID-19 is, having struck at the heart of the UK government, and has resulted in the PM being admitted to hospital followed by a time in intensive care (Helm, 2020)

While various individual and collective ecosystems (Marston & van Hoof, 2019; Sheerman *et al.*, 2020) attempt to adjust to some kind of normality taking each day at a time, we see the impact of COVID-19 has on our individual communities. Social distancing for example has exposed problems in doing simple everyday activities such as shopping and communicating with friends and family members. This problem is acute for older people who have tighter restrictions at this time (Holden, 2020). Therefore we need to be adaptive, creative, and understanding to respond to vulnerable community member's needs.

With our lives currently adapting, on an international landscape, the United Nations (UN) made an unprecedented call in unprecedented times, it published an open brief for the creative community to propose interventions to the COVID-19 pandemic. UN Secretary-General António Guterres wrote:

"We are in an unprecedented situation and the normal rules no longer apply. We cannot resort to the usual tools in such unusual times. The creativity of the response must match the unique nature of the crisis – and the magnitude of the response must match its scale." (United Nations Secretary-General Guterres, 2020)

Seeking creative responses to problem areas from 'Myth busting' to personal hygiene, personal distancing and donating the call is seeking agile and adaptive means to address the ongoing pandemic. It demonstrates how creative approaches are now accepted as a means to address unprecedented wicked problems.

Design methods and wicked problems

Design principles and practices are interwoven and interconnected throughout everything in our ecosystems. From the design of cars that move us from one place to another, to the sweeping brush used for cleaning the yard, or a poster in a shop window stating closure. The artefacts around us are designed to fulfil a task or solve a problem. Herbert Simon's book *The Sciences of the Artificial* (1968) first differentiated Design as a problem-solving activity stating that "...the Natural Sciences are concerned with how things are ...Design on the other hand is concerned with how things ought to be" (Simon, 1968, p. 132). Echoing these virtues were contemporaries Horst Rittel and Melvin

Webber. In their paper 'Dilemmas in a General Theory of Planning' they explored contemporary issues surrounding social policy and argued how the 'scientific' approaches could not resolve complex societal problems alone. Stating that the objectives of scientific approaches were to resolve "tame" rather than "wicked problems" (Rittel & Webber, 1973).

In the current societal ecosystem that we have found ourselves in, Design methods and processes can be applied to a vast array of problems from business (Gaynor *et al.*, 2018) to healthcare. They have potential to react to ever growing concerns and offer solutions to both national and international Governments alike. Design approaches such as Design Thinking and Design Sprints (Knapp *et al.*, 2016) have been created to act on problems in an agile and fast manner. These processes were created by truncating traditionally time consuming Design processes into shorter and faster codified ones and have been popularised within fast moving corporate and industry environments due to their agility in response. However, they have been highlighted to having faults through level of rigour, with Nussbaum describing Design Thinking as a "failed experiment" (Nussbaum, 2011).

When faced with an unrepresented wicked problem such as the COVID-19 pandemic, the legitimacy and rigour of design and creative processes can and will be tested. Ascertaining whether the ability to conduct rigorous research, design, and develop products that people require in an agile approach while maintaining integrity can be achieved. So, what are the suitable design methods in tackling problems in a pandemic? We may need to go back to the source of the problem and understand needs and users more deeply, observe how individuals and communities understand their ecosystem and how they respond, adapt, and design their own environments and products in times of need.

Design responses in a pandemic

During the pandemic we are readjusting not only to our individual ecosystems, but our way of life in wider communities, towns, and cities. Whether this is via the living room, apartment balcony, in the garden, or city centre, the need for adhering to government policy of social distancing is critical for the health of all citizens. Due to the imposed restrictions, every day we are applying new ad hoc design responses to our individual space and place. While exploring and appropriating a hacking approach to both our existing and new ecosystem(s) we are attempting, by design, to improve our daily lives, for ourselves and others sharing the same physical ecosystem.

What COVID-19 has and is continuing to demonstrate is how important human centred design responses are; from a simple task of creating a shop closure notice to a more complex repurposing and retrofitting of existing large spaces such as the ExCel in central London, into the NHS Nightingale temporary hospital, with a purpose built morgue (Wainright, 2020). Across the UK, additional repurposing and retrofitting exercises are taking place to cater for citizens who contract COVID-19, in the North of England – Harrogate, Manchester, South West – Bristol

(BBC, 2020a; BBC, 2020b); Scotland (BBC, 2020c; UK Defence Journal, 2020), Wales (BBC, 2020d) and in Northern Ireland (BBC, 2020e). These agile, real time and life examples demonstrate how various actors such as health practitioners, military, industry, and government strategists are able to work coherently to provide a physical space for health treatment and encompassing a human centred designed response.

Not all these design responses are sophisticated; some demonstrate the most minimally viable options based on low fidelity materials or whatever resources might be at hand. The responses are created by personal worldviews, learnt conventions, or mental models, examples such as Figure 1 tell us a lot about how users understand their environment and how they would like products and environments design for them.

Future age friendly design and technology

Within a very limited and short space of time, all citizens have adjusted to their new ecosystem from the changing standpoint of their own individual space and that of their respective community. Previously, Marston & van Hoof (2019) discussed the importance of a smart age-friendly ecosystem, an extension of the WHO framework (WHO, 2007). However,

COVID-19 for the time being has put pay to this, and we are now learning about new individual and community needs for a future smart age-friendly ecosystem.

The pandemic makes us envision what age friendly environments should be, and how we could make them better with technology. It makes us ask many questions such as: what should our working and home environments look like? How should outdoor activities be facilitated? i.e. physical activity, gardening, relaxing, and a space for both young and old to interact together. Should our indoor space encompass a multitude of additional activities, such as physical activity (e.g. yoga, Pilates)? How can we better facilitate everyday tasks such as baking, reading, in addition to the regular, everyday chores such as laundry, showering, and watching TV? And how can we encourage communication and social events like meeting friends, going to church and supporting community groups via online platforms such as Skype, Facetime, and Zoom?

Age friendly technology and communication

From the standpoint of Ireland, over the last several weeks, COVID-19 has specifically taken its toll on the older population. As of Midnight on March 28th, 45% of hospital cases and

a



b



Figure 1. 1a & 1b: COVID 19 signs and wayfinding: Hacked communication responses using low fidelity resources at hand. Photo for Figure 1a taken by Dr H.R. Marston. Permission granted by Dr H.R. Marston and the Bakery Stony Strateford, UK to use Figure 1a. Photo taken and permission granted by Dr P.J White for Figure 1b

86% of all deaths were of citizens over 65 years of age (HSPC, 2020). To date, both Irish and UK Governments respectively have mandated that all vulnerable and older citizens should self-isolate, and rely on the support of local business, neighbours, family members and friends to deliver groceries. Furthermore, to protect older people and those extremely medically vulnerable, the Irish government introduced the concept of ‘cocooning’ (BBC, 2020f; Gov.ie, 2020; UK Government, 2020; The Journal.ie, 2020).

Cocooning is a “[...] measure to protect people who are over 70 years of age or those who are extremely medically vulnerable by minimising all interaction between them and others” (Gov.ie, 2020). Types of measures within the concept of cocooning include: remaining indoors, not leaving your house, not attend any gatherings, and keeping in touch using remote technology such as phone, Internet, and social media (Gov.ie, 2020). Although the UK Government have not used the term ‘cocooning’ they have mandated such directives (BBC, 2020f; UK Government, 2020). Moreover, cocooning holds a multitude of social problems, asking young people to stay at home in the spring weather (Sky News, 2020; Townsend & Kassam, 2020), as well as primarily dealing with the digital divide; older citizens face a particular risk of feeling lonely and depressed as a result of social distancing (Fuchs, 2020).

From this perspective, older people who do not have access to technology such as a laptop or desktop personal computers, coupled with Internet access, are already at a disadvantage as opposed to younger citizens. Marston *et al.* (2020), described how technology will and is playing a part in the area of self-isolation, continuing social connections, between family members, friends and community groups. Furthermore, without access to technology and social media platforms such as Facebook and communication platforms such as Skype, Zoom, or What’s App Marston *et al.* (2020); all citizens could feel more socially isolated as the lockdown continues, leading to the development and continuing physical and mental health issues.

Exposing deficiencies

The COVID-19 pandemic has therefore exposed technological deficiencies for specific products and services for our older communities and citizens. This opens up questions of our existing poor infrastructures and future preparedness for a growing ageing society. Designing age friendly technology is a complex task; the ageing population are not a homogenous cohort, with specific and non-specific technology need and requirements. To assist future design processors, we need to look at many things, not limited to:

- Future consultation to understand the breath of technological needs. Consultation is required not just from older citizens but intergenerational perspectives, the future old and across a spectrum technology users and non-users (Marston & van Hoof, 2019; Shore *et al.*, 2017; Shore *et al.*, 2018; Vrkljan *et al.*, 2019; White, 2018).

- Further development and refinement of design methods that are user sensitive and inclusive. (Newell *et al.*, 2011; Shore *et al.*, 2018; White & Devitt, 2011).
- Further development and use of standards to ensure user centred consultation with older people when improving and managing the accessibility and usability of technology products and services Standards such as the recently published I.S. EN 17161:2019 by the National Standards of Ireland (NSAI, 2019).
- Extending our understanding of technology acceptance frameworks. In particular older citizens who are likely to be unfamiliar with existing technological engagements (Shore, 2019).

Finally, and most importantly, we need:

- Designers and developers to get into the mind-set of how users behave in their own ecosystem and existing mental models. This is imperative to truly meet the needs of all citizens including older citizens who may find themselves at a disadvantage during COVID-19.

Mental models and designing for older people

Mental models are an individual symbol or representation of an external reality within the roles of cognition, reasoning and decision making, personal to the individual and in some instances multiple people, dependent upon experiences. Mental models are rooted from individual biases and worldviews onto their experiences of products” (Norman, 2002) While Forrester (1971) provides a definition of mental models as such:

“The image of the world around us, which we carry in our head, is just a model. Nobody in his head imagines all the world, government or country. He has only selected concepts, and relationships between them, and uses those to represent the real system (Forrester, 1971).”

We see mental models and learning styles in the field of education, comprising of various styles such as Kolb’s model of experiential learning (1984), and the VAK model proposed by Barbe and colleagues (1979). This model comprises of three learning modalities (visual, kinaesthetic/tactile and auditory), additional iterations of the VAK model were conducted by Fleming and included visual, auditory, physical and social learning (Fleming & Mills, 1992). Piaget, a developmental psychologist, whose work was built on the notion of the nature of knowledge, believed that reality was a dynamic system that was continuously changing (Piaget, 1977). With this in mind, citizens acquiring, and constructing their newly founded knowledge, regardless of their various differences within respective environments; their reality is evolving and changing.

Focusing on problem solving, we as adults endeavour to seek the answer to solve the problem. However, Piaget, noted how children would adjust their concepts accordingly (McLeod, 2018), thus the world in the eyes of a child or children was

constantly evolving, based on their experiences and discrepancies of what they were already familiar with (McLeod, 2018). From a human centred design perspective, older people's mental models are imperative and key to understanding needs. Their existing experiences will impact on the design process, be it in a positive or negative way. If the latter is the case, alternative approaches need to be considered, to overcome the existing negative perceptions of employing technology into their lives.

Intergenerational support can be one affordable solution to remove negative perception. Employing an intergenerational design approach offers the sharing of knowledge and experiences, exposing new mental models, founded in pre-existing knowledge and experience.

Prensky (2001), discusses the various issues surrounding new experiences and technology and describes citizens as 'digital natives, digital immigrants.' As we are entering the third decade of the 21st century, the notions posited by Prensky (2001) are still relevant, and as this pandemic is illustrating, more so than ever. Given that many citizens in society have received the directive to stay indoors, these citizens are reliant upon the support of friends, family, their community and local business to deliver their essential goods. While some citizens are able to access key information, for example, relating to which stores and

local businesses are still open, many citizens will not. This could be a result of the existing digital divide, whether it's by their own choice – of choosing not to engage and implement technology into their individual ecosystem or other issues which could be related to financial constraints, or their own perception of the benefit of employing technology into their lives.

Mental models and hacked responses

As designers we need to be aware of mental models, and the impact that such models may have on the design process. This is particularly the case for those who are unfamiliar with technology – the digital immigrant, while digital natives have a pivotal role to play, either in the design sessions or in the extended ecosystem, by offering support and guidance. With this in mind, Figure 2 illustrates a novel, innovative and alternative design hack that was instigated by the participant of an ethnographic research study (White, 2012). While the older participant was grappling with technology, the digital native (son of the participant) 'hacked' a low fidelity response based on his mother's understanding of her phone's address book.

Hacks as inspiration for concepts

With this simple hack as an example, designers and engineers can be inspired to conceptualise future ideas for older people. For example taking the notion of a traditional address book, and



Figure 2. Hacking communication devices based on personal mental models Photo taken and permission granted by Dr. P.J. White.

an older person looking to find a telephone number for their point of contact (POC), a family member(s) or a friend from their community group (e.g. church, bingo); it is likely that they would select the appropriate letter in the address book, whether it's under the first name or surname and identify the appropriate telephone number. However, under the notion of a digital address, interaction would be simpler (Figure 3). This would take the design approach of unified modelling language (UML) usually found in the field of software engineering.

Figure 3 created by Marston *et al.* (2020), illustrates a soft touch UML approach, which could be deployed in an agile design and development environment. This UML diagram illustrates the processes, of how an older person using a piece of technology such as a tablet could identify appropriate contacts based on their needs or in case of emergencies. If the older person wanted to contact their POC they could select the contact number via the button or speech. The same concept applies for family members and/or social networks in the community. However, if the older person was requiring assistance due to an emergency they could contact the POC initially by pressing and holding down the button, and should the POC not answer, it would ring down through the digital address book (e.g. via family member(s), and then social contacts), until someone answered.

Using an UML approach to design offers multiple actors (e.g. designers, software engineers, project managers, health practitioners, researchers, academics) and more importantly the end-users the opportunity to understand the processors that would be undertaken early on in the design and development lifecycle process.

Furthermore, it would also assist each of the various actors in understanding their roles and responsibilities. For example, a software engineer could read the UML diagram and understand what needs to be implemented which would also include the various decisions/tasks conducted by the user. While an end-user has the possibility to understand what is needed and expected of them. From a design standpoint, knowing where the GUI may differ, and implement appropriate interfaces to ensure the end-user recognises the different environment within the digital address book would be critical when selecting a specific contact.

In the following examples, we illustrate participatory methodologies (Elizarova *et al.*, 2017; Spinuzzi, 2005) and in the wild (Jones & Marsden, 2005; Shore, 2019) examples as a form of engaging and immersing researchers and designers into various ecosystems which in turn inform our understanding more so of the unmet needs of users.

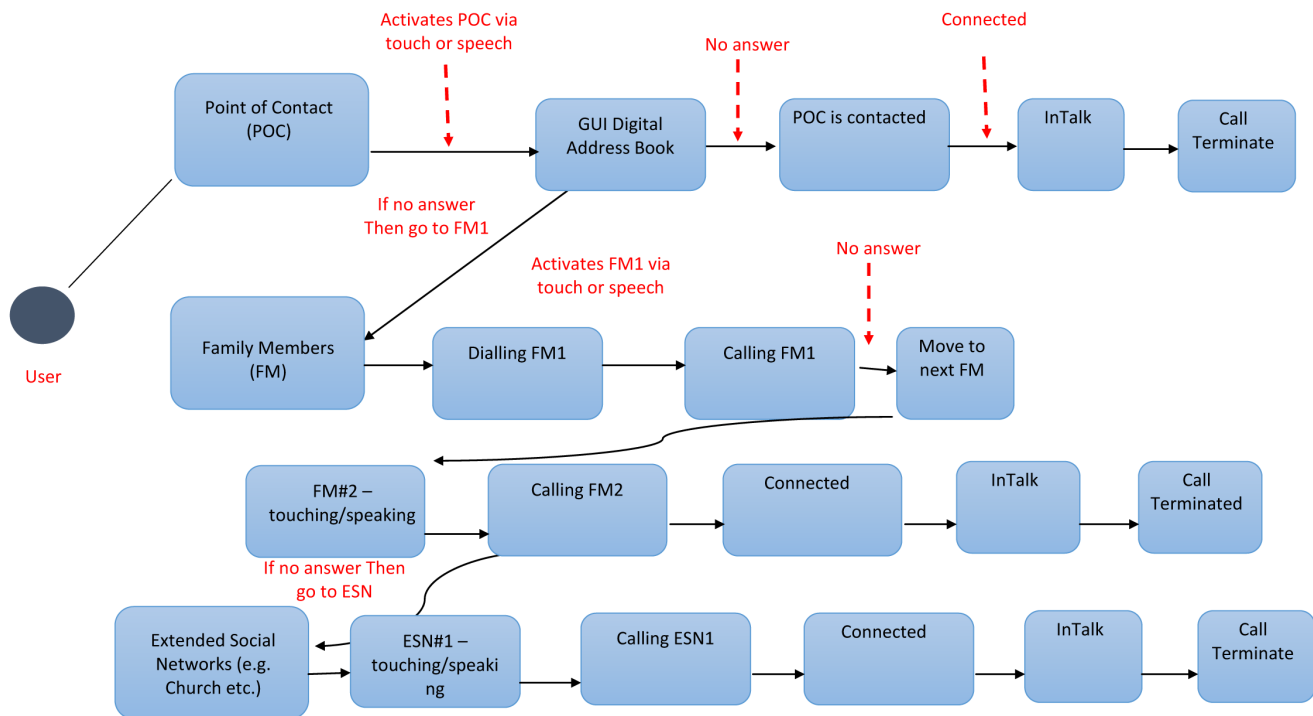


Figure 3. UML diagram interaction between an older user and a digital address book (created by Marston *et al.*, 2020) 'contacting POC, family member, social networks'. POC – Point of Contact, FM – Family Member, ESN – Extended Social Network, GUI – Graphical User Interface

Exploring Design hacking further, in [Figure 4](#) we see an inter-generational approach to communication hacking. For many citizens, young and old, social interaction is important, and ever more so in this pandemic. [Figure 4](#) illustrates two key facets, the first is intergenerational engagement, attempting to maintain a sense of normality while adhering to Government directives. Secondly, and from a research design standpoint, we have the ability to draw discourse analysis from the both the visual and textual information presented using existing mental models of engagement.

Such design hacks as presented here in [Figure 4](#), provide the opportunity to collect research data which pre-March 2020, may not have been perceived as suitable data collection approaches. Yet, in this every changing narrative within the pandemic this specific approach is offering various opportunities to researchers, designers and participants alike to contribute innovate and alternative forms of data collection.

If we take this notion of design hacking a step further, we can see how simplicity can be translated into real life approaches, building on the existing conventions or mental models that many older citizens have instilled. Life and society as we know it has changed since March 2020. Many national and community events have been cancelled which in turn has left a wide

variety of stock available (e.g. posters advertising such events). Local communities rely on various events to fundraise to keep services and activities available year on year. Given that many shops are closed because their stock is categorised as non-essential products, using alternative materials is key. One exemplar of this is shown in [Figures 5a and 5b](#). These photographs are of a poster which would have been used to advertise a local event in a community, which has been cancelled. Instead of throwing the event posters away, they have been instead repackaged using various materials (e.g. wrapping paper) and various sticking tape (e.g. masking tape, gift tape) and delivered to the homes that have been purchased. Precautions have been taken into account, either via PayPal, or leaving money on the doorstep in a bag ([Figure 5c](#)).

Although this is not solely relatable to design hacking, it does illustrate the innovative approaches to wrapping a gift. Moreover, this pandemic while it is offering up alternative approaches to research and design hacking, it is also demonstrating alternative forms of gifting and presenting an artefact in a visual format that is positive and pleasant.

Presenting an object in an aesthetically pleasing representation, while continuing to maintain health, wellbeing and safety measure is key to continuing a life that much of society knew



Figure 4. “Picnic through the pane” Hacking communication with older family members - Written informed consent has been agreed and kindly given by all individuals in this image.

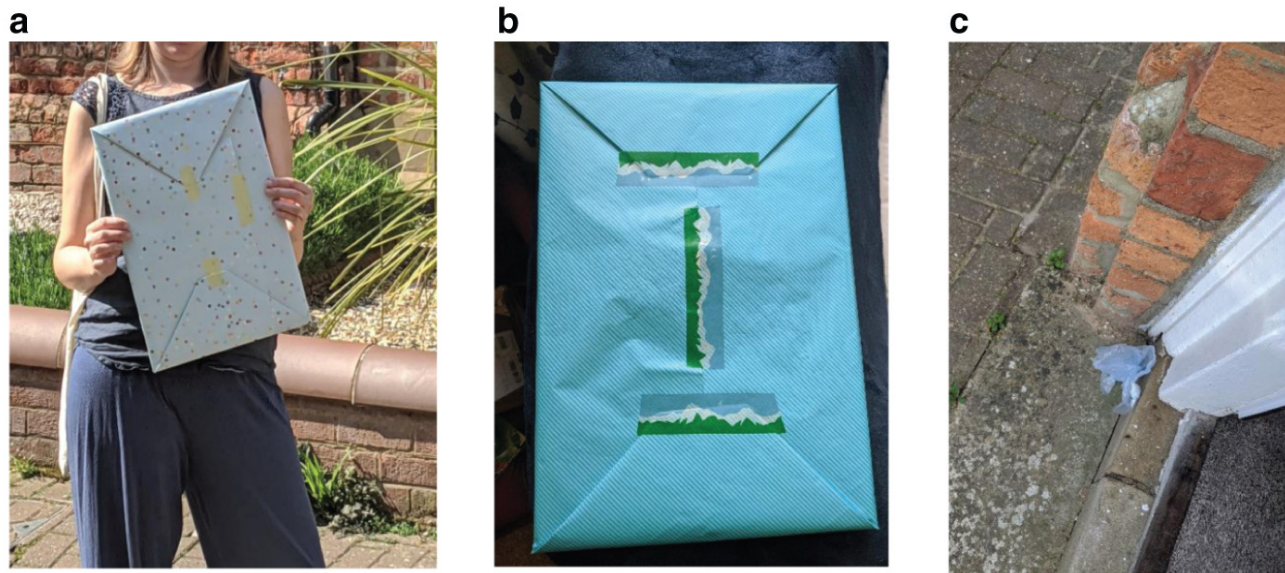


Figure 5. 5a, and 5b illustrate the hack design of wrapping a parcel, using whatever material is available. 5c, illustrates the cost of the parcel which will go towards community support services. (Photographs taken by Dr H.R. Marston, and permission is granted).

pre-March 2020. Figures 5a, 5b and 5c, illustrate the personal empathy of delivering a gift, but ensuring that the gift is still aesthetically pleasing to the recipient. Under normal circumstances, such a parcel may have been decorated using the same type of paper and tape. However, given the restrictions, such a parcel(s) is gifted using the materials available within our own individual ecosystems. This illustrates several facets, firstly, in such a crisis, using the materials available to hand is important, and regardless of whether the wrapping paper is the same or not, wrapping a parcel in the materials at hand is thoughtful. For many citizens, using clear tape would have been key to securing the wrapping paper. However, as Figures 5a and 5b illustrate two types of tape been used on two pieces of different wrapping paper. The type of tape is very different from one another, and some may say, adds to the aesthetic nature of presenting the gift. At this moment in time, citizens may have to use the materials available to them. The notion of having all materials colour coordinated are not as relevant as what they may have been in the past. What is key, is ensuring the parcel is delivered in an aesthetically pleasing manner and maintaining a sense of normality.

These design hacks illustrate the participatory design methodologies which facilitate a co-production and co-design approach (Elizarova *et al.*, 2017; Shore *et al.*, 2017). Furthermore, these examples above display the various approaches that can be undertaken involving user influence and activity to inform design. Taking this design approach, researchers and designers can gain empathy from and with the users for whom they are designing for. Moreover, the immersion of designers and researchers in the respective ecosystems of users facilitates greater understanding of the unmet needs (Shore *et al.*, 2018)

Conclusions and implications for future research

In the current societal ecosystem that we have found ourselves in, design methods and processes can be applied to a vast array of problems. Although previously, human centred design has been at the front of research studies; COVID-19 has moved this forward at a greater speed and has pushed the research community into identifying alternative forms of design and research thinking. Crisis situations require many viewpoints to address a problem. We, the research community have a duty to citizens and participants alike in offering an opportunity to share their experiences through their own conventions or mental models.

In terms of the design of future age-friendly cities, products, services and environments, this pandemic makes us envision what should be, and how we could create more appropriate solutions through technology. The narrative surrounding age-friendly cities has been ongoing since 2007, and with the proposed extension 'a smart age-friendly ecosystem' by Marston & van Hoof (2019), in addition to individual ecosystems, based on the current situation of COVID-19, design hacking has the potential to benefit various actors, as well as understanding in greater detail the interplay and impact within individual smart age-friendly ecosystems. Given how this pandemic is impacting all citizens within their respective community and individual ecosystems, we now have an opportunity to explore what an individual smart age-friendly ecosystem may look like, and what kind of impact this may have on both older and younger citizens.

In this opinion piece we have provided various examples of design hacks, coupled with a UML diagram to illustrate the flow of processors and engagement of a conceptual digital

address book for older people. [Figure 3](#) illustrates one element within an individual ecosystem, and with this notion, we can explore different objects found within the individual ecosystem which play an integral role within one's life. Additional exploration can be conducted to understand how a 'smart age-friendly ecosystem' may look within the confines of a pandemic, and the aftermath. Furthermore, carrying this notion forward, future work should consider the relationship in which the internet of things (IoT) could possibly play within such ecosystems, building on the notions of ([Sheerman et al., forthcoming](#)). Moreover, design hacking allows researchers from various disciplines to

engage with citizens in alternative ways, being creative as well as collecting rich data that can be translated into real world design solutions.

Data availability

Underlying data

No data are associated with this article.

Consent

We confirm that we have obtained permission to use images from the individuals included in this presentation

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Helene Fournier

National Research Council Canada, Moncton, Canada

This opinion piece makes a valuable contribution to the area of **Future age friendly design and technology** by exploring the literature related to user-sensitive inclusive design for products, goods and services, and contributes to our understanding of suitable design methods in tackling problems in a pandemic and beyond. The authors adequately cover the challenges that COVID-19 has revealed, as well as the importance of human centered design in meeting unmet needs; an understanding older people's mental models as key in understanding their needs. The authors provide illustrations of hacked communication responses using low fidelity resources at hand for COVID 19 signs and way-finding, with concrete examples from the Irish and UK context in particular, which could easily be applied to a wider ageing population.

The authors underscore how the COVID-19 pandemic has exposed technological deficiencies for specific products and services for older communities and citizens; they also point out larger issues such as poor infrastructures and the need for future preparedness for a growing ageing society. The need for design hacking approaches that consider individual needs as well as community needs for a future smart age-friendly ecosystem is effectively argued. The authors propose that by going back to the source of the problem in order to understand needs and users more deeply, observing how individuals and communities understand their ecosystem, researchers can gain a better understanding of how individual and communities respond, adapt, and design their own environments and products in times of need.

The authors also effectively point out the complexities of designing age friendly technology (i.e, the ageing population are not a homogenous and they have specific and non-specific technology needs and requirements). To assist in future design activities, the authors recommend further consultations to understand the breath of technological needs, engaging with older citizens and also the need for intergenerational perspectives, and engaging with the "future old" as well as "across a spectrum of technology users and nonusers". The need for further development and refinement is also highlighted, including design methods that are user sensitive and inclusive with the use of standards to ensure user-centered considerations are made in order to address important barriers such as accessibility and usability issues related to technology, products, and

service.

The manuscript would, however, benefit from closer proofreading with minor revisions. For example in the abstract, this sentence is not clear: *"However, when faced with unprecedented wicked problems such as these, the rigour of design and creative processes can tested"*—sentence would need to be corrected.

Section on **Future age friendly design and technology**. This sentence: *"COVID-19 for the time being has put pay to this, and we are now learning about new individual and community needs for a future smart age-friendly ecosystem"*. What does "has put pay to this" mean? Money? Budget? Please avoid colloquial language and expressions that are not common with a wider readership.

Overall, this is an important opinion piece which contributes findings to the field of user centered technology design during COVID-19 and beyond.

Is the topic of the opinion article discussed accurately in the context of the current literature?

Yes

Are all factual statements correct and adequately supported by citations?

Yes

Are arguments sufficiently supported by evidence from the published literature?

Yes

Are the conclusions drawn balanced and justified on the basis of the presented arguments?

Yes

Is the argument information presented in such a way that it can be understood by a non-academic audience?

Yes

Does the piece present solutions to actual real world challenges?

Yes

Is real-world evidence provided to support any conclusions made?

Yes

Could any solutions being offered be effectively implemented in practice?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Human-Computer Interaction, Human Factors, Assistive Technologies, Ageing in Place

I confirm that I have read this submission and believe that I have an appropriate level of

expertise to confirm that it is of an acceptable scientific standard.
